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HW--68039

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IRRADIATION PROCESSING DEPARTMENT

# MONTHLY REPORT

DECEMBER 1960

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HANFORD ATOMIC PRODUCTS OPERATION

**GENERAL  ELECTRIC**

RICHLAND, WASHINGTON

RETURN TO: RECORDS SERVICE CENTER

BUILDING 712

700 AREA

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IRRADIATION PROCESSING DEPARTMENT  
MONTHLY REPORT  
DECEMBER, 1960

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IPD Personnel

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January 16, 1961

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RICHLAND, WASHINGTON

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SUMMARY

RESEARCH & ENGINEERING OPERATION

Self-supported fuel tests continued with no ruptures experienced. During discharge of 30 tubes from C Reactor, some difficulty with a partially stuck charge was experienced for the first time. Post-irradiation data are being analyzed.

Operation of KE Reactor with nitrogen replacing carbon dioxide in the pile atmosphere was started under provisions of PT-IP-358-AC. No difficulties have been encountered thus far.

The increased alum feed rate test at 100-B was discontinued because reduction of radioisotope concentrations in the effluent water had leveled off; the test at 100-H using aluminum nitrate was continued through December to study corrosion effects.

A document entitled "Evaluation of Supplementary Control Incentives and Effectiveness" was issued. During 1960 the average ECT value observed was approximately 2-1/2 percent higher than 1959 and non-equilibrium losses per startup were reduced to an average value under 1/2 day.

The primary limit to reactor power levels during the month was rupture control considerations; administrative limits were reached at two reactors late in the month.

MANUFACTURING OPERATION

Production

Record reactor input production exceeded the November maximum by 3.3 percent. Forecast was exceeded by 9.5 percent, 12.9 percent at the six old reactors and 4.7 percent at the K's.

Over-all time operated efficiency was 84.9 percent (82 percent forecast); 86.3 percent at the six old reactors and 80.6 at the K's.

The combined reactor instantaneous power level was increased 205 megawatts (18580 to 18785). The individual reactor record power levels were increased 90 megawatts at KW (3910 to 4000), 70 at B (1775 to 1845), 25 at D (1785 to 1810), 20 at C (2070 to 2090), 10 at H (1890 to 1900) and 10 at F (1825 to 1835). Input production records were achieved at D, DR, F, H and KW Reactors during December.

Twelve ruptures, six I&E regular metal, five I&E enriched and one solid regular, were removed from the reactors. Three of the I&E regular ruptures were at KE and one each at B, F and H. Two of the enriched ruptures were at KW, two at C and one at KE. The solid rupture was at DR.

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Engineering

During the month, spare parts inventory increased \$5,857. The interim report on reactor block combustible gases resulted in a request for additional tests; this is being performed at 105-C. Instrument and mechanical manual writers were selected and assigned to the NPR group.

Examination of a broken inlet nozzle from B Reactor is essentially complete. Visual and metallographic examinations indicate that there was no fatigue crack or other defect and that the nozzle material was sound. A recommendation was made that all nozzles broached for bumper fuel elements be machined to provide the capability for installation of a sleeve.

Recovery and testing of previously discarded spiral pigtailed for interim use on the rear face of H Reactor was completed. A report was issued assessing the integrity of the braid covered inlet connectors. Planned work continued in support of project engineering action for crossunder lines, poison spline coils, geminol thermocouple readout instrumentation, analog-to-digital converters, Beckman-Panellit interlocks, and radiation monitoring instrumentation.

The Industrial Engineering Operation library of motion picture films is being reclassified to Confidential-Unclassified. This makes it easier for Department personnel to borrow and use these motion picture films for training purposes.

A study of duplicating needs in 100-F Reactor Operation was completed. A report, with recommendations, was sent to the Supervisor, Office Practices.

A study of cyclic painting requirements for 100-F Area was completed.

Justification for semi-automated fuel element handling in the reactor work area was documented (HW-67706). It was recommended that "fuel clip" handling be adopted.

Plans are being made to double the number of fuel elements examined in the 105-C Metal Examination Facility.

FACILITIES ENGINEERING OPERATION

Preliminary designs are being prepared for replacement of vertical safety rods at 105-C Reactor.

The design for an inlet nozzle reinforcing sleeve to convert present nozzles for use with bumper fuel elements has been completed.

Design changes for Project CGI-791 have been issued to provide liquid level sight glasses for the filter building seal pits, safety railings around access ladders of the filter buildings, and entrainment separators upstream of the filters. The charcoal filters have been rejected since they were poorly constructed and leaked graphite.

The cell piping drawings for Project CGI-839 have been revised. Sectional drawings of the pump were returned to the vendor for revision.

Detail design for Project CGI-844 is 57 percent complete. G. R. Rich, Hydraulic Consultant, has completed his examination of the hydraulic transients of the diesel pump house supply and discharge lines. Results of his study indicate the design to be satisfactory for the worst credible operating conditions.

Detail design for Project CGI-883 is 66 percent complete. A design, development, and research contract has been negotiated with Washington State University for K Reactor downcomer orifice plate model studies and rear face crossheader expansion joint hydraulic tests.

One of the overbored channels at C Reactor was counterbored both front and rear; new larger hardware was installed on front and rear but with a standard-sized tube; the tube was changed and is operative. Thirty-five additional flapper caps were installed on the rear face of KE Reactor, making a total of 73 flapper caps and six ball caps under test. High speed scanning equipment for Phase I of CGI-802 has arrived and is undergoing inter-connection. The NPR-PCE Loop completed 2000 temperature cycles on tube joints and fittings, to add data for final selection of NPR equipment.

Assistance was provided to Manufacturing Section in evaluating bids for interim rear face connectors of helical configuration.

A failed rear face Parker fitting from D Reactor has been inspected and sent to HLO for metallographic testing to determine exact cause of failure.

A detailed analysis of "Causes of Reactor Shutdowns" has been completed and forwarded to interested parties.

A review of operating practices of Priest Rapids Dam has been initiated as a result of erratic discharges from this facility.

A report of the performance characteristics of Knight Ideal Coal has been published for use by Manufacturing Section.

The contract portion of Project CGI-791, Reactor Confinement, is complete except for punch list items in 100-B, C, D, DR, F, and H.

The 105 Building exhaust air is being filtered in 117-B, C, D, DR, F, and H Areas.

#### NPR PROJECT OPERATION

Design manpower continues to be applied on widely diversified activities not specifically directed toward the normal design products, such as drawings and specifications. Normally, a reduced design load would be anticipated as completion of the design products reaches the 80 percent point; however, all indications are that higher than normal design staffing will be required for the remainder of the project. Pressure of project schedules are requiring an increasing number of decisions based on judgment rather than complete development data.



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Construction activity continued at the 100-N site without interruption.

The average production of notched graphite during the month was approximately 100 notched details per shift, compared to the official schedule (revised 11-30-60) for approximately 200 per shift. Reject rate continued to be high.

Work preparatory to setting up the on-site process tube preparation shop for production was accelerated. The most important items requiring additional attention are the autoclaves.

Shipment of graphite and zirconium continued to be satisfactory.

Primary loop piping work continued to lag.

#### FINANCIAL OPERATION

During December four employees submitted expenses for attendance at Professional and Trade Society meetings. Total expenditures amounted to \$794.88.

During the same period, three employees reported attendance at Offsite Courses. Total expenditures amounted to \$1,210.45.

The pricing method on poison splines was revised to relieve the account of the cost of all splines currently on hand prior to receipts on the new contract. The new contract price is \$25.75 each, compared to a current average cost of \$43.17.

The total number of personnel assigned to the Department as of December 31 was 2,264; a decrease of one from the previous month.

#### RELATIONS PRACTICES OPERATION

Two technically trained candidates and two PhDs were interviewed during the month with two offers extended. Six monthly employees transferred into the Department from other HAPO components and four transferred out of the Department. Four security violations were reported during the month.

#### GENERAL

#### RESPONSIBILITY

There was no significant change in responsibility.

FORCE SUMMARY

	<u>Exempt</u>	<u>Non Exempt</u>	<u>Total</u>
General	7	2	9
Research & Engineering Operation	106	61	167
Manufacturing Operation	391	1354	1745
Facilities Engineering Operation	125	45	170
NPR Project Operation	88	30	118
Financial Operation	17	14	31
Relations Practices Operation	<u>6</u>	<u>18</u>	<u>24</u>
TOTAL	740	1524	2264

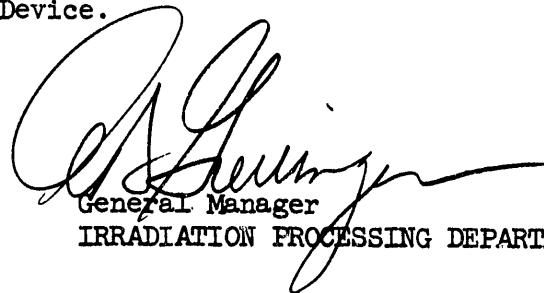
SAFETY, SECURITY AND RADIATION EXPERIENCE

There were 59 medical treatment injuries, four security violations and no radiation exposures exceeding operational control.

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.

<u>Date</u>	<u>Name</u>	<u>Title</u>
12-2-60	JH Greer	Silicon Controlled Rectifier Gate Circuit.
12-14-60	RA Hemphill	Cylindrical Piece Surface Conditioning Device.

  
 General Manager  
 IRRADIATION PROCESSING DEPARTMENT

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RESEARCH AND ENGINEERING OPERATIONPROCESS AND REACTOR DEVELOPMENT OPERATIONREACTOR FUELSPresent Reactor TechnologyProjection Fuel TestingSelf-Supported Fuel Development

Thirty columns of CIVNS fuel were discharged from C Reactor at an average exposure of 918 MWD/T during the outage of December 4. One tube (3672-C, 878 MWD/T) failed to move under full force of the charge machine and was classified as the first stuck charge experienced in a self-supported fuel geometry. The tube was finally discharged with charge machine forces after undergoing a series of oil flushes between pushes.

The modified prototype charging machine for self-supported fuel elements was demonstrated during the December 4 outage and was moderately successful. Some further slight modifications will be required before the machine can be termed fully successful.

Bumper Fuel Development

Twelve tubes of bumper fuel elements (4-rail) were successfully machine charged at D Reactor during the 12-12-60 outage, bringing the total number of bumper charges in D Reactor to 36.

Post-irradiation examinations of bumper elements to determine the associated hot-spot frequency reduction have been completed at the 105-C-MEF. The data are being prepared for machine processing and analysis.

Hot-spots were observed on some bumper fuel elements fitted with collapsible bridge rail bumpers. The data have not been fully analyzed as yet and the significance of the observations is not yet apparent.

Three bumper fuel elements that exhibited high weight losses will be sent to Radiometallurgy for residual can-wall determination. One control piece that exhibited a post-irradiation ellipticity measurement of 69 mils will also be sent to Radiometallurgy.

Advanced Reactor TechnologyHigh Temperature Irradiations

KER-1: Ten NIN-1 elements were charged in KER-1 on December 8, 1960, under PT-IP-378-A to evaluate the effect of different heat treatments on fuel distortion during high temperature irradiation. This heat treatment test was charged following an unsuccessful attempt to charge a different test with a thermocouple train.

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STATUS REPORT OF PRODUCTION TESTS

<u>Test No.</u>	<u>Type Metal</u>	<u>Tubes</u>	<u>Reactor</u>	<u>Goal Exposure</u>	<u>Current Exposure</u>	<u>Remarks</u>
IP-84-A	Projection self-supported fuel in ribless aluminum tubes.					Preliminary evaluation of self-supported fuel elements. Routine charging to continue until tubes are replaced.
	a) Supports at 1/7 position	3	B	1200 MMD/T	Varies with charge date	Ultrasonically attached supports currently being used. Goal exposure increased from 900 MMD/T to 1200 MMD/T.
	b) End Spider	8	B	1200 MMD/T		Initial charging of end-spider supports.
IP-171-A	I&E X-8001 OIIN	6	F	Variable	400 MMD/T	Provide for evaluation of alternate aluminum component vendors. Control columns are only ones carried special. Rest are lot charged. Cliff Manufacturing components are now under irradiation.
IP-216-A	Normal Prod. Natural & Enriched fuel elements	81	All	Normal Variable Goal		Provides for monitoring the performance of a sample of all normal production material to assist in development of a Quality Index for Production use. Test is continuous.
IP-255-A	Solid Black Mint	7	H	2 years	14 months	Provides for long term irradiation of solid black mint for conversion ratio, and fuel performance determination. Three control columns discharged for special extraction.
IP-262-A	Bumper supported fuel in ribbed process tubes.	36	D	1200 MMD/T		Provides for testing of bumper type fuel elements in ribbed process tubes to determine handling problems associated with bumper fuel elements.

<u>Test No.</u>	<u>Type Metal</u>	<u>Tubes</u>	<u>Reactor</u>	<u>Goal Exposure</u>	<u>Current Exposure</u>	<u>Remarks</u>
IP-272-A	CIVN Geometry I&E self-supported fuel	69	C	Variable		Provides for testing of CIVN geometry fuel in C Reactor ribless zirconium process tubes.
IP-309-A & Supp. A	Four heavy walled single tube elements three heavy walled single tube elements with capped jacket defects for failure testing.	1	KE	2500 MWD/T	1730 MWD/T on elements charged 3 July; 345 MWD/T on elements charged 11 Nov., 60	Six elements charged in KER-3 on July 3, 1960; one element added to charge on 11 Nov., 60. Discharged 12-9-60 due to a failure in a KSN-1 element.
IP-363-A	Four 18-inch KSE-3 elements	3	KE	4000 MWD/T	540 MWD/T on elements charged 11-11-60	KER-2 and 4 charged Nov. 11, 1960. KER-3 charged Dec. 15, 1960.

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KER-2 and KER-4: The charges of KSE-3 elements with brazed end closures in KER-2 and 4, PT-IP-363-A, have reached an exposure of about 540 MWD/T.

KER-3: A failure occurred on December 9, 1960 in the KSN-1 elements being irradiated in KER-3 under PT-IP-309-A and Pt-IP-309-A, Supplement A at an exposure of about 1730 MWD/T. The fuel element jacket was circumferentially split just below the weld bead. The mechanism of the failure has not been established. This was the first test of unbonded, flush-seated cap, welded end closures.

Loop 3 was recharged on December 15, 1960, with four KSE-3 elements, PT-IP-363-A, to evaluate the behavior of large diameter tubular elements with brazed end closures.

### Fuel Design Analysis

An extensive table of operating conditions for the enriched single tube-inert rod elements presently under irradiation in KER loops 2 and 4 was developed with the MOFDA program. With the aid of this table pertinent fuel conditions can be estimated for given changes in loop operating conditions.

### REACTOR ENGINEERING

#### Present Reactor Technology

#### Oversize C Reactor Tubing

As reported last month, Zircaloy tubing for the 20-tube overbored facility has been ordered. The 12 tubes ordered from Allegheny Ludlum Steel Co. have been extruded and tube-reduced. After final sizing and inspection they will be shipped. (Shipment is expected during the week of January 9, 1961.) Other Zr. and Al tubes on order are expected to be delivered about February 1, 1961.

#### Decontamination

A procedure for testing to determine the decontamination efficiency of a sulfuric-oxalic acid solution and Turco 4306 C in the production reactors has been approved.

Execution of the test will be delayed until the formulation of Turco 4306 C has been verified. Some batches of this proprietary material have been very effective in out-of-reactor tests, and some have been essentially ineffective.

#### Piping Investigations

The KER front face lateral and inlet connector has been removed from each of loops, No. 1 and No. 3 for destructive examination. The rear-face lateral from loop No. 1 was removed upon discovery that a flared fitting was leaking.

Sections of the tubing will be tested to determine effects of service environment. In particular the rusting of carbon steel (from loop 1) and the potential for stress corrosion cracking of stainless steel (from loop 3) will be monitored to determine the cumulative effects of water leaks on the front face.

#### Use of Nitrogen in KE Reactor

Operation of KE Reactor with a helium-nitrogen atmosphere rather than a helium-carbon dioxide atmosphere under the conditions of PI-IP-358-AC, "Replacement of Carbon Dioxide with Nitrogen as a Constituent of the K Reactor Atmosphere" (HW-66973), was started on December 5, 1960. The use of nitrogen, if found satisfactory, will permit operation with higher graphite temperatures than could be tolerated when using carbon dioxide. At these higher temperatures the increased rate of reaction of carbon dioxide with graphite would cause excessive burnout of the graphite. No difficulties have been encountered thus far in the use of nitrogen.

#### Advanced Reactor Technology

##### Zr Tube Fabrication

The Wah Chang Co. scrap recovery process appears to yield reactor grade sponge. It may be desirable to perform further out-of-reactor and in-reactor tests of this material at HAPO.

##### NFR Technical Manual

A Technical Manual for the NFR is under preparation. A rough draft detailed outline has been circulated for comment. Some comments have been received and the outline is being revised. Work has started on systems descriptions. The summary section of the manual is approximately 15% complete in rough draft form.

##### NFR Graphite

Top and Bottom Reflector: Shipment of final bars from Great Lakes Carbon Corp. plant in Morgantown, N. C. was made December 15, 1960.

Active Core: All of the required 6"x 6" solid bars have been received from the National Carbon Company plant in Clarksburg, W. Va. This represents about one-third of the number of bars and one-half of the total tonnage of bars ordered for the active core. The Clarksburg plant was visited on December 13, 1960 by C. E. Love (NFR Project Section) and R. W. Benoliel for general technical audit of the manufacture. Machining of the 2"x 3"x 48" bars was just being set up. All material in general appears to be of satisfactory quality.

Front and Rear Reflector: The Niagara Falls plant of the Speer Carbon Co. was visited by C. E. Love and R. W. Benoliel on December 14, 1960 for general technical audit of the manufacture of this graphite. The graphitized

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8" x 9" cross section bars and several hundred machined "doughnuts" which will fit into the 8" x 9" front and rear reflector blocks were seen. All material in general appears to be of satisfactory quality.

## REACTOR PHYSICS

### Present Reactor Technology

#### Overboring Studies

A study is being made to determine the strength of the Ball 3X system in the overbored flooded C-pile. The present methods used are not adequate to describe the real physical systems and it has been necessary to investigate more detailed methods. This involves a multi-region and possibly a two-group calculation.

Input data have been prepared for the "Flex I" calculation program to determine the effects of flooding under various exposures and operating conditions.

#### High-Speed Scanning

The justification of the full-pile installation portion of this project is presently being reviewed. The prototype is complete and is yet to experience its first failure. This project is being carefully reviewed with respect to the safety function only this project can provide.

#### E-N Calculations

The E-N  $k_{OO}$  calculations previously done were repeated using the corrected  $P_3$  and "Idiot" program results. The relative length ratio was 18.45" E to 1" N when the  $k_{OO}$ 's were matched for the hot, clean, wet case. The E-N ratio may be too high since the same axial flux distribution was assumed for both cold and hot cases. The above results were based on the assumption that the measured E-N ratio of 14.95 to 1 matched the natural uranium reactivity for the cold dry case.

### Advanced Reactor Technology

#### NPR Ceramic Balls

The activity of the ball 3X candidates which were irradiated under PT-IP-330-A was measured two months after discharge from a one-month irradiation. The average activity of five balls of each type is:

Boron-stainless steel:	64 mr at 1 ft
Boron-carbon steel:	125 mr at 1 ft
Samarium-ceramic	80 mr at 1 ft
Gadolinium-ceramic	130 mr at 1 ft

Short-term 305 pile irradiations and subsequent activity measurements on these balls indicate that about 100 hours after irradiation the activity of a samarium ball becomes less than that of a boron-carbon steel ball.



A 305 irradiation showed that the early activity of the stainless steel ball was considerably higher than either samarium or boron-carbon steel. These later measurements indicate that the long-term decay rate decreases faster for the stainless steel ball than the other two.

Basic Studies

Variation of the cold, clean, green reactivity as a function of Zr-2 density, uranium density, graphite dih and density, end caps, and dimensional tolerances have been calculated using the "Idiot" and "Flex" programs. This study was undertaken to assist in assessing the adequacy of the enrichment of the NPR fuel elements. The results obtained from the computer programs were normalized to the experimental values obtained from HLO.

Slowing-Down Program

Analysis of the data on the NPR has been completed, as far as the bulk energy loss in the graphite is concerned. A report of results must await the completion of similar analyses for present reactor lattices.

NPR Primary Loop Simulation

The neutron kinetics, reactor heat transfer, and heat exchanger with controller have each been simulated and checked out. The complete system has been put on the computer and will be run as soon as final maintenance adjustments are made on the computer.

RADIOLOGICAL ENGINEERING

Radiation Control Experience

The following table summarizes the radiation exposure experience of critical IPD classifications for the year to the date of the last badge exchange (December 2, 1960 - 48 weeks):

Classification	Total Dose	No. of Employees	Average Dose/Employee	Extrapolated Year End Average	No. of Employees over 3r Extrapolated Exposure
Radiation Monitors	216012 mr	87	2483 mr	2690 mr	2
Processing Operators	546219 mr	257	2125 mr	2302 mr	6
Pipefitters	172079 mr	93	1850 mr	2004 mr	1
Millwrights	136192 mr	76	1792 mr	1941 mr	0

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Lapse of Control

	<u>Lapse of Radiation Control</u>								<u>IPD Totals</u>
	<u>Distribution by Reactor and Component</u>								
	<u>B</u>	<u>C</u>	<u>D</u>	<u>DR</u>	<u>F</u>	<u>H</u>	<u>KE</u>	<u>KW</u>	
Processing	0	2	0	0	0	0	0	0	2
Maintenance	1	0	0	1	0	0	0	0	2
Supplemental Crews	1	0	0	0	0	0	0	0	1
Research & Engineering	0	1	0	0	0	0	1	0	2
Facilities Engineering	0	0	0	0	0	0	0	0	0
Central Maintenance	0	0	0	0	0	0	0	0	0
Reactor Areas	0	0	0	0	1	0	0	0	1
Assigned Totals	2	2	0	1	1	0	1	0	7
IPD General									
Outside IPD									1

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 Concentration of Radioisotopes in Reactor Effluent Water

The average concentrations of radioisotopes in reactor effluent water from samples taken during November, 1960 are given. Concentration is in units of (10<sup>-12</sup> curies per cc).

<u>Reactor</u>	<u>P32</u>	<u>As76</u>	<u>Zn65</u>	<u>Np239</u>	<u>Cr51</u>
B (Test side)	8	130	7	100	380
B (Control side)	17	240	11	260	330
C	27	260	21	200	440
D	21	310	16	390	380
DR	24	330	14	410	360
F	20	330	---	220	3400
H (Test side)	11	240	29	97	630
H (Control side)	24	330	90	310	760
KE		No Samples Taken			
KW	8	100	11	240	190

\* The determination of Zinc-65 concentrations in samples from 105-F reactor was delayed because the samples prepared in the usual way had too much activity to count.

Effluent Activity Reduction

The test at 100-B measuring the effects on effluent activity of adding 18 ppm aluminum sulfate in the water treatment process was terminated December 8 because reduction of radioisotope concentrations had apparently leveled off. The following reductions were reported: P32 - 60%, Cu64 - 33%, As76 - 75%, Zn65 - 33%, Cr51 - 25%, and Np239 - 57%.

The test at 100-H measuring the effect on effluent activity of adding 20 ppm aluminum nitrate in the water treatment process is continuing to study corrosion effects. The following reductions were reported: P<sup>32</sup> - 70%, Cu<sup>64</sup> - 33%, As<sup>76</sup> - 75%, Zn<sup>65</sup> - 25%, Cr<sup>51</sup> - 25% and Ni<sup>239</sup> - 65%. The reduction in Cr<sup>51</sup> at both H and B is unexplained. The concentration of chromium in the influent water is known to have been the same on the test side and the control side of both reactors.

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PROCESS TECHNOLOGY OPERATION

REACTOR POWER LEVEL LIMITATIONS

The primary limit to reactor power levels during this report period has been rupture control considerations. However, H and KW Reactors were limited for a portion of this period by the administrative limit.

PROCESS STANDARDS

HW-46000 B, Process Standards - Reactor

One revised standard was issued during the month. This was:

Process Standard A-050 - "Panellit System Control"

Low-trip specifications were up-dated by the addition of new constants applicable to revised venturis and orifices which have been, or will be, installed on the reactor. High and low-trip pressure specifications were added for tubes equipped with recently approved 400 psi dial-span pressure gauges. These gauges are presently restricted to use with tubes containing non-fissionable charges.

A new method for determining process-tube pressure-gauge response time was included in this revision. This check is based on the criterion that all gauges shall show 98 per cent response to a step pressure change in at least two seconds.

HW-46000 D, Process Standards - Reactor

Two revised standards were issued during the month. These were:

Process Standard A-020 - "Tube Outlet Water Temperature Limits, TAI"

Process-tube outlet-temperature limits are currently determined by the "Trip-After-Instability" concept. This temperature limit, in conjunction with process-tube pressure low-trip specifications, was developed to prevent boiling in a process tube should water flow to the tube be reduced. The former, simplified and conservative presentation of the "Trip-After-Instability" concept, was revised to gain better limits by consideration of all factors involved in the concept which are variables, rather than selection of some of these functions as conservative, arbitrary constants.

Process Standard A-050 - "Panellit System Control"

Revisions to this standard are identical to those for HW-46000 B, above.

HW-46000 F, Process Standards - Reactor

Two revised standards were issued during the month. These were:

Process Standard A-050 - "Panellit System Control"

Revisions to this standard are identical to those for HW-46000 B, above.

Process Standard F-020 - "Make-Up of Tube Charges"

Major changes made to this standard were as follows:

1. Lengthy sections of "Advice" were deleted.
2. Displacement of up to 25 natural uranium charges any distance upstream or downstream is now permitted without creating a total control problem.
3. Relaxation of the requirement for re-positioning slug junctions in the process tube, to prevent tube pitting at these locations, was provided. Extensive probolog programs exist at some reactors. When it is known from data representing the entire reactor geometry, that corrosion at slug junctions is not significant, changes in slug junction positions are unnecessary.
4. Minimum charge-length specifications designed to prevent cavitation of the front-face fittings and connectors were deleted. This information is more adequately covered in Process Standard A-050 which specifies minimum process-tube pressures which will prevent cavitation of these fittings.

HW-46000 K, Process Standards - Reactor

One revised standard was issued during the month. This was:

Process Standard F-020 - "Make-Up of Tube Charges"

Revisions to this standard are identical to those for HW-46000 F, above.

PROCESS CHANGE AUTHORIZATIONS

Eight Process Change Authorizations were issued during the month to permit temporary deviation from Process Standards - Reactor, HW-46000, and one Process Change Authorization was issued to permit temporary deviation from Process Equipment Standards, HW-41000. These were:

PCA #0-99 - "Removal of High Pressure Crosstie Flow Limiting Orifices, K Reactors"

Removal of the flow-limiting orifice from the high-pressure crosstie and safety-circuit changes were to be made which would delay opening of the V-73 valve until five seconds after the aiding reactor has been shut down. These changes were made to increase the flow rate of the coolant backup system. The changes could also result in more flow being diverted than desired.

This PCA presented a valving procedure to be used at a shutdown K Reactor to minimize the potential for unwanted coolant diversion.

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PCA #0-100 - "Thermal Shield Cooling, K Reactors"

Process Standard A-070 specifies temperature limits for the reactor bottom-shield cooling water and the concrete pad directly below the thermal shield. Difficulties have been encountered in meeting these temperature requirements. The limits are specified to control the thermal gradient through the concrete pad. Operating experience has shown that the thermal gradient in the pad is well below the value which might cause damage to the pad.

Authorization was given for a 40 per cent increase in the maximum outlet temperature limit for the bottom-thermal-shield cooling water and a 20 per cent reduction in the lower limit specified for the pad. The temperature differential must not exceed 25°C. This authorization will expire December 30, 1960, or upon revision of the referenced standard, whichever is sooner.

PCA #0-101 - "Low Graphite Temperature - DR Reactor"

On November 8, 1960, DR Reactor's graphite temperatures were 20°C lower than the minimum specified by Process Standard C-040. The low graphite temperature resulted during the approach to equilibrium operation when helium was added to the reactor atmosphere during a heat cycle to obtain more control flexibility. The operating conditions specified by standards are designed to promote extended life of the graphite stack. Operation outside of these limits for a short time may, upon occasion, be desirable to prevent an immediate unscheduled outage.

This process change authorized continued operation with the graphite no more than 20°C below the limit specified in the above standard, for a maximum period of 24 hours, provided operating conditions were adjusted to continually increase graphite temperature to within limits.

PCA #0-102 - "Water Leak, D Reactor"

Process Standard B-010 specifies the maximum condensate collection rate that is permissible from the reactor gas atmosphere.

Water collection rate at D Reactor increased during November to approximately 45 gallons per day. Although some rear nozzle gasket leaks were corrected during a recent leak testing outage, the water collection rate indicated not all of the leaks were located, or a new leak had occurred.

Data indicated that the leak was in the rear section of the reactor and that operation for a short period would not significantly affect reactor life. In order to permit efficient job and manpower scheduling for the outage, continued was authorized by the process change until November 14, 1960, provided the following specifications were met:

1. The dewpoint of the inlet gas to the reactor should be maintained at less than 15°F.
2. The water collection should not exceed 60 gallons per day.

3. A reactor shutdown is required on any tube power reduction which could be caused by water in the moderator.

PCA #0-103 - "Panellit Gauge Trouble Shooting Equipment - H Reactor"

During a recent startup at H Reactor, four process-tube pressure-monitor scrams occurred. Because there is no coordinate indication in the pressure gauge system at H Reactor, it is often impossible to determine which gauge is responsible for a reactor shutdown.

Equipment has been developed by Component Testing Unit which will detect the specific gauge responsible for initiation of a scram after the trouble has been isolated to a single row of gauges. The detecting device and method consists of placing two 0.005 ampere fuses in series across each pressure monitor gauge switch in the row causing the scram. Since the current through the gauge switch is 0.18 amperes, the receipt of a high or low trip on any gauges will blow the 0.005 ampere fuse and the gauge can then be located by inspection. Tests of this device for detecting offending gauges show that reactor safety is not compromised when the device is used under carefully controlled conditions.

The PCA authorized the use of the device to locate the offending gauge.

PCA #0-104 - "Water Leak, DR Reactor"

Process Standard B-010 specifies the maximum condensate collection rate that is permissible from the reactor gas atmosphere.

On November 14, 1960, the water collection at DR increased slightly over that permitted in the referenced standard. No loss in reactivity had been observed and a survey of tube powers did not show excessive amounts of water in the moderator. These data indicated the water leak was in the rear section of the reactor and would not significantly affect reactor life.

In order to permit efficient job and manpower scheduling for the outage, continued operation was authorized by this process change until November 17, 1960, provided the following specifications were met:

1. The dewpoint of the inlet gas to the reactor should be maintained at less than 15°F.
2. A reactor shutdown is required on any tube power reduction which could be caused by water in the moderator.

PCA #0-105 - "Graphite Thermocouple Stringers, KE and KW Reactors"

Process Standard C-040 requires that the K Reactors contain nine serviceable graphite thermocouple stringers. This standard also requires replacement of graphite thermocouple stringers within three months, whenever the stringer is no longer serviceable. Serviceability is defined in the referenced standard. Considerable effort has been expended at both KE and KW to remove the failed stringers. During the past two months, one standard graphite stringer

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was installed at KW Reactor and two test stringers were installed at KE Reactor. Preliminary data obtained from the two test stringers at KE Reactor indicate that this type thermocouple stringer can adequately monitor graphite temperatures. An additional month of testing is necessary to determine if stringers of this design, which are much easier to remove and install, can be utilized to replace the standard thermocouple stringers as they fail.

This process change authorized operation with less than the specified number of serviceable graphite stringers until December 19, 1960, provided:

1. Continued effort is made to remove failed stringers.
2. Graphite temperatures in the unmonitored regions of the failed stringers are calculated as specified in the referenced standard.
3. The 50°C increase in the maximum limit for graphite within one lattice unit of (a) uncooled process tube channels, and (b) enrichment columns when helium percentage is over 95 per cent shall not apply to regions of the reactor not monitored by graphite thermocouple instrumentation.

PCA #O-106 - "Rear Header Pressure Requirement, K Reactors"

Trip-After-Instability limits are based, in part, on a maximum rear cross-header pressure of 40 psig. The measurement of rear header pressures indicates that this limit, specified in Process Standard A-020, is being exceeded.

The major parameter affected by rear header pressure is the pressure monitor gauge low-trip setting. Calculations have been completed which present pressure monitor low trip as a function of rear header pressure and TAI limits.

This process change authorized calculation of TAI limits, and pressure monitor low-trip settings by the technique presented in HW-65729, "Technical Review of TAI Limits," provided the high-trip limits specified in HW-59703, "Individual Process Tube Flow Protection, Low-Pressure Operation of K Reactors," are adhered to during five pump operation.

PCA #O-107 - "Poison Column Control Facilities - H Reactor"

Process Standard F-050 specifies that prior to charging a PCCF tube with fissionable slugs, the valved front connector and the front and rear ball valves shall be removed. The precaution of removing the rear ball valve is necessary to eliminate the risk of a uranium fire which is incurred when through inadvertent opening of the rear ball valve, a uranium column could be flushed during reactor operation. In January 1961, H Reactor is planning on charging fissionable material into 13 ball-valve tubes for one metal cycle. When the E-N loading, expected in April, starts, it is necessary to return these tubes to use in the poison column control facility. Removal and subsequent re-installing of these 13 rear ball valves is estimated to require 20 hours of outage time.

This PCA authorizes charging of fissionable slugs into PCCF tubes at H Reactor without replacing the rear ball valves, provided that on each tube so charged:



1. A pipe plug is threaded into the outlet end of the ball valve to prevent flushing even if the ball valve is inadvertently opened.
2. The key is removed from the ball-valve control handle located in the control room. Also, the handle is to be tagged "Do Not Operate - This tube contains fissionable material."

This PCA will expire on April 28, 1961.

PROCESS ASSISTANCE

One engineer audited conformance to process standards by making nine inspections at each reactor during the report period.

RUPTURE EXPERIENCE

<u>Failure Date</u>	<u>Tube Number</u>	<u>Lot Number</u>	<u>Type of Material</u>	<u>Exposure</u>	<u>Type of Failure</u>
12/4/60	5359 KW	KS-227-F	I&E E (0.94%)	619	Side Hot-Spot
12/7/60	5360-KE	KS-821-F	I&E E (0.94%)	603	Hole
12/9/60	3565-KE <sup>(1)</sup>	IP-309-A	KSN-1	2173	Unclassified
12/10/60	3476-KE	KR-277-D	I&E N	495	Hole
12/11/60	4090-DR	CA-903-H	SN	793	Split-Long.
12/14/60	0957-C	KG-278-F	I&E E (0.94%)	590	Hole
12/15/60	4351-KE	KR-321-D	I&E N	530	Hole
12/17/60	2861-F	KL-560-D	I&E N	499	Unknown
12/18/60	1559-B	KL-559-D	I&E N	603	Side-Other
12/21/60	5261-KW	KS-232-F	I&E E (0.94%)	426	Side Hot-Spot
12/21/60	5055-KE	KR-221-D	I&E N	585	Side Hot-Spot
12/25/60	2276-C	KG-856-A	I&E E (0.94%)	514	Side Hot-Spot
12/26/60	1472-H	KL-521-D	I&E N	524	Side-Other

(1) KER Loop #3

Legend:

I&E N - This is the symbol of internally and externally cooled production reactor fuel elements of natural uranium.

I&E E - This is the symbol for internally and externally cooled production reactor fuel elements with uranium cores enriched in U-235. The weight per cent U-235 in the core material is stated.

SN - This is the symbol for production reactor fuel elements having a solid cylindrical core of natural uranium.

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KSN - This is the symbol for single tube, Zircaloy clad, natural uranium fuel elements designed for irradiation in KER test facilities.

Side Hot-Spot - Failure probably caused by accelerated corrosion of the external can wall in a localized region of high temperature.

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

Unclassified - The failure did not logically fall into any of the usual types.

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.

Side-Other - Failure probably caused by corrosion of water penetration of the external can wall or other unknown mechanism.

OPERATIONAL PHYSICS OPERATIONPILE PHYSICS ASSISTANCE

Flattening efficiency as measured by total ECT matched last month's record high of 78.5 percent of all reactor tubes. Startup efficiency continued to improve with nearly all reactors achieving non-equilibrium losses in the low range of 0.15 to 0.30 of an equilibrium day per startup. KW and H Reactors achieved their respective AEC administrative limits during the month as a result of decreasing inlet water temperatures and high flattening efficiency.

SUMMARY OF OPERATING DATA OF PHYSICS INTEREST  
FOR THE MONTH OF DECEMBER, 1960

Reactor	B	C	D	DR	F	H	KE	KW
ECT in December (1)	1505	1700	1505	1550	1475	1650	2540	2550
12-Month Average ECT	1470	1690	1495	1555	1445	1620	2510	2490
Equil. Scram Time (2)	14-16	25-30	15-17	30-40	14-20	20-24	25-30**	20-25**
No. of Scrams and Recoveries (3)	0/0	0/0	0/0	2/2	1/1	0/0	2/2	0/0
No. of Non-Scram Outages (4)	0/0	0/0	0/0	0/0	0/0	1/1	6/1	1/0
Recording Period								
From:	11-18	11-18	11-17	11-18	11-18	11-21	11-18	11-17
To:	12-21	12-20	12-21	12-20	12-21	12-20	12-20	12-21

\*\*Equilibrium scram recoveries are not 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 - S. L. Stewart

A record high equilibrium power level and a new high average ECT of 1510 were attained during this report period; operation was interrupted only

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twice, both times by ruptures. Two splines were inserted in the reactor during operation for the first time. They were used as an aid to flattening and were left in the pile as supplementary startup control.

C Reactor - D. E. Newbrough

Only two outages interrupted continuity during the report period (one scheduled and one for a rupture). The equilibrium flattening efficiency as measured by average ECT was maintained at the previous month's record high, and the total non-equilibrium loss for the two outages was only 0.4 equilibrium day. Insufficient reactivity for optimum control following a large discharge restricted efficiency during one week; this reactivity deficiency was partially aggravated by the tubes out of service in conjunction with the overbore program. Enrichment is being added as necessary to maintain sufficient reactivity as more tubes are removed from service.

The new rod configuration change to a more dominantly downstream pattern and the loading of 105 front enrichment charges as authorized by PT-IP-324-C during the past few months have significantly lowered the longitudinal flux peak and moved it toward the front. In the past five months no ruptures have occurred in zones which have exhibited the most definite upstream flux shift.

With the failure of No. 42 VSR during the report period, four VSR's are out of service; total control requirements are being satisfied through the use of a smaller BDF type VSR in one channel; thus it has not been necessary to unby-pass the Ball 3X System early during an outage nor to insert additional supplemental poison to meet safety control requirements.

D Reactor - J. F. Jaklevick, Jr.

Excellent operating continuity was achieved with only one outage, a scheduled one, to interrupt a long equilibrium operating period. A new high power level 40 MW higher than the previous maximum was obtained. Supplemental control adjustments to compensate for long-term gains caused a slight distributional cycle and a sensitive control condition.

The initial use of reclaimed splines was only partially successful; further modifications are planned to improve the spline straightening process.

DR Reactor - D. G. Montague

Operating continuity was interrupted by a series of three solid metal ruptures which caused two full-length outages.

Erratic behavior of the new helium analyzer-controller system required that the old helium analyzer be reinstalled on a temporary basis; control stability near the end of the block discharge exposure cycle has been difficult as a result of excessive swings in gas composition.

Two splines were successfully inserted during operation for the first time to control flux distribution during equilibrium operation; splines have effectively flattened the flux between the heavily loaded PCCF tubes near the end of the central exposure cycle.

Only slight long-term gains were obtained during the relatively steady and long operating period from 11-21 to 12-11, indicating that the hot clean reactivity was leveling out during the latter third of the exposure cycle.

#### F Reactor - C. D. Wilkinson

Although operating continuity was limited by three full-length outages, a new record high average ECT of 1475 and a new high equilibrium power level were attained together with a decrease in non-equilibrium losses to the range of 0.2 to 0.3 of an equilibrium day per startup.

The last two PCCF tubes inside the rod banks were removed from service; all supplemental control in this area will be provided by splines in the future. With increased experience flattening with splines has proven to be very effective. Except for minor mechanical difficulties, the reliability of the system for limited use until the spline wrapper removal system becomes available has been satisfactory.

#### H Reactor - A. R. Kosmata

Stable control was maintained but was more sensitive as central exposure increased from one third to two thirds of goal; a corresponding increase in hot reactivity of about 600 cmk was observed. In order to gain the additional 500 cmk of hot reactivity needed following the block discharge scheduled in January, planning includes substitution of splines for central PCCF (Poison Column Control Facility) tubes, expediting of a PITA permitting higher graphite temperatures during the early portion of the cycle, and added enrichment.

Initial results from studies of the split enrichment columns indicate the anticipated upstream flux shift and reduced flux peak; rupture potential curves developed by Process Technology indicate that use of these loadings for normal enrichment requirements could result in reducing reactor rupture potentials as much as 50 percent at reactors where gross amounts of enrichment are used (C, H, KE, KW).

H Reactor had a long operating period which was interrupted only by one short outage caused by a scram due to a faulty Panellit gage and a subsequent minimum outage resulting from a water leak after the scram recovery.

#### KE Reactor - G. F. Bailey

Operating continuity was interrupted by five full-length outages and three short outages resulting from four ruptures, a KER failure, a Panellit scram caused by a spline cap seal failure, and two deliberate shutdowns to correct equipment problems. One hot startup attempt 24 hours after a cold startup was successful.

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A new low non-equilibrium loss of 0.135 equilibrium day was achieved after one cold startup. Although the equilibrium flattening efficiency was above average, full equilibrium operation was achieved only during about one week of the report period.

The initial replacement of CO<sub>2</sub> as a pile gas by N<sub>2</sub> under PT-IP-358-AC occurred without incident; a gas composition of about 75 percent He and 25 percent N<sub>2</sub> was attained. Although the erratic operating continuity restricted analysis of the gas transition, the scattered data supported the anticipation of negligible hot reactivity loss due to the higher neutron capture cross section of N<sub>2</sub>.

Three horizontal rods continue to be only partially insertable due to the sifting of 3X balls into the rod channels; current operation is only slightly affected by partial loss of these rods. Continued loss of one or two rods, however, would hinder use of an upstream inboard rod configuration; this possibility may be reasonable for production testing in conjunction with supplementary control equipment and higher graphite temperature limits recently made available.

#### KW Reactor - R. A. Chitwood

Operating performance was very satisfactory with above-average flattening efficiencies and record power levels being maintained through the report period; two outages (for two enrichment ruptures) interrupted continuity of operation. Installation of the 49-point rapid tube temperature scanner was completed.

#### PROCESS PHYSICS STUDIES

##### Safety Control Studies

VSR insertion problems at the C pile required a review of safety control status at that reactor. Lack of any VSR does not affect total control considerations as long as the Ball 3X System is operable. Geometry effects due to malfunction of several adjacent VSR's could result in inadequate speed of control; however, rods sufficiently smaller to permit insertion reliability would likely have sufficient control strength to meet speed of control requirements.

The proposed bumper fuel loading for D pile will extend the exposure range and will thereby increase reactivity transients involved in total control and speed of control. Total control requirements can be met with existing supplementary control techniques. Speed of control considerations may, for the first time, require comparable Operational Physics standards administration; Process and Reactor Development is currently developing bases for possible standards.

Final reports on subcritical monitor and power rate meter operational performance tests have been issued as HW-67449 and -67450 respectively.

### Pile Reactivity Studies

Survey-type calculations of conversion ratios in flat and buckled regions and in "gray" and "black" lattices indicate that conclusions drawn from homogeneous machine program calculations made to date for the overbore program should be valid. Although the machine program slightly overcalculates on an absolute basis, the difference indicated by machine calculation between existing and overbore conversion ratios would be conservative for the realistically flattened case. Similar survey calculations are being done in support of the E-N separations observations.

A "Test of Experimental Control System Logic and Design Parameters" is being circulated for approval as PT-IP-383-C. This test will apply fixed operational control rules in order to determine workable reaction increments and timing for a subsequent automatic control demonstration system.

The production test for a small-block E-N reactivity measurement has been reviewed in the rough draft stage and will be circulated for approval prior to the H Reactor January discharge.

### Control Efficiency Studies

The average ECT (effective central tubes) value observed during 1960 at the eight production reactors was approximately 2-1/2 percent higher than that during 1959. Non-equilibrium losses per startup were reduced during the year to an average value under one half day per startup. These Operational Physics measurements data are normally published in separate reports semi-annually. A significant portion of the gains during the past year are attributed to large scale use of splines at the C and K Reactors.

A background document on "Evaluation of Supplementary Control Incentives and Effectiveness" was issued during the month as HW-67403.

### Shielding Studies

Measurements continued during the month on various iron, iron-epoxy, and boron-epoxy shielding ring configurations in conjunction with C-pile overbore tests.

### Reactor Fundamentals Training

The fall section of the pile operator training program was completed during the month. A spring session will be scheduled to commence in January. A winter session for the 32 operating specialists started November 30.

A series of reactor fundamentals classes totaling eight hours for service personnel with engineering background was conducted during the quarter for a class scheduled by Relations Practices.

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TESTING OPERATION

IRRADIATION TESTING OPERATION

DR-1 Loop

DR-1 Loop was operated without a test element for 398 hours during the month to test loop components.

The test element for the MGR-HDR-3 test was received and is being checked in preparation for insertion into the loop.

H-1 Loop

H-1 Loop was cooled by single-pass process water during the entire report period.

Sample Irradiations

The following samples were irradiated or undergoing irradiation during the month:

<u>Reactor</u>	<u>Test Hole</u>	<u>Facility</u>	<u>Request No.</u>	<u>No. of Samples</u>	<u>Material - Purpose</u>
KE	2D	Quickie	HAP0-184	7	Washington Designated Program
KE	2D	Quickie	HAP0-172	4	Effluent water (radioisotopes concentration study)
KW	2C	Hot Graphite	HAP0-177	1	Graphite (damage studies)
KW	3C	Gen.Purpose	HAP0-236	1	Zirconium (creep test)
DR		PCCF	HAP0-218	2	Uranium (fission product release study)
F	E	Quickie	HAP0-172	13	Effluent water (radioisotopes concentration study)
F	E	Quickie	HAP0-219	3	Strontium (separation plant waste product study)
F	E	Quickie	HAP0-249	2	Graphite (damage studies)
F	E	Quickie	HAP0-223	3	Flux monitor wire (NPR activation and decay study)
F	E	Quickie	HAP0-229	1	UO <sub>2</sub> (thin films)
F	E	Quickie	HAP0-223	1	Thermal setting cement (Gas Loop material activation analysis)
KW	4C	Snout	HAP0-242	1	Fenwal detector (radiation damage study)
KW	3A	Gen.Purpose	HAP0-236	1	Zirconium (creep test)
KW	4B	Snout	HAP0-243	12	Reactor structural materials (fission damage studies)
KW	4C	Snout	HAP0-249	1	Graphite (damage study)
KE	2D	Quickie	HAP0-252	1	Arsenic (tracer isotope production)



Reactor	Test Hole	Facility	Request No.	No. of Samples	Material - Purpose
		Gamma*	HAPO-171	3	Plastics and Rubber (damage studies)
		Gamma*		1	Crystal (damage studies)
		Gamma*		4	Vacuum tubes (damage studies)
		Gamma*		6	Epco (epoxy resin)(damage studies)
		Gamma*		9	Chemicals (damage studies)

\*Gamma Irradiation Facility in Building 105-KE storage basin.

Borescoping Activities

Process Channel 1965, 105- F - The steel washer at the end of the inlet tube steel had been cut out by the channel overboring tool.

Process Channel 1968, 105- F - The steel washer at the end of the inlet tube sleeve could not be observed due to graphite dust and chips.

Vertical Safety Rod Channel No. 50, 105-KE - Two graphite filler blocks were obstructing the channel at 13 feet from the top of the rod housing. The blocks were protruding into the channel approximately one and one-fourth inches. The remainder of the channel was clear.

Vertical Bowing Measurements

Following is a summary of vertical bowing measurements. All distances are measured from the process tube inlet flange or reactor face:

Area	Tube No.	Date	Distance	Remarks
105-F	4676	12-18-60	36 ft.	Up .14 inch at 9'4" since 7-17-60 Down .06 inch at 20' since 7-17-60
105-KE	Y-2	12-19-60	42 ft.	Up .02 inch at 11' since 4-28-60 Down .57 inch at 24'4" since 4-28-60

COOLANT TESTING OPERATION

KER Loop Operations

KER-1 - The loop was on single-pass operation with dummies until the outage of December 7, when an attempt was made to charge a thermocouple assembly from the front face as authorized by PT-IP-314-A, Supplement F. The assembly stuck with approximately four feet of the assembly left to charge. Before charging the tube was gauged by passing self-supported dummies up to 24 inches long and 1.9 inches diameter, which was larger than any element in the train.

The in-reactor piping was decontaminated and the tube was charged with ten 15-inch NIN1 fuel elements with electron beam welded end caps as authorized by PT-IP-378-A. The lower front-face crossheader and connector were removed for metallographic examination and were replaced.

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The loop was held at low temperature December 16 through 19 because of leaks at the rear tube-to-nozzle seal and lower crossheader-to-pigtail connection. A new crossheader was installed and a new O-ring and repaired nozzle installed.

KER-2 - Testing as described and authorized by PT-IP-363-A continued throughout the month. The charge consisted of four 18-inch 1.6 per cent enriched single-tube elements with beryllium-zirconium brazed end closures. On December 9, the No. 1 primary pump was replaced due to a failed upper radial bearing.

KER-3 - Testing as described and authorized by PT-IP-309-A and PT-IP-309-A, Supplement A, continued until December 9, when the reactor was shut down due to a fuel element rupture. The fuel elements were discharged into a tray and lowered to the basin. The failure was found to be a circumferential split in the weld of one of the undefected elements. The tube was recharged with dummies and operated on single-pass status until December 15. The loop was then charged with four 18-inch 1.6 per cent enriched (KSE3) elements as specified and authorized by PT-IP-363-A. The front lower crossheader and connector were removed for metallographic examination and were replaced. The No. 1 primary pump was replaced due to failed radial bearings.

KER-4 - Testing of four 1.6 per cent enriched single-tube elements (KSE3) specified and authorized by PT-IP-363-A continued throughout the month. The loop was on single-pass operation December 9 to 11, to repair primary pump Numbers 1 and 2.

#### 1706-KE Single-Pass Tube Operation

During the outage of November 28, tubes 4355, 4456, 4557, and 4863 were removed. Tubes 4355, 4557, and 4863 were retubed with ribless C-size Zircaloy-2 tubes and charged with C-IV-N fuel elements as authorized by PT-IP-361-A for corrosion and effluent activities testing with process water.

Zircaloy-2 ribless process tubes were installed in channels 2952 and 3050 during the December 7 outage. Tubes 2943 and 3043 were returned to 105-KE production service. Tubes 2952 and 3050 were charged with C-IV-N fuel elements.

Channel 4456 was retubed on December 16 with a regular K-size aluminum tube and charged with K-III-N fuel elements. All eight tubes are being supplied with normal process water.

#### Outage Performance

There was one unscheduled outage charged to Coolant Testing during the report period. A total of 77.3 hours was charged to Coolant Testing as listed below:

<u>Production Test</u>	<u>Description</u>	<u>Time</u>
IP-197-A and IP-361-A	Discharged tubes 4355, 4456, 4557, and 4863. Installed new Zircaloy-2 tubes in 4355, 4557, and 4863.	32.6 hrs.
IP-314-A and IP-378-A	Discharged dummies, attempted front face thermocouple charge, recharged with ten 15-inch fuel elements.	4.8
IP-361-A	Retubed 4456 and relocated piping to 2952 and 3050. Retubed 2952 and 3050 with ribless Zircaloy-2 tubes.	29.0
IP-309-A	Discharged rupture charge into tray. Recharged with dummies.	6.2
IP-378-A and IP-361-A	Repaired leaks on KER-1 rear header and nozzle. Installed process tube in channel 4456 and charged tube.	4.7

Ex-Reactor Facility Operation

1706-KE Mock-Up Tubes - The following tests were continued throughout the month:

1. Corrosion characteristics of improved nickel-plated fuel elements.
2. Corrosion characteristics of aluminum cermets.
3. Pre-filming of carbon steel samples at different exposure temperatures in process water for later testing of candidate decontamination procedures.

Dowtherm - Testing of the effects on heat transfer by fouling caused by raw water on a carbon steel tube and a carbon steel tube clad with copper was resumed.

ELMO-4 - Piping revisions have been completed; a new Chempump has been installed and initial shakedown runs are being performed.

ELMO-5 - Testing of Zircaloy-2, Haynes Alloy No. 41, and carbon steel subjected to various heat treatments to determine the uniform corrosion rate in 290 C and pH 10 water were continued during the month.

ELMO-6 - Corrosion testing on aluminum alloys X-8001 and A-288 at 300 C and pH 6 to pH 7 were continued throughout the month.

ELMO-7 - Thermal cyclic tests on two KER inner tube fuel elements were continued throughout the month. Testing of a stainless steel tubular dummy in a Zircaloy-2 tube to investigate the effects of chattering was also continued. Cyclic testing of seal gaskets for KER process tube nozzles, Design Test 1079, was suspended after four tests of the metallic spring seal were completed. The Design Test is being revised to include testing of

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CGI-839 nozzle-to-tube and nozzle-to-end cap seals. Testing of dummy fuel elements to determine corrosion rates on various types of "suitcase handle" supports was continued.

ELMO-8 - Rebuilding of the loop is approximately 75 per cent complete. Design of threaded caps to replace the two-bolt connectors on the test sections has been initiated.

ELMO-10 - Three decontamination cycles were completed on coupons which had been conditioned in CEP-1.

CEP-1 - Testing continued on evaluation of the effects of cyclic decontamination and operation on corrosion rates of galvanically-coupled welds, carbon steel and Zircaloy-2 mechanically coupled to stainless steel and carbon steel, and carbon steel mechanically coupled to Zircaloy-2. Five decontamination cycles have been completed.

CEP-2 - Testing of fretting corrosion characteristics on Zircaloy-2 at 20 C was resumed after repair of the electromagnetic cycle controller.

CEP-3 - The loop is being repaired following the damage caused by the connector failure on November 22.

CEP-4 - The loop is undergoing modification of piping for removal of the two-bolt connectors similar to the one which failed on CEP-3.

REP-1 - Two gross decontamination tests were completed. In the first test the loop was contaminated by 0.04 pound of irradiated uranium and decontaminated with AP-1 followed by Phos-3. In the second test 0.02 pound of irradiated uranium was used to contaminate the loop and it was decontaminated with AP-1 followed by Phos-2.

#### COMPONENT TESTING

##### Irradiated Material Examination

Examinations were completed on the fuel elements from the following 61 tubes during the month of December, in the Metal Examination Facility (105-C).

<u>PT No.</u>	<u>Tube No.</u>	<u>PT No.</u>	<u>Tube No.</u>	<u>PT No.</u>	<u>Tube No.</u>	<u>PT No.</u>	<u>Tube No.</u>
216A	3966-C	216A	1268-DR	216A	1984-KE	262A	3864-D
	2059-C		1269-DR		2953-KE		3980-D
	2158-C		1860-DR		4266-KE		3982-D
	1673-C		1861-DR	262A	3170-D		3387-D
	0970-C		2260-DR		3173-D		3488-D
	2364-D		2261-DR		3263-D		3489-D
	2583-D		2670-DR		3361-D		3582-D
	2671-D		2863-DR		3382-D		3686-D
	2683-D		3570-DR		3460-D		3884-D
	3677-D		3873-DR		3476-D		3886-D
	2582-D		4284-DR		3577-D	272A	3869-D

<u>PT No.</u>	<u>Tube No.</u>	<u>PT No.</u>	<u>Tube No.</u>	<u>PT No.</u>	<u>Tube No.</u>	<u>PT No.</u>	<u>Tube No.</u>
	0566-D		1154-F		3588-D		3479-D
	1980-D		1772-F		3679-D	347A	1659-H
	1462-D		3077-F		3787-D		1690-H
	2468-D		3782-F		3863-D		2660-H
							2685-H

Process Tube Corrosion Monitoring Program

In-reactor measurements of 270 process tubes were completed during the month. Listed below are the number of tubes measured per reactor and document numbers of reports issued.

<u>Reactor</u>	<u>No. of Tubes Probologged</u>	<u>Report No.</u>	<u>HW Number</u>
B	23	64	67669
F	32	65	67702
D	139	66	67804
B	6	67	67810
F	64	68	67825

Six KE process tubes were probologged. The measurements from these tubes will be used for a calibration of the probolog instrument for K Reactor process tubes.

Visual examination, wall thickness and rib height measurements were completed on two tubes from C Reactor, three tubes from D Reactor and three tubes from KE Reactor. The tubes from C Reactor were examined to investigate the rate of corrosion and to verify the accuracy of the probolog interpretation. Actual wall thickness measurements of the two tubes showed the probolog interpretation to be accurate to within one mil. Tubes 0960-D and 2582-D were removed because they contained rear process tube flange leaks. In tube 2582-D, a circumferential crack was found on the bottom half, approximately one-fourth inch upstream from the rear process tube flange. Tube 1366-D, which operated only six months, was a tube leak. The leak was located at the 2 o'clock position, between 13-1/2 and 14 feet from the rear process tube flange. From the appearance of the film and corrosion pattern, it appeared that a misaligned fuel element may have caused the accelerated corrosion. The three tubes from KE Reactor were examined to determine the current wall thickness and the nature of corrosion.

Panellit System Programs

Gauges repaired, calibrated by Maintenance	-	334	
Gauges meeting examination criteria	-	308	(92 %)
-previous month	-		(93 %)
In-board gauge reliability examinations	-	1026	
Gauges meeting examination criteria	-	880	(86 %)
-previous month	-		(90 %)
-average for past year	-		(88 %)

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Response time determinations -	1026	
Meeting response criteria -	992	
-last two months 1959		(89 %)
-first 11 months 1960		(96 %)
-December 1960		(97 %)
 In-board coil leak examinations -	8019	
Non-leaking coils -	7991	(99.6 %)
-average rate for last two years		(99.5 %)

"Critical Component" inspection of Panellit gauge components, for warehousing and direct-to-user availability, is as follows:

	<u>Switches</u>	<u>Bourdon Coils</u>
Inspected	49	0
Rejected	9	0
Rejection rate	18 %	

Rejection rates were below the figures for the past year's inspection activities.

The Failure Analysis Report for the two-month period ending November 30, was published as Document HW-67695.

The test program to determine the suitability of Delrin plastic for Panellit gauge dial pivots and bushings showed them to have incurred very little wear in accelerated testing equivalent to more than 14 months normal service.

*O. H. Greager*

PRODUCTION, ENGINEERING & REACTOR OPERATIONSPRODUCTION OPERATIONPRODUCTION PLANNING & SCHEDULING OPERATION

There were no discharge exposure adjustments initiated during December. The overall discharge exposure level was down slightly from the previous month due primarily to extra discharging from KE Reactor.

Discharge Exposure Comparison (MWD/T)

	<u>Regular Solid</u>		<u>Regular I&amp;E</u>		<u>Enriched I&amp;E</u>	
	<u>6 Old</u>	<u>2 K's</u>	<u>6 Old</u>	<u>2 K's</u>	<u>6 Old</u>	<u>2 K's</u>
October	740	752	693	679	796	744
November	713	749	709	700	849	681
December	721	759	693	642	852	678

ESSENTIAL MATERIALS

Rail and truck shipments received in December were as follows:

Carload shipments for IPD	- 204
Carload shipments for other Depts.	- 223
Truck shipments for IPD	- <u>169</u>
Total	596

MISCELLANEOUS ACTIVITIES

During December six of IPD's first-year men in the Mfg. Training Program were transferred to their second 6-month work assignments - four to other departments at HAPO, and two within IPD. Three of those who left IPD were replaced with first-year Program members from other HAPO departments. Trainee performance appraisals were continued on schedule.

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REACTOR OPERATIONS STATISTICS - PROCESSING														
MONTH	December, 1960													
	B	C	D	DR	F	H	KE	KW	TOTAL					TOTAL
NO. OF REACTOR OUTAGES & HOURS	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.
INPUT PROD. - PU (% OF FORECAST)	102.5	105.5	123.8	111.3	115.3	119.4	93.7	115.4	109.5					109.5
TIME OPER. EFF. (% OVERALL)	82.2	77.8	92.6	89.4	83.4	92.5	74.9	86.3	84.9					84.9
SCHEDULED	1	128.3	1	43.9	-	66.0	-	31.8	-	62.0	-	63.6	2	546.4
UNSCCHEDULED - SCRAMS	-	0.3	-	-	-	0	-	0.3	3	38.3	-	0	5	38.9
- OTHER	2	36.9	-	34.8	3	57.3	1	24.0	6	86.3	2	38.1	19	314.2
TOTAL	2	132.4	5	165.5	1	55.2	2	56.1	9	186.6	2	101.7	26	899.5
BREAK'D N OF REACTOR OTGE HRS.														TOTAL HRS. TIME
PLANNED														
CHARGE-DISCHARGE	25.5	65.8	27.5	27.0	25.6	16.5	16.8	46.8	251.5	4.2				4.2
TUBE REPLACEMENT	17.8		12.7		4.9	2.0			37.4	0.6				0.6
PROJECT WORK	4.0	4.0			3.0				16.5	0.3				0.3
PRODUCTION TEST	3.7	33.0	4.3						80.1	1.4				1.4
MAINTENANCE	44.9	25.5	10.4	16.9	32.5	13.3	9.9	6.0	159.4	2.7				2.7
MISCELLANEOUS														
SUB - TOTAL	95.9	128.3	54.9	43.9	66.0	31.8	62.0	1.5	546.4	9.2				9.2
UNPLANNED														
CHARGE - DISCHARGE		7.0	0.3	10.1	4.6				24.7	0.4				0.4
PRODUCTION TEST					1.5				19.7	0.3				0.3
RUPTURE REMOVAL	11.5	29.5		9.9	10.8	18.7	73.9	26.8	181.1	3.0				3.0
WATER LEAK	23.1			14.8	19.0				56.9	1.0				1.0
MAINTENANCE	1.9	0.4			19.9	5.3			37.0	0.6				0.6
INSTRUMENTATION		0.3							0.3	0				0
PANELLIT						0.3			0.3	0				0
MISCELLANEOUS					1.5				33.1	0.6				0.6
SUB - TOTAL	36.5	37.2	0.3	34.8	57.3	24.3	124.6	38.1	353.1	5.9				5.9
TOTAL	132.4	165.5	55.2	78.7	123.3	56.1	186.6	101.7	899.5	15.1				15.1
NO. SLUG RUPT. (ALL TYPES)	1	2	0	1	1	1	4	2	12					
NO. NEW TUBES INSTALLED	8	0	0	2	0	0	0	0	10					
TYPE OF WATER LEAK - TUBE	2	0	0	1	0	1	0	0	4					
VAN STONE	0	0	0	0	1	0	0	0	1					
Helium Used M. Cu. Ft.	529.8	390.4	443.1	257.1	527.4	864.7	421.8	315.0	3749.3					





MONTH		REACTOR OPERATIONS STATISTICS - POWER										SHEET 1
December, 1960		100-B	100-C	100-D	100-DR	100-F	100-H	100-KE	100-KW	TOTAL		
RIVER WATER (BLDG.181)												
TO RESERVOIR (BLDG.182)	GPM AVG.	15041		2346		3952	2749			24088		
TO FILTER PLANT (BLDG.183)	GPM AVG.	67219		95670		78686	85100	151700	166500	644975		
TO FILTER PLANT (CSDR)	GPM AVG.	97145		63529						160674		
TO R & E (KER) FEO	GPM AVG.			203				620		823		
TOTAL	GPM AVG.	179405		161748		82638	87849	152320	166600	830560		
TOTAL	M GAL.	8008.6		7220.4		3688.9	3921.6	6799.6	7437.0	37076.1		
RESERVOIR WATER (BLDG.182)												
TO POWER HOUSE (BLDG.184)	GPM AVG.	45		63		403	90			601		
TO COND-SYSTEM (BLDG.190)	GPM AVG.			526		3544	2659			6729		
TO COND-SYSTEM (190DR & 188F)	GPM AVG.			1757		5				1762		
TO EXPORT SYSTEM Incl. NPR	GPM AVG.	14996								14996		
TOTAL	M GAL.	671.4		104.7		176.4	122.7			1075.2		
FILTER WATER (BLDG. 183)												
TO POWER HOUSE (BLDG.184)	GPM AVG.	190		207		116	160			673		
TO PROCESS (BLDG. 190)	GPM AVG.	73903	80874	80945	76409	77070	80800	149560	164623	784184		
TO 108	GPM AVG.	2800	4500	58		1053	1210			9621		
TO 108DR	GPM AVG.			59						59		
TO FILTER PLANT (BLDG.183DR) & F	GPM AVG.		10652	13353						(24005)		
TO F & S SYSTEM	GPM AVG.	100		281		144	75	213	50	650		
TO R & E (KER) & FEO	GPM AVG.	878	1119	614	473	303	2855	1927	1927	10096		
BACKWASH	GPM AVG.	3476.2	4336.5	4270.7	3432.0	3512.5	3798.9	6771.9	7437.0	37035.7		
TOTAL	M GAL.											
PROCESS WATER (BLDG. 190)												
TO REACTOR	GPM AVG.	73503	80474	80545	76009	76670	80300	145400	161500	774401		
TO REACTOR	GPM NOR.	84800	94800	85500	85000	86800	85200	180000	182000	884100		
POWER HOUSE (K AREA)	GPM AVG.							34	12	46		
108 (KE - KW)	GPM AVG.							3641	2711	6352		
TO R & E (KER)	GPM AVG.							85		85		
BUILDING USAGE	GPM AVG.	400	400	400	400	400	500	400	400	3300		
TOTAL	M GAL.	3299.0	3610.2	3613.4	3410.9	3440.4	3606.9	6676.4	7348.8	35006.0		
RIVER DATA												
ELEVATION (MSL.FT.)	(MAX.)	388.2		382.0		367.6	372.3			382.7		
	(MIN.)	384.4		378.0		364.9	369.9			379.4		
	(AVG.)	386.5		379.1		366.0	371.1			381.1		
TEMPERATURE	AVG. °F	45.3		48.0		49.8	49.3			47.0		

MONTH

December, 1960

REACTOR OPERATIONS STATISTICS - POWER

SHEET 2

	100-B	100-C	100-D	100-DR	100-F	100-H	100-KE	100-KW	TOTAL
<u>WATER TREATMENT DATA</u>									
AT BLDG. 182									
BLDG. 183	3000.7	4336.6	4270.7	2835.9	3512.5	3798.9	6771.9	7437.0	35964.2
						(E-1754.4) (W-2044.5)			
<u>CHEMICAL CONSUMPTION</u>									
CHLORINE (BLDG. 182)									
(BLDG. 183)	5453	11629	730	475	13390	13281	22500	26400	93858
	.2	.3	.02	.02	.5	.4	.4	.4	.3
*Alumina	31225	19491	-						54716
Aluminum-Nitrate									
Avg - PPM						260307			260307
						(2)	8.2		8.2
ALUM	8214	20384	89566	75020	91321	53315	185600	204100	727520
	.3	.6	2.5	3.1	3.1(1)	3.6	3.3	3.3	2.5
SEPARAN	100					250			350
	.004					(W) .007			.005
SULPHURIC ACID						(E) 165700			
(AS 100%)	216205	316153	325000	220000	265056	209545	599000	560000	2710959
	8.6	8.7	9.1	9.3	9.0	6.6	10.6	9.0	9.0
DICHROMATE	49406	41564	52678	49726	51600	55685	92300	103000	495959
PURGE MATERIAL CONSUMPTION									
SOLIDS	-	-	-	600	-	-	-	-	600

\*Alumina and Alum combined for PPM in alum column.

\*\*PPM feed rates in east-west basins based on actual water treated

(1) 1754.4 MM gals, and (2) 2044.5 due to PT-IP-347-A.

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MONTH		REACTOR OPERATIONS STATISTICS - POWER										SHEET 3
December, 1960		100-B	100-C	100-D	100-DR	100-F	100-H	100-KE	100-KW			
<u>ANALYTICAL DATA</u>												
<u>RAW WATER</u>												
PH	PH AVG	9.0	7.7	8.1	8.1	8.1	8.1	7.7	7.6			
TURBIDITY	PPM AVG	3	4	2	4	3	1	4	5			
<u>FINISHED WATER</u>												
PH	PH AVG	7.1	7.1	7.1	7.1	7.1	7.1	7.0	7.1			
TURBIDITY	PPM AVG	.004	.005	.007	.007	.008	.006	.006	.009			
Cl <sub>2</sub> RESIDUAL	PPM AVG	.05	.05	0	0	.05	.05	.05	.06			
DICHROMATE	PPM AVG	1.8	1.4	1.8	1.8	1.8	1.9	1.8	1.8			
<u>STEAM DATA</u>												
GENERATED (MAX)	LBS/HR	138000	146000	68000	78000	430000	62000	73000	135000			
(NOR)	LBS/HR	98000	81000	55000	62000	296000	-	-	-			
(AVG)	LBS/HR	98800	106881	56408	61448	323537	38876	35145	74021			
TOTAL	M LBS	73593	79520	41968	45717	240798	28924	26148	55072			
TO PLANT	M LBS	62406	67432	36932	38768	205538	26031	23533	49564			
COAL RECEIVED	TONS	3032	4610	2960	3008	13610						
CONSUMED	TONS	3990	4345	2401	2862	13598						
IN STORAGE	TONS	16019	18905	14598	16915	66437						
GEN STEAM/LB. OF COAL		9.22	9.15	8.74	7.99	8.85						
OIL RECEIVED	GALLONS						211828	348702	560530			
CONSUMED	GALLONS						260590	239880	500470			
IN STORAGE	GALLONS						1187508	1166676	2354184			
GEN STEAM/GAL. OF OIL							111.0	109.0	110.0			
<u>ELECTRICAL DATA</u>												
TOTAL GENERATED KW HRS.							1652000	1730400	1825400			
Peak Demand Control							164000	242400	406400			

APPLIED REACTOR ENGINEERING OPERATIONINDUSTRIAL ENGINEERING OPERATIONRear Face Improvements, All 105 Reactor Buildings

Physical installation of rear face conveyors and nozzle cap trucks has been completed. Each area has received a partial shipment of nozzle cap trays. The vendor furnishing Fiberglas nozzle cap trays completed 80 per cent of the 720 cap trays originally ordered, prior to going out of business. The remaining 20 per cent of the order is being renegotiated by the Purchasing Operations. At present a replacement vendor has not been selected.

Program of Tube Replacement Improvement

This improvement program was recently installed in 105-F reactor for a 72 tube replacement job. The direct work standards specified an over-all unit time performance of .86 hours per tube. F Maintenance personnel performed the outage work using the proposed engineered system at a unit time performance of .80 hours per tube.

105-F Reactor has been selected for lead reactor installation of the final phase of improved tube replacement performance. Training classes began December 14, 1960 and will continue each Wednesday for a total of 5 repeat sessions. Forty-five (45) first-line Maintenance Supervisors and one hundred (100) craftsmen have been scheduled to attend the sessions. Instructors from Radiological Engineering and Maintenance Practices Operation are participating in conducting the training program.

Resident Industrial Engineering Service, 100-D, DR Reactor Operations

Assistance was given to the development of bumper fuel elements charging techniques. Two charging machines are being considered by D Processing. One machine uses a hand fed position technique; the other machine uses a clip position hand fed technique. An evaluation of these two charging machines is being conducted to determine the potential charging rates and crew requirements.

Methods, material flow and time standards are also being developed for nozzle replacement.

Resident Industrial Engineering Service, 100-H and 100-F Reactor Operations

Outage Work Scheduling - A technique of using templates as a dynamic visual aid in scheduling outage work has been introduced and is being used in H Reactor Operation.

Nozzle Replacement - A request has been received to assist on the bumper fuel program by working up an appropriate material handling system for all the work involved in revising front face equipment. A work pallet and flow chart for nozzle handling was designed and prepared.

Program of Charge-Discharge Improvements

Tests of work area and "C" elevator lay-out, methods, manpower deployment and resultant time values were conducted according to engineered procedures. The results of the test indicated need for some changes. These have been incorporated in the engineered procedure.

Training Films

The reclassifying of our film was completed on December 9, 1960 and all film returned from 300 Classified Files. Work is progressing on splicing new penalty stamps and titles on all film. Estimated completion date January 16, 1961. The re-classification should improve and expedite use of the film.

Study of Duplicating Needs, 100-F Area

A study has been made to determine the feasibility of placing a duplicating service in 100-F Area. The amount of duplicating work and projected costs have been submitted in a report dated December 14, 1960, to the Supervisor of Office Service and Program Administration.

Assistance to Supplemental Crew Activity

Two training meetings were held during this report period with Reactor Operation crews. These on-the-job meetings dealt with rear face cap handling techniques. The total to date of these meetings is 18. These meetings are held during 4-12 shift in those reactors which have the carts and trays, but have not started using them routinely. The meetings consist of 35-40 minutes of talk with visual aids (flip charts) and at least 11 minutes of filmed work activity.

Methods Appreciation Course

A four-hour, two session training course has been prepared for presentation to Manufacturing Supervisors and Specialists. During this report period there were five "make-up" meetings conducted for those who missed regular sessions. Attendance at Session 1 was 55 per cent; at Session 2, 47 per cent.

Determination of the Base Painting Load in Irradiation Processing Department

A painting survey for 100-F Area was completed. A five year painting schedule was compiled, Document HW-67719 (Unclassified), dated December 9, 1960, which includes the following data:

- 1) The frequency required for painting 100-F Area buildings and installations.
- 2) The man-hours and materials required to paint 100-F Area buildings using current Irradiation Processing Department work practices.
- 3) The man-hours and materials required to paint 100-F Area buildings using the General Electric Company Indirect Labor Measurements system of time values for maintenance work.

- 4) The man-hour and materials required by an outside contractor to paint 100-F Area buildings and installations.

#### Lead Reactor Installation, Fuel Element Material Handling, Work Area and C Elevator

A report "Reactor Costs for Fuel Loading", HW-67706, dated December 6, 1960, has compared the cost for man-power to achieve peak rates of fuel loading. The study reveals that use of the fuel clip for charging regular fuel in all Irradiation Processing Department reactors would have a pay-out time of 1.5 years and direct savings of \$100,000 to \$150,000 per year thereafter.

To attain this saving and pay-out time, the fuel clip material handling system must not cost more than about \$34,000 per reactor. It appears at this time that new charging systems for bumper and supported fuel may incorporate full use of the sort of system considered in this task.

#### Helium Leak Detection System Evaluation

Industrial Engineering Operation has been requested to work up some improvements in water leak detection methods. The entire system of apparatus now available for leak detection is being studied to determine the optimum usage of the equipment with respect to time required to locate leaks. The detection apparatus can be used in many ways. To determine the "best" way by tests in practice may cause delays to completing reactor outage work. Therefore, some better means of testing the leak detection system is required. To fill this need, a means of "simulating" experience with the Helium leak detection system is being developed. By using the simulation means, the outage cost for alternative Helium leak procedures can be tested thoroughly before the procedure is put to actual use on the reactor.

#### Reactor Front Face Nozzle Broaching

Study has been completed and the report issued. Direct labor estimate for broaching 1500 nozzles at one reactor is \$9720 including I.M.E. plus a 20 per cent contingency factor. Manpower requirements are estimated at 26 men per shift.

#### Resident Industrial Engineering Service, 100-B, C Reactor Operations

Rear face tube identification tags are becoming illegible in some areas due to moisture and chemical deterioration of the paint. Potential vendors are being queried as to their interest in supplying tags of greater lasting quality, such as those with punched numbers.

Panellit test bench methods were filmed in C Reactor as a basis for re-design.

Work has been initiated to accumulate a list of Maintenance and Processing job times used to plan and schedule outages.

Work Improvement, 105-C Metal Examination Facility

It is desired to double production in this facility. Industrial Engineering will determine the procedures to be followed in reviewing work activities of the area. To date Flow Process charts of material flow have been made. From information gained, planning cards are being made.

MAINTENANCE PRACTICES OPERATIONSpare Parts Inventory

During the month, revisions to spare parts inventory were as follows:

Increase		
Plants	\$	3,916
Projects		5,913
		<u>9,829</u>
Decrease		<u>3,972</u>
Over-all Increase	\$	5,857

Purchase requisitions were initiated for both interim expedited and long range pigtail requirements.

Helium Loss Reduction

Work continuing on this program effort is being directed toward revisions to Process Standards. Omega seal leakage, leak detection, and repair is currently being investigated in conjunction with other activities connected with this study. The Irradiation Processing Department helium loss trend is continuing upward at approximately the same rate reported in August.

Gas Purification Proposal

Facilities Engineering Operation has issued the feasibility study on rear face sealing rejected in favor of alternate methods of gas purification. In addition, we are awaiting a specific proposal from Equipment Development Operation on helium purification at 105-C.

Survey for Combustible Gases

As a result of the interim report dated November 9, additional information and study have been requested on the presence of combustible and/or toxic gases in the 105 Buildings. Gas samples are being taken at 105-C under normal ventilation conditions on a weekly basis. A test is being designed whereby the air flow in various areas will be interrupted on a temporary basis and samples taken to simulate conditions of undesirable air balance.

Code Compliance

Engineering Request No. 9 requested Facilities Engineering Operation to reactivate engineering work for modification of C and D Elevators to comply.



with Safety and Code considerations. It is anticipated that this request will be assigned by January 3, 1961. Equipment Engineering Operation is coordinating the remaining items not included in Request No. 9.

#### 105 Work Area Personnel Service Elevator

Data on a 500 pound capacity tower mounted personnel elevator in the \$5,000 price range, for servicing the work area elevator, was forwarded to 105-C Processing for their review.

#### Training Courses for Helium Leak Detection and Repair

On December 6, 1960, a proposal for the subject course was forwarded to Processing and Maintenance Managers. This proposal is a portion of the over-all Helium Loss Reduction Program. Comments on this proposal were requested by December 30.

#### Third Party Inspection

During the month of December, one boiler, three elevators, one metal hoist, and nine hot water tanks were inspected.

#### Rear Face Connectors - Older Reactors

A report, "Pigtail Replacement - Six Older Reactors", was issued December 14. It reviews in detail the rear face pigtail status and recommends a course of action for replacement of rear face pigtails. In a meeting December 22, the Reactor Managers agreed on the following action: order tubing and place fabrication orders on an expedited basis for fabrication of 3,200 pigtails with the balance of 6,800 pigtails for longer range needs on a normal non-premium basis.

#### Rear Face Omega Seals

Inspections have been initiated at various reactors on the rear face Omega gas seals to determine the status and course of action to be taken for all reactors. It is known that some of these seals are either cracked or corroded and are a source of gas leaks and water ingress. The B, D, and F seals are especially critical since these were fabricated from black sheet steel. The seals in the balance of the areas were fabricated from stainless steel. Stress corrosion may be a factor on the stainless steel seals.

#### Service Manuals and Procedures

Service manual writer selection tests were conducted and two manual writers were selected and assigned to NPR. These men are H. H. Wrangham, instrument manual writer, and C. E. Ragland, mechanical manual writer.

The Instrument Servicing Procedure book containing the initial eight servicing procedures was published and distributed to the areas.

The Instrument Trainee Manual covering the subject material used in first year training, was completed and distributed to the trainees.

The Horizontal Control Rod System Electrical Manual for B, D, DR, and F Reactors has been completed and distributed. The 105-C Horizontal Control Rod Manual is in preparation.

The Ball 3X Safety Circuit Electrical Service Manual for B, D, DR, F, and H has been completed and is being distributed.

Craft Training - Instrument

Twelve instrument trainees completed the training course on electronics and have passed proficiency tests on this subject. This completes the theoretical phase of instrument trainee training; the second phase constituting actual Manufacturing instrumentation has been begun.

A course in transistor fundamentals was initiated for four B Area technicians. This is part of a planned training program on the Analog Digital Computer System.

Craft Training - Mechanical

Two training courses devoted to Phase II - 105-F Tube Replacement Training have been conducted jointly by Maintenance Practices Operation and Industrial Engineering Operation. Four 4-hour sessions have been completed for approximately forty craftsmen and supervisors.

Six supervisors qualified for Powder Actuated Tool permits.

Safety

Serious Accidents - IPD 60-19 A PRTR fuel element in an out-of-pile loop in the 1706-KE Building was dropped and resulted in \$2,000 damage to the element.

IPD 60-20 A grayloc coupling failed on a high pressure, high temperature loop in the 1706-KE Building; \$4,700 damage was sustained.

Fires - Leaking safety plug in the bottom of an acetylene cylinder ignited from friction and destroyed the cylinder. The portable welding cart was the property of J. A. Jones and was stored in the 105-KE Building.

A chair in the proximity of an electric wall heater in the 1709-F Building was damaged when the cushion ignited.

Safety Bulletins - The IPD bulletins concerning (a) Zirconium, (b) Controlled Burning, and (c) Waste Disposal, were revised and presented to the IPD Central Safety Council for approval.

PLANT EQUIPMENT ENGINEERING OPERATIONBroken Inlet Nozzle - B Reactor

An inlet nozzle was broken during tube charging. Visual examination by the Irradiation Processing Department Principal Metallurgical Engineer indicated that the material was sound with no indication of a fatigue crack. Metallographic examination of the failure confirmed these conclusions; however, mechanical property data are only partially complete. Investigation is continuing.

Bumper Fuel Element Program

It has been recommended that all nozzles broached for bumper fuel be machined to accept a sleeve and lug ring. Modified nozzles which pass previously recommended inspection may be re-installed without sleeves. Later installation of sleeves will depend on the outcome of test work currently in progress to establish nozzle integrity experimentally.

Calculation of stresses in existing K Reactor inlet nozzles indicates that stress levels are higher at the front snap ring groove than peak stresses at any point in modified CG-558 nozzles.

Re-Use of Spiral Connectors

Use of previously discarded spiral connectors on the H Reactor rear face is contemplated as an interim measure. Assistance was provided to H Maintenance in reclaiming an adequate number of connectors, establishing a test procedure for inspection prior to re-use, and in determining installation patterns to avoid interferences.

Improved Equipment and Facilities

Project Representative activity continued on CGI-884 for Cross-Under Lines, CGI-904 for Improvements to the Gamma Monitor Systems, and CGI-905 for Poison Spline Coilers.

Planned work continued in support of project engineering activity to provide geminol thermocouple readout instrumentation, analog-to-digital converters, Beckman-Panellit interlocks, and improved radiation monitoring instrumentation.

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HW-63039

## B-C REACTOR OPERATION

### OPERATING EXPERIENCE

New high equilibrium power levels and 24-hour production records were established at both B and C Reactors during December. A level of 1845 MW was sustained at B for 24 hours on the seventeenth, and C was operated at 2090 MW throughout the twenty-fourth. Further increases in levels were prohibited by tube powers at B, and by the planned rupture control program at C. A slug rupture at each reactor interrupted the high level runs.

### EQUIPMENT EXPERIENCE

At B Reactor, eight new tubes were installed in replacement of two leaking tubes, three with thin walls and three deactivated PCCF tubes.

Parker fittings and nozzle connector adaptors at 64 rear crossheader positions at B Reactor were reamed to original size to restore normal tube flow conditions.

About 23 feet of tubing was removed from B's problem channel No. 0493; borescoping revealed some tubing remains at the rear of the channel.

The repair of defective rear gunbarrel bellows, rear Omega seals and rear neoprene seals was continued at B to further reduce helium losses.

The Zone Temperature Monitor at B Reactor was incapacitated for 24 hours when the duct system was fouled with water from core boring operations in the outer rod room.

At C Reactor, a replacement rod (B Reactor type) was installed in VSR channel No. 35 to maintain a necessary minimum number of operable rods. The regular larger "C" rod, rendered inoperable by channel-blocking graphite distortion, had been removed during a previous outage to permit study of the graphite distortion problem.

At Building 190-C, third generation rotating assemblies were installed in process water pumps No. 3 and No. 12. Both removed assemblies were shipped to Byron-Jackson for installation of third generation impellers.

Malfunction of the Priest Rapids (Columbia River) telemetering equipment was experienced throughout the month. Arrangements are being made for B-C Maintenance Operation to assume responsibility for maintaining the equipment.

### IMPROVEMENT EXPERIENCE

At B Reactor, an emergency low-pressure trip was installed in the Ball 3X Safety Circuit in accordance with Design Change No. 368-B. Initial physical work was performed in connection with Projects CGI-904, Improvements to Gamma Monitoring System, and CGI-889, Effluent Modifications - 100 B/C.

At C Reactor, channels 1459 and 1464 were overbored 550 mils completely through the reactor. Channel 1464 was equipped with a "C" type, ribbed aluminum tube and hardware described in FT-IP-341-AP. Channel 1459 remains an "air" channel.

Project CG-845, Increased Pumping Capacity - 181-C, was physically completed in December.

Development Test No. IP-357-A, Increased Alum Feed (a one-half plant test, at B, to reduce the P<sup>32</sup> content of effluent water) was discontinued December 8. Preliminary data indicate an approximate 60 percent reduction of P<sup>32</sup> during the test period.

Crude bauxite is being used successfully in treatment of process water flowing through the South half of the 183-B filter plant. Refined bauxite is used in treatment of the remaining flow to B and C Reactors.

#### RADIATION MONITORING EXPERIENCE

During charge-discharge operations at C Reactor, an irradiated slug was lodged on the near pad. Personnel were exposed to dose rates up to 25 r/hr during dislodgment of the slug. All doses were within HAPO control limits.

The Irradiation Testing Operation at Building 105-C shipped a cask of irradiated samples from the X-1 level to 300 Area. Both cask and truck were grossly contaminated on arrival. Details are reported in HW-67749, Radiation Occurrence Investigation Report, dated 12-12-60.

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D-DR REACTOR OPERATION

OPERATING EXPERIENCE

Operating levels in December were limited at D Reactor by rupture control tube power and at DR Reactor by graphite temperature. New records in power level and daily production were set at D Reactor and in monthly production at both.

There was one scheduled outage at D for charge-discharge, and two at DR from a rupture and a water leak. Outage time was utilized at both reactors for routine maintenance, orifice and venturi changes, and pigtail inspections.

EQUIPMENT EXPERIENCE

Several coats of sealing paint were applied to stop gas leakage through the top rear neoprene seal of D Reactor.

Calibration difficulties in the power calculator at DR Reactor were traced to capacity imbalance in signal leads.

A foot-long crack was found in the pump casing of No. 5 unit in the river pump house. Gasket plates had also pulled loose at their welds. Repairs by welding the crack and installing heavier gaskets eliminated vibration in the unit that had been prevalent prior to the repairs.

Installation of coal scales was begun on No. 2 conveyor at the power house.

IMPROVEMENT EXPERIENCE

Front Face - C Elevator Protection - An interlock device called "traveling broomstick," designed to prevent C elevator movement during connection of equipment to the front face, was installed and is operable at D Reactor. Performance is satisfactory.

Bumper Fuel Element Program - A bumper element charging machine of the clip design was re-tested at 105-D, exhibiting greatly improved performance and with charging rates up to 80 per cent of the existing non-bumper charging rates. Ten nozzles have been broached and externally machined for conversion to the bumper type and workmanship appears excellent. During January 300 nozzles will be ready.

Confinement Project - Building exhaust air was diverted through the filter buildings this month at D and DR Reactors.

RADIATION MONITORING EXPERIENCE

The one lapse of radiation control in December occurred at DR Reactor when a highly contaminated tube splitter reading 20 rads/hour at contact was moved from the work area to the reactor tool shop. About 100 mrem of unplanned exposure was received by the employee handling the tool.

There was one case of building contamination at the 117-D filter building when low level contamination was blown into the corridors by an exhaust fan starting up while wired in reverse.

There were no cases of overexposure during the month.

F REACTOR OPERATIONOPERATING EXPERIENCE

New production and power level records were established during December. A record high power level of 1835 was attained on December 16. Reactor levels were governed by rupture control tube power considerations.

Production interruptions during the month were due to a water leak, two ruptures, and the necessity of opening a valve on the gamma monitoring system.

A power surge occurred at 9:53 a.m. on December 21 when a generator relayed out at Priest Rapids Dam. The surge caused No. 7A motor to drop out of synchronization momentarily.

EQUIPMENT EXPERIENCE

Significant items replaced were: 32 rear water connectors, 26 sample line valves, 5 VSR and HCR gas seals, 19 process tube thermocouples, 6 rear gas boot seals, and 5 pressure monitor Panellit gages.

Nine experimental Panellit gage suppressors were removed because they were incompatible with the present procedure of dampening with oil.

Two of 109 tubes probologged were found to have severe corrosion. One Vanstone and two gasket leaks were corrected.

Efforts to repair gas leaks resulted in a helium usage of about 13,000 cubic feet per day following the December 17 outage; however, losses increased to 20,000 cubic feet per day during the last few days of the month.

IMPROVEMENT EXPERIENCE

F Reactor charged the first production enriched I & E fuel elements of bumpered design during the December 17 outage.

A fog spray curtain was installed, completing the rear face fog spray work.

Engineering work has been completed, and minor Design Change No. 60-2 was issued to change the control circuitry on the limitorque control valves in the 190 building to comply with the Manufacturer's recommendations on seating pressures.

RADIATION MONITORING EXPERIENCE

One minor lapse of radiation control and the absence of any personal contamination cases characterized the favorable control experienced during December.

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H REACTOR OPERATIONOPERATING EXPERIENCE

Input production of 52,555 MWD for the month established a record high for a single month's production for H Reactor. Equilibrium power levels reached the administrative high of 1,900 MW.

An unscheduled outage of 55.8 hours was required to remove a ruptured fuel element and leaking process tube from channel 1472, and perform charge-discharge, process tube probologging and traversing, etc.

EQUIPMENT EXPERIENCE

A two and one-half foot crack in the reactor neoprene gas seal was found at the top far side of the reactor where it presses against the wall separating the discharge and experimental level areas. Distortion of the seal from pressure against the wall appears to be the cause for the crack. The foam type repairs to the seal were partly successful, resulting in a 50 percent reduction in helium gas loss. Additional repairs to the seal will be made during the extended outage in January, 1961.

Production Test IP-34-7-A, "Use of Aluminum Nitrate in Place of Aluminum Sulphate for Water Treatment," was terminated at the request of the Radiological Engineering group on December 26, 1960. Aluminum nitrate will continue to be used until the current supply is exhausted. The supply will last until about January 9, 1961.

The process water pumping load was transferred from eight to seven-pump operation to facilitate installation of the two available class "B" 4,500 HP motor stators. Reduction to seven-pump operation at this time was done to take advantage of the availability of the motor stators and low river water temperatures.

IMPROVEMENT EXPERIENCE

Revisions to the reactor charge elevator, consisting primarily of installation of overhead charging machines and improved lighting, radiation monitoring instrumentation and elevator controls, has been completed. The revisions will result in increased charging rates and improved front face lighting and radiation monitoring protection.

The reactor charge elevator flushing console design and installation was completed except for painting and water supply lines. Charging machine feeder bars have been converted from a right to a left-hand feed for better maneuverability of the charge seating equipment.

In preparation for the use of poison splines, the original poison spline equipment consisting of spline chopper and disposal casks is being reactivated for use until a spline coiler can be installed. In addition, 19 of the required 75 spline caps have been installed on appropriate front face nozzles.



RADIATION EXPERIENCE

Removal of a ruptured fuel element and process tube from channel 1472 spread high level contamination into the discharge area. Difficulties encountered in removing the process tube, plus greater than normally found contamination from the blow-out type rupture, caused the spread. Exposure rates up to 4.0 r/hr were encountered during removal operations. Dose rates up to 1.0 r/hr from contamination were found on the rear face and elevator after the work was completed. There was no undue exposure to personnel and no adverse effects are expected from the contamination.

CENTRAL MAINTENANCE OPERATION

Work in connection with the overboring program continued with the fabrication and revision of tools and on-reactor testing at the C Reactor.

A new broaching machine was installed in 185-F and placed in operation. This machine, with two lathes to be installed later, will be used to broach front face nozzles for bumper fuel elements at D and H Reactors. To date, a total of ten nozzles have been broached. All have been tested and approved for use.

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KE-KW REACTOR OPERATION

OPERATING EXPERIENCE

The power level at KW Reactor was limited by the administrative limit for six days when a new record power level of 4,000 megawatts was achieved. The average operating level for the month was at a record level of 3866, resulting in a new high production total for a calendar month.

Monthly production at KE Reactor was the third lowest of the year due to nine outages. The nine outages are summarized below:

<u>Outage Cause</u>	<u>Number of Outages</u>
Fuel element failures	4
KER Production test rupture	1
Replace orifices in two 1706-KE experimental single pass tubes	1
Panellit scram due to ruptured spline cap seal	1
Improve shielding in two out-of-service vertical safety rod channels	1
Panellit scram due to pressure variations during a hot startup	1

EQUIPMENT EXPERIENCE

On December 5, the incoming transformer IT-1 at 165-KW functioned improperly during startup and was removed from service due to failure of the voltage regulation tap changer. Service was maintained by closing the bus tie between A and B busbars. Necessary repairs were made to return the transformer to service. On December 19 through 22, Electrical Distribution Operation personnel made a complete check of the transformer during a planned outage of this equipment.

Vertical safety rods Numbers 50 and 59 at KE Reactor were taken out of service when restrictions were noted at a point thirteen feet below the top of the step plugs. Visual and boroscope observations indicated protrusion of graphite blocks into the channels at the restriction point.

IMPROVEMENT EXPERIENCE

The 49 point thermocouple scanning system was installed and placed into service at KW Reactor to provide rapid outlet tube temperature information at this number of points during reactor startups.

IMPROVEMENT EXPERIENCE (Cont'd)

A closed cycle reactor foundation cooling system was placed into operation in both reactors by incorporating heat exchangers exsessed from the 183 Buildings into the piping system that was originally placed in the reactor foundation block to dissipate heat of the curing concrete during construction of the reactor. The water is specially treated to inhibit corrosion of the mild steel piping.



Manager  
Manufacturing Operation

OC Schroeder/

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FACILITIES ENGINEERING OPERATIONREACTOR MODIFICATION DESIGN OPERATIONRESEARCH AND DEVELOPMENT

Preliminary designs are being prepared for replacement vertical safety rods at 105-C Reactor. Graphite distortion has rendered two vertical safety rods inoperable and caused binding in three additional rods.

The design for an inlet nozzle reinforcing sleeve to convert present inlet nozzles for use with bumper fuel elements has been completed. The sleeve replaces existing nozzle lug rings with integral lugs which transfer the charging machine and end cap loads from the snap ring groove, which has been weakened from enlarging the nozzle barrel, to the heavy section of the nozzle barrel. Ten sleeves have been fabricated for testing.

Preliminary results of a study to determine the adequacy of the C Reactor downcomers for proposed flow increases to 115,000 gpm indicate that the downcomer trays should be perforated and the individual tray vents eliminated. The remainder of the system, downcomer approach section and effluent lines, appear adequate.

An engineering study for restoration of the K Reactor graphite stack continued with completion of study items on shield bracing and motion monitoring, evaluation of materials for horizontal control rod sleeves, determination of rod deflection and pushing forces with saddle blocks removed, evaluation of graphite sleeves and cost estimates for saddle block removal and installation of ceramic sleeves. The study indicates that graphite sleeves for the horizontal control rod channels are feasible and recommends their installation. Distortion slope predictions for the graphite will be met by installing short segmented lengths of sleeve.

The scope of work proposed for modifying the export water system and last ditch coolant supply has been revised to exclude modifications to the high tank piping. Modifications will include improved reliability of the export water system and temperature control for water stored in the high tanks.

DESIGN PROJECTSCGL 791 - Reactor Confinement

Design changes were issued to provide liquid level sight glasses for the filter building seal pits, safety railings around access ladders of the filter buildings, and entrainment separators upstream of the filters.

The ventilation fan from one filter building, returned to the factory to be modified, performed satisfactorily following modification. The remaining seven fans will be modified by the vendor.

High efficiency filters being installed in the filter buildings at B, C, and F Reactors, have been tested for leakage following installation using a portable DOP tester. Approximately 15 of the 368 units installed to date were found to be leaking.

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An inspection of the charcoal filters indicated these units were poorly constructed, leaked charcoal and were not leak tight. The filters were rejected and returned to the vendor.

CGI-839 - Modification of Fuel Element Test Facilities, 1706-KER

The cell piping drawings have been revised to provide for the new recirculation pump connections and relocation of the pump base flush with the cell floor. Sectional drawings of the pump were returned to the vendor to incorporate a replaceable electrical terminal lug.

Testing of the parallel coincident delayed neutron rupture detection system has revealed that a second low trip will be undetected if it occurs after the first unit has alarmed. Also a single channel high trip would not initiate a reactor shutdown until the low trip had been manually reset. The circuitry is being revised to provide a separate alarm circuit for each low trip channel.

Strain gauge testing of the nozzles continues to be hampered by failure of the "O" ring seals on the test nozzle. Tests are in progress to evaluate replacement seals.

CGI-844 - 100-K Coolant Backup System

Detailed design is 57 percent complete. Bids have been reviewed for the diesel driven gear and pump units for the 182 Diesel Pump House and for the steam turbine gear and pump units for the 190 Main Pump House. The second low bid was recommended for the steam turbine driven pumping units since the low bid did not meet specifications.

Mr. G. R. Rich, Hydraulic Consultant, was retained under Contract CA-262 to examine the hydraulic transients of the diesel pump house supply and discharge lines and to audit design allowances for surge and acceleration. Results of the study indicate the design to be satisfactory for the worst credible operating conditions.

CGI-883 - Increased Process Water Flow - 100-K Areas

Detail design is 66 percent complete. A construction specification for a fixed price contract covering the 190-K Main Pump House ventilating modifications has been distributed for comment.

Design progress is being delayed due to the lack of vendor information. The delay results from the fact orders for the long delivery engineered equipment have not been placed.

A prototype impeller, originally installed in the 190-KE Main Pump House on Project CG-775, was repaired and installed in 190-KW for testing. An inspection of the impeller following a four month operating period indicated minor cavitation damage.

A design, development, and research contract has been negotiated with Washington State University for K Reactor downcomer orifice plate model studies and rear face crossheader expansion joint hydraulic tests. Two expansion joints of improved design have been shipped to Washington State University for testing.

CGI-884 - Rear Face Crossunder Lines B, D, DR, F, and H Reactors

The project scope has been revised to include crossunder line facilities at C Reactor. A design work release has been issued initiating detail design for these facilities.

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EQUIPMENT DEVELOPMENT OPERATION

EXISTING REACTOR WORK

Reactor Modification Program

During an unscheduled C Reactor outage, December 26-27, one overbored channel, 1464, was counterbored for large sized gunbarrels. Installation of oversized hardware was completed and the tube was pressure tested, charged, and is operative. A standard sized process tube was used in the absence of oversized tubes, and a sleeve installed to shield the annular space in the over-size gunbarrel which would ordinarily be filled by the oversized tube. The very wet conditions and the close proximity of rear crossheaders to the rear face made welding quite difficult.

Remote Rear Face

Thirty-five additional flapper cap seals were installed on KE Reactor, making a total of 88 flapper caps and six ball caps under test. Upon startup, 33 of these cap seals leaked and were removed pending replacement with a newly designed seal. On December 22 most of the flapper cap seals were rearranged in three horizontal rows, 51, 52, and 53, for operating convenience; and additional caps were installed. At present there are 73 flapper seals and six ball seals on the reactor.

Other Existing Reactor Work

An improved mattress plate material has been formulated and tested for resistance to water, radiation, and impact. The material, a Hycar Buna N, #1002, was specified for replacement mattress plates at DR Reactor.

NEW PRODUCTION WORK

Design Tests

The NPR-PCE loop completed 2000 temperature cycles on the latest model Grayloc threaded tube-to-nozzle joint, and several other fittings, to provide data for final selection of reactor equipment. Design Test 1081 - Sealing Plug for Inlet Barrier Wall Penetration Sleeves - was completed and a supplemental test report issued. No new tests were received.

Instrumentation

Twenty NPR immersion RTD's (Resistance Temperature Detectors) and their associated parts were removed from a 1647-hour corrosion test involving 2894 combined temperature and shock cycles at 400 to 600° F. These data will require evaluation to apply directly to a choice for materials and combinations for NPR.

PLANT ENGINEERING OPERATIONDRAFTING OPERATION

Summary of services provided by the Drafting Operation is as follows:

New Engineering Drawings	183
Revisions, Layouts and Sketches	103
Microfilm prints reproduced	545
Microfilm drawings added or retired	3419
Ozolid check prints reproduced	869
Customers serviced - Microfilm files	215
Customers serviced - Catalog files	31
Catalogs added to files	30

WATER PLANT AND UTILITIES ENGINEERINGEngineering Supporting Electrical Demand Control

The Semi-Annual Five-Year Power Forecast was issued after review of the rough draft by area management.

Power control procedures were set for the month of January to take maximum advantage of seven-pump operation at the 190 Buildings in several areas.

Engineering assistance was given KW Power Operation in calibrating the power recorder at 165-KW Control Room. A preliminary operating procedure and introductory instruction for the Electrical Demand Display System was provided to 165-KE and KW Building supervisors and power operators. Routine assistance was given to Product Cost and Budget Operation in determining area loads.

Columbia River Flow

On December 21, all Priest Rapids turbines relayed out, shutting off all river flow at the dam except turbine closing flow (about 10,000 to 12,000 cfs). It is reported that the barges below the dam, holding the contractor's dredges, settled to the river bed. Flow was restored within minutes. Emergency power to operate the gates came from the contractor's temporary line.

The cofferdams below the gates were washed out when gates were opened and river flow was restored. Our gage station several miles below the dam showed flow there held above 36,000 cfs. A report of the incident is being prepared.

Coal Utilization Standards

A report on the test made to determine the suitability of coal furnished by Knight Ideal Coal Company has been published. The analysis of test results showed some undesirable burning characteristics which were attributed to coarseness in the size consist. This was discussed with the vendor, and correction seems to have been made. Five screen analyses made since are practically the same as that of satisfactory coal being received from two other vendors in the same vicinity. Use of Knight Ideal coal was approved with recommendations for overcoming specific difficulties.



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### 1706-KE Experimental Water Filtration Facilities

At the request of Coolant Testing Operation, and with assistance from Construction Engineering and Utilities, work was started on an engineering study of a model filtration plant to be used in conjunction with the single pass 1706-KE facilities. The merits of modifying one of the existing 1706 filters, as compared to building a new filter bed, are a part of the program of investigation.

### REACTOR, PLANT ENGINEERING

#### Rear Face Connectors - Older Reactors

Pending the availability of improved rear face connectors being developed by the Materials Development Operation, an acute need for replacement units has become evident, particularly at the 105-H Reactor. To minimize a possible emergency due to lack of suitable replacement components, the design, specifications, drawings and purchase requisitions were provided for an interim connector of the helical configuration. Specifications were written for a choice of Inconel or stainless steel as the tubing material. Satisfactory bids have been received for review and order quantities are being determined by Manufacturing Section.

#### Rear Crossheader Parker Fitting Failure - 105-D

The failure of a rear face Parker fitting on tube 3776 in D Reactor was investigated. The fitting cracked in the thread relief area. A peculiar pitting completely through the fitting near the flare area was observed but no theory on this has been developed. The fitting is undergoing metallographic testing and examination in Hanford Laboratories Operation.

This is the second failure of this type, the first cracked fitting occurred in 105-F in early 1960, but the connection was abandoned before complete failure.

#### Scram Analysis

HW-67741, Secret, "Causes of Reactor Shutdowns," was issued on December 19, to provide information on the performance of reactor safety and control circuits. The document contains scram shutdown information showing trends during the past 28 months of operation. Other information such as the number of ruptures, water leaks, equipment failures, and planned outages is included.

#### Noise Level Evaluation - F Filter Plant Pump Room

Noise level measurements were made in the subject pump room at the request of F Power management. The measurements showed that noise levels were somewhat higher than those taken shortly after completion of Project CG-558 alterations. The noise levels now exceed HAPO Criteria and appropriate recommendations have been provided. Plans have been made to review other areas.

PROJECT ENGINEERING OPERATIONPROJECTSCGI-791 - Reactor ConfinementPhase I - Fog Spray

Curtains to protect the rear face thermocouple ducts have been installed in 105-DR and have been fabricated for installation at 105-B, D, and F.

Phase II-A - Site Preparation

This phase was completed February 19, 1960.

Phase II-B - Filter and Sample Buildings

The contract work is complete, except for punch list items, in all areas except 100-K Area. Acceptance testing is in progress at the K areas.

Phase III - Ventilation System Modifications

100-B and C - The exhaust air from the 105-B and C Buildings is now being filtered.

100-D - The ventilation supply modifications are complete. New drive motors have been installed on No. 7 and 8 exhaust fans; a new turbine and drive gear were installed on No. 9 exhaust fan. One-half of the filters have been installed in the 117-D filter building.

100-DR - Modification of No. 7 and 8 exhaust fans is complete. Modification of the ventilation supply system is also complete. Filters have been installed in one-half of the filter building. All the exhaust air is being filtered.

100-F - The No. 9 exhaust fan turbine piping is 90 percent complete. All filters have been installed; the 105 building exhaust air is now filtered.

100-H - The filters have been installed in one-half of the filter building. All 105 Building exhaust air is being filtered.

100-KE - The diesel fuel piping for the exhaust fan diesel engine drives is 70 percent complete. One engine is in place. The tubing for sensing lines is 90 percent complete. Work is continuing on the ventilation control zone barrier.

100-KW - The diesel fuel piping for the exhaust fan diesel engine drives is 70 percent complete. The tubing for sensing lines is 40 percent complete. Work is continuing on the ventilation control zone barrier.

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HW-68039

CGI-802 - Process Safety Monitoring - High Speed Scanning Type for Temperature Monitoring

The purpose of this project is to initiate the design for a high speed scanning temperature system and to procure a 116 point system prototype which would be capable of demonstrating the adequacy and feasibility of high speed scanning when applied to reactor control. This unit was on plant December 15, 1960. It is now being made ready for installation in a room specifically designed for this purpose in the 1713-D Building. Because of additional testing of this equipment at HAPO and delays encountered during the manufacturing period, a revision to the project proposal has been submitted and a six-month extension of time requested.

CGI-844 - 100-K Area Coolant Backup

This project will modify existing, secondary, and last ditch reactor coolant backup systems to meet water plant safety criteria. An interim work release of \$200,000 has been issued to J. A. Jones Company to initiate the procurement of the construction material which they will furnish. Bid packages which will be used to obtain lump sum contractors, are being prepared for the new pumping station and all pipe line work.

CGI-889 - Effluent System Modifications - 100-B/C Area

This job, estimated to cost approximately \$490,000, actually started in construction on December 17, 1960. The preparation of design drawings and specifications has been completed and issued to J. A. Jones Construction Company who will perform all work. Two sub-contracts were let by J. A. Jones. The first was to construct a 6" pipe line from the 100-B Area fire and sanitary water system to the 107-B basin. The second sub-contract was let to construct an underground electric system which will connect the 107 basin with the 105-B and C Buildings. The certified construction schedule has been prepared and submitted to the Commission. All other job schedules have been issued.

MJA-27 - Replacement of Central Viewer - 105-C

The purpose of this MJA was to replace the damaged and deactivated water-filled central viewer at 105-C with a dry type lead glass viewer similar to the one previously installed in 105-B. The work, which started on February 10, 1960, was assigned to J. A. Jones and completed. The location of this viewer in the rear wall of the reactor, together with the excellent optical efficiencies, has resulted in an unusually wide range of vision and represents an improvement over those previously installed.

PROJECT PROPOSALS

Project Proposals Approved

CGI-884 Rear Face Crossunder Lines - B, C, D, DR, F, and H Reactors  
Rev. 1

Directive No. HW-508 Mod. No. 1, dated December 14, 1960 authorized the inclusion of C Reactor and increased authorized funds to \$335,000.

CPFF CONSTRUCTION SERVICE CONTRACTOR - LIAISON

Two new work orders were issued, one new project released, and five old jobs supplemented for a total of \$489,313 to J. A. Jones in the month of December.

This makes a total of \$3,180,679 for calendar year 1960.

PLANT FORCES WORK REVIEW

The Labor Standards Board approved five jobs for assignment to Plant Forces, which are estimated to cost \$374,986.

This makes a total of \$2,245,190 for calendar year 1960.



MANAGER  
FACILITIES ENGINEERING OPERATION

RT Jessen:dgm

**DECLASSIFIED**

PROCESS DESIGNResearch and Development

The study of the seven rod cluster fuel elements for Phase III NPR operation is nearing completion. The primary objectives of this study were to determine the optimum goal exposure, physics parameters, and limitations from operating at high exposure levels. Goal exposures of 7,100, 14,600 and 21,400 MWD/T(UO<sub>2</sub>) can be achieved using initial enrichment values of 1.3, 1.9 and 2.5 weight percent U<sup>235</sup>. Optimum goal exposures have been developed which covered a wide range of values up to 11,000 MWD/T depending on which uranium price schedule was used. Operating at high exposures will be much more difficult due to the required high initial reactivity of the pile. The horizontal control rod system is adequate for exposures up to 16,000 MWD/T. Methods of providing the necessary control for higher exposures would include the use of burnable poisons, poison columns, or low enrichment columns in some of the process tubes.

Authorization has been received from the Atomic Energy Commission for the funds to continue the General Electric engineering work on conversion to March 1, 1961. The objective is to complete the preliminary design work needed to start preparation of turbine-generator specifications.

Project CAI-816

Preliminary drafts of the Burns and Roe instrument and control specification were reviewed by General Electric personnel at Hempstead during the month. Considerable integration was accomplished; however, some points will require further resolution. Burns and Roe agreed to supply supporting information to demonstrate feasibility of their control approaches. As a goal, the January 15th comment issue of the specification should reflect General Electric and Burns and Roe agreement on basic control approaches.

The dummy fuel spacers will be fabricated from carbon steel. Prototype dummies have been charged into the KEER loop in conjunction with the fuel evaluation program. These dummies will be discharged as required by the fuel tests and information will be developed as to the corrosion and radiation activity effects.

The process tube will be jointed to the rear nozzle by means of the rolled joint approach and procurement is now underway for these nozzle assemblies. Due to special maintenance problems involving the bellows systems on the front face, a threaded collar technique has been developed for holding the process tube in the nozzle. A Grayloc type gasket provides a demonstrated suitable seal. The development of a compact sliding helium seal for the front face would permit the use of a rolled joint approach on the front face and would reduce cost of the nozzle assembly. Data to date from tests on a dynamic helium seal appear promising.

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Project CAI-816 (Continued)

A detailed study has been completed to determine whether or not the same conditions which led to the failure of the CEP-3 Grayloc coupling could exist in the NPR application. The results of the study are presented in HW-67803 and it was concluded that conditions differ appreciably in the two applications. The vendor has proposed several alternate bolting schemes, one of which appears to be feasible from a space consideration; however, such an arrangement must be evaluated in the same types of tests previously conducted on couplings. Studies are under way to determine if project schedules permit thorough evaluation of these alternate bolting schemes.

Renewed interest has been directed toward the development of concrete wall coatings within the Zone 1 confinement area. In addition to the confinement advantages of the coating, the decontamination and dust reduction factors are also important. Dust reduction is desirable from the standpoint of filter life for the 105 filter system. Several vendors of potential coatings have voluntarily applied their products on test walls at the construction site. Cost data developed from these coating demonstrations is encouraging; however, further testing and demonstration of these coatings will be necessary before final selection.

DEVELOPMENT AND TESTING

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

The Component Test Loop was thermally cycled, automatically, during the month to evaluate various joints and fittings. Testing priorities were established as follows: first, joints and fitting evaluation; second, primary loop dumping; and third, process tube rupturing in a graphite stack.

Document HW-67258, "NPR Process Tube-to-Nozzle Fitting Evaluation," by J. H. Fastabend, dated December 1, 1960, was issued. This document describes the development work performed in the search for a satisfactory zirconium process tube-to-nozzle joint and supports recommendations of a three-grooved rolled joint for the rear face and a threaded tube, Grayloc sealed joint for the front face.

In the fitting development program, primary emphasis was placed on the evaluation of a rolled zirconium process tube-to-front-face-nozzle joint with its associated packed gas seal. Due to space limitations and nozzle geometry, it has not been possible to complete a design which uses the rolled joint and a flexible bellows for tube expansion and gas sealing. Development of a packed gas seal would permit the use of rolled joints, generally considered the best joints evaluated to date, on both the front and rear faces. John Crane Style 177-J7, an asbestos yarn over a graphited asbestos core, is the packing that shows the most promise. Leak checking and thermal and bend cycle testing are proceeding on an expedited and priority basis.

Laboratory testing of prototypic resistance temperature detectors has shown (1) thermal cycling of three Engelhard strap-on resistance temperature detectors changed their calibration less than  $1/2^{\circ}\text{C}$ ; (2) after 1,250 hours at  $495^{\circ}\text{C}$ , the calibration of an Engelhard strap-on resistance temperature detector shifted upscale approximately  $1^{\circ}\text{C}$ ; (3) response times of Engelhard and Ruge immersion-type resistance temperature detectors agree within  $1/2$  second; (4) the silver alloy braze of one Engelhard immersion resistance temperature detector was "washed away" after seven days in the Component Test Loop at a flow rate of 70-80 gpm and a cycling temperature of  $400-600^{\circ}\text{F}$ ; and (5) corrosion data were obtained from samples of twenty immersion-type resistance temperature detectors after a 1,647 hour corrosion test including 2,894 combined temperature and shock cycles at 400 to  $600^{\circ}\text{F}$  in the Component Test Loop.

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FIELD AND OPERATIONS ENGINEERING

Construction

105-N and 109-N Buildings

As of December 27, 1960, Kaiser Engineers placed a total of approximately 1400 cubic yards of concrete in the 105 substructure. Approximately 14,900 cubic yards of concrete had been placed in the 105-N substructure by Sound Construction and Engineering Company. Total concrete placed in 105-N was 16,300 cubic yards. The left outer rod room walls were in place to elevation (+)30 feet. The walls and roof slab were complete for the control room and concrete placed for the Blue Tool Room, decontamination room, hot shop, soiled clothes room, and #1 and #2 dryer rooms. Work was also started on the TC air lock. Approximately 1800 cubic yards of concrete remain to be placed in this portion of the building.

As of December 23, 1960, approximately 12,470 cubic yards had been placed in 109-N.

The Phase I electrical subcontractor installed approximately 23,150 linear feet of conduit in the 105-N Building. The electrical subcontractor for the 105-N superstructure installed approximately 5,000 linear feet of conduit. This work is proceeding on a two-shift basis.

Gas riser assemblies were received from HUICO and were being installed by Urban Plumbing and Heating Company.

A preliminary acceptance inspection was held covering Areas 1-A and 1-B of the 105-N substructure, resulting in a preliminary punch list of approximately 75 items.

Kaiser Engineers started pipe fabrication work in their own shop at the job site. Their first X-rays of pipe welds indicated 80 percent defective welding.

151-N Building

The basic construction of the building is completed and a preliminary acceptance inspection made. Some electrical trays were installed and work is continuing on the ventilation and plumbing and heating.

153-N Building

The construction of this building was nearing completion.

163-N and 183-N Buildings

The clearwell was completed. The equipment foundations for the demineralizer building are in place. The pipe gallery concrete and service bay footings are in place. The coagulator area is under construction with about one-half of the walls in place.



166-N Building

The side wall steel was erected for the large storage tank and good progress is being made on the underground pipe in the tank area.

181-N Building

The 60-ton bridge crane was installed and preliminary tests completed with 125 percent of rated load. Electrical tests cannot be completed until permanent power source is available.

182-N Building

The afterheat removal tank storage base was excavated and formed, and excavation started for the demineralized water storage tank base.

184-N Building

The installation of underground pipe by the superstructure subcontractor is in progress.

1734-N Building

The electrical work on this building is nearing completion.

230 Kv Transmission Line

Very little progress was made during this reporting period.

Temporary Construction

Drawings and specifications for improvement of the existing TC first aid facilities were forwarded to Kaiser Engineers for incorporation into a bid package.

Drawings and specifications for alteration of the two-story building at Camp Hanford for General Electric TC office facilities were prepared for a bid package pending release of the building.

Graphite

Except for a period of about one week, production of acceptable graphite details proceeded at a fairly steady rate during the past month. The average production during the month was approximately 100 notched details per shift compared to the official schedule (revised 11-30-60) for approximately 200 per shift. Shutdowns for cutter adjustments and changes have had significant effect on operating efficiency. The reject rate continues to run at approximately 14 percent; however, a large percentage of these bars are salvable either as full length or shorter details.

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During the reporting period, the balance of the reflector material from Great Lakes was received. Also, National Carbon completed delivery of the 6" x 6" solid material. Material stockpiles at 2101-M are now well ahead of fabrication requirements.

A second shift, devoted primarily to the notching operation, was initiated on December 5, 1960. Modification of the two Sundstrand mills for notched bar production is proceeding essentially on schedule, with initial shop tests scheduled for January 3, 1961, in Seattle.

#### Zirconium

Two hundred and eighty-four NPR process tubes and 12 cooling tubes have been received to date. Pilot orders received were: Allegheny Ludlum - 79; Chase Brass - 21; Harvey Aluminum - 71. Harvey Aluminum also delivered 113 tubes on the production order and were continuing to fabricate tubes ahead of the production schedule. On-site inspection continued on the pilot order tubes and on the production order tubing furnished by Harvey Aluminum on a spot-check basis.

One hundred and thirty tubes had been vidigaged and immerscoped, 63 Zyglo tested, and 49 X-rayed. Difficulty has been experienced with the dye penetrant station because of the speed of penetrant contamination. Modification to this station was initiated to improve its operation.

Bovay consulting engineers continued work on autoclave problems. The first trial run of autoclave #2 was scheduled for January 3, 1961. The use of autoclave #1 is still dependent upon means of straightening and assurance of its safety.

Progress by the zirconium fabricators was as follows:

#### Chase Brass

Progress continued to be slow. Chase Brass had been requested to report to the Commission reasons why they should not be put in default for not meeting delivery commitments. This meeting was held December 29, 1960, at Richland, resulting in a new, improved production schedule.

#### Allegheny Ludlum

Shipment was completed on all tubes under the contract.

#### Harvey Aluminum

Shipment was completed on the pilot order. Approximately ten additional tubes that are at slight variation with the specifications may be acceptable after rework. Harvey was requested to submit a detailed inspection report for each one of these tubes for consideration.

Wolverine Tube

Twelve graphite cooling tubes were received and an additional 340 pieces were shipped December 20, 1960. Progress is proceeding satisfactorily after a poor start. Wolverine was requested to furnish a firm completion date since their official completion date of December 16, 1960, has been exceeded.

Primary Loop

Following is the status of approval data on the HUICO subcontract as of December 28, 1960:

Total number items received	706
Number approved	47
Number approved with exceptions	108
Number not approved	374
Number currently being reviewed	177

To date, no primary pipe components have been processed through the subcontractor's shop. The manufacturing procedures and fabrication drawings submitted for approval have, in general, been at variance with the specifications.

The subcontractor's progress schedule calls for shop fabrication to begin on October 1, 1960, and field erection to begin on December 1, 1960.

Manufacturing of some components, such as fittings and pipe, was started at Ladish Company, a lower-tier supplier to HUICO.

Procurement

A complete change of supervisory personnel by the vendor, Yuba Consolidated Industries, together with an improved approach toward the work, has deferred consideration to relocate fabrication of the primary shield crate.

Todd Shipyards continued to progress satisfactorily with design and fabrication of the hydraulic elevators.

Administration

The following data was processed by Drawing and Specification Control during the period of November 28, 1960, through December 23, 1960.

Drawings	497
Specifications	39
Criteria	11
Requisitions	125
ATP's	1
Other	54
Total	<u>727</u>

Accumulative total since March 25, 1959: 12,695.

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

On detail drawings	146
On specifications	10
On scope	10
On ATP's	1
On Total	<u>167</u>

Accumulative total since June 23, 1959: 5,464.

#### Operational Planning

Operations Engineers have studied and prepared 30 preliminary sketches and system descriptions during this reporting period.

Material on a proposed maintenance cost accounting system for 100-N Plant was prepared for presentation to the Manager, Manufacturing.

A rough draft of the operating sequence of the horizontal rod, ball drop, and ball secondary systems was completed.

Seven requisitions for spare parts were processed with a total cost of \$12,811.29.

Planning for furniture requirements and space for TC and permanent "H" personnel continued.

Initial study for compiling a preliminary master schedule for 100-N testing programs was initiated.

#### CONSULTING ENGINEER

HW-67473, "Evaluation of Beloyarsk (URAL) Reactor," was transmitted to the AEC on December 1, 1960. A supplement to this report, concerned primarily with the use of molybdenum-uranium alloy fuel, was transmitted to the AEC on December 20, 1960.

PROGRAM EVALUATION

Design Status

	<u>Wt'd. Total</u>	<u>Certified Schedule</u>	<u>Actual % Complete</u>
<u>Reactor Plant as of 1-1-61</u>			
<u>Title I</u>			
Scope		100	100*
<u>Title II</u>			
Drawings	70	80.0	84.3
Specifications	8	97.5	86.3
Requisitions	8	47.0	44.8
ATP's	4	24.5	14.3
Development and Testing	<u>10</u>	<u>78.0</u>	<u>73.5</u>
Total	100	77.0	77.4

Heat Dissipation Plant as of 1-1-61

<u>Title I</u>		
Scope Criteria		98.75
<u>Title II</u>		
Detail Design		88.0

	<u>Req'd.</u>	<u>No. Issued to Scheduled</u>	<u>12-24-60 Actual</u>
Criteria	23	23	21
Preliminary Drawings (bid)	801	718	732
Detail Drawings (for const.)	864	567	574
Specifications (bid)	155	140	137
Requisitions	170	146	143
ATP's	-	0	0

Composite Design Completion as of 1-1-61  
(Reactor and Heat Dissipation Combined)

Total		<u>Certified Schedule</u>	<u>Actual % Complete</u>
		78.5	84.6

Cost Estimate

The next scheduled Kaiser Engineers, General Electric, AEC, and Burns and Roe cost review meeting will begin on January 9, 1961, with a "Budget Control

\* This percentage represents only the completion of 44 criteria and does not include updating or revising.

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Estimate" to be issued about February 15, 1961.

Previously issued subcontract change order cost estimates are now being analyzed by General Electric and Burns and Roe, Inc. to Kaiser Engineers' final negotiation with the subcontractors.


Schedules

Kaiser Engineers and AEC will issue revised construction schedules after completion of the budget estimate.

Sound Construction Company's contract completion date for the 105-N - 109-N substructure was December 8, 1960. Kaiser Engineers are processing a contract modification extending the completion date 77 days to February 23, 1961.

  
MANAGER  
NFR PROJECT

JS McMahon:mf

  
FINANCIAL SECTIONGENERAL ACCOUNTING SECTION

During December four employees submitted expenses for attendance at Professional and Trade Society meetings. Total expenditures amounted to \$794.88.

During the same period, three employees reported attendance at Offsite Courses. Total expenditures amounted to \$1 210.45.

Request for interim Equipment Expenditure Pattern Review was transmitted to all IPD Managers December 2, 1960, and the Interim Equipment Expenditure Pattern Revision 2 was transmitted to Contract Accounting December 27, 1960.

PRODUCT COST & BUDGET SECTION

Complete quarterly details of the FY 1961 Midyear Review (by organization components) were compiled and distributed.

Revisions to a weekly work order cost-to-date IBM report (deleting considerable detail) resulted in improved and more useful information and will reduce by 1 1/2 to 2 hours the weekly machine printing time required.

The pricing method on poison splines was revised to relieve the account of the cost of all splines currently on hand prior to receipts on the new contract. The new contract price is \$25.75/each, compared to a current average cost of \$43.17.

PERSONNEL ACCOUNTING

The total number of personnel assigned to the Department as of December 31, was 2 264; a decrease of one from the previous month.

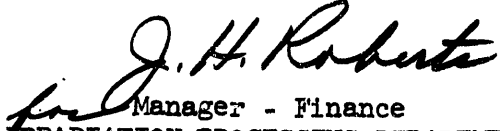
PROCEDURES

Work continued on the evaluation of the existing cost accounting system which included the development of a flow chart showing the cost descriptions for the various levels within each section. The form to be used for material transfers was revised.

AUDITING

Revisions to fourteen AEC Manual Chapters were reviewed for their effect on IPD Operations.

A survey of the duplicating facilities and their administration was started during the month.

  
Manager - Finance  
IRRADIATION PROCESSING DEPARTMENT

[REDACTED]

RELATIONS PRACTICES OPERATION

Two technically trained candidates and two PhDs were interviewed during the month with two offers extended. One offer to a PhD remained open at month end. Six monthly employees transferred into the Department from other HAPO components and four transferred out of the Department.

A total of \$1,085 was paid to 24 suggesters. The largest award was \$270.

Communication activities included publication of 8 Management News Bulletins 2 priority messages and 2 Headliners. GE NEWS coverage included 17 items about IPD activities totaling 305 column inches.

Three General Manager's Awards were completed and presented.

There were four security violations in the Department--three in Research and Engineering and one in Facilities Engineering. There were no disabling injuries in December; 59 medical treatment cases were reported.

*W. D. Shanks*

**UNCLASSIFIED**

[REDACTED]



SIGNIFICANT REPORTS ISSUED

<u>Number</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-57665-3	Confidential	EL Etheridge	12-19-60	Project CGI-791, Reactor Confinement Design Criteria for Phase III Ventilation System Modifications.
HW-67152	Unclassified	CE Jones DE Newby	12-27-60	Reactor Confinement Project CGI-791 Operating Manual 100-C.
HW-67416	Unclassified	CE Jones DE Newby	12-1-60	Reactor Confinement Project CGI-791 Operating Manual 100-H.
HW-67417	Unclassified	CE Jones DE Newby	12-20-60	Reactor Confinement Project CGI-791 Operating Manual 100-DR.
HW-67418	Unclassified	CE Jones DE Newby	12-30-60	Reactor Confinement Project CGI-791 Operating Manual 100-K.
HW-67768	Unclassified	ER Rudock	12-14-60	HCR Sleeves for K Graphite Distortion.
HW-67779	Unclassified	RM Baltrusch	12-27-60	Design Test Request No. DT-1079-A Metallic Seal Test for CGI-839 Nozzle for KER Loops.
HW-67258	Unclassified	JH Fastabend	12-1-60	NPR Process Tube to Nozzle Fitting Evaluation.
HW-67057 Sup.	Unclassified	JM Pinkerton	12-6-60	DT-1081 - Sealing Plug for Inlet Barrier Wall Penetration Sleeve Test Report - Supplement.
HW-67657	Unclassified	GE Brown	12-1-60	Test Proposal - DT-1075 NPR Water Sample Flow Regulator & Flow Indicator Test.
HW-67751	Unclassified	GE Brown	12-12-60	NPR Resistance Temperature Detector Vibration Test Report.

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HW-68039

<u>Number</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-67917	Unclassified	JM Pinkerton	12-29-60	DT-1083 - Pressure Test for NPR Electrical Connectors Test Report.
HW-67916	Unclassified	JM Pinkerton	12-29-60	DT-1055 - Graphite Cooling Connectors - Test Report.
HW-63821 Sup.	Confidential	JM Pinkerton	12-29-60	DT-1043 - NPR Horizontal Rod Gunbarrel Assembly Test Report Supplement.
HW-67769	Unclassified	RJ Robison	12-29-60	DT-1084 - 105-K H-Rod Zirconium-2 Sleeves - Test Report
--	Unclassified	JH Fastabend	12-12-60	NPR Fitting Development Status Report.
--	Unclassified	JH Fastabend RE Hubbard	12-19-60	Interim Report - Packing Type Dynamic Gas Seal for NPR.
--	Unclassified	MP Black	12-21-60	Stainless Steel Helical Pigtail Test.
--	Unclassified	JL Rusk	12-27-60	"D" Nozzle Test.
--	Unclassified	PB McCarthy	12-27-60	Safety Characteristics of the 0.550-Inch Oversized Tube Hardware.
HW-67746	Unclassified	PH Hutton	12-15-60	Feasibility Study, Inert Atmosphere for Reactor Discharge Area, All Reactors.
HW-67741	Secret	JL Deichman	12-19-60	Causes of Reactor Shut-downs.
HW-67713	Secret Red Label	LB Brinkman JP Corley	12-6-60	Rear Header Parker Fitting Reaming.
HW-64940	Secret	VG Blanchette JM Whalen	12-20-60	IPD Five-Year Electric Power Forecast - Fiscal Years 1961 through 1966.
HW-67234 PT B	Unclassified	JC Baudendistel DB Janes	12-21-60	Suitability of Knight Ideal Coal.
--	Unclassified	VG Blanchette	12-9-60	Trip Report - Bonneville Power Administration Spokane Area Customer Meeting, November 28.

<u>Number</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-67656	Unclassified	MC Fraser	12-5-60	Summary of Available Data on Irradiation Effects on Ceramics.
HW-67789	Secret	DL Condotta	12-16-60	Reactor Design Analysis Monthly Report - 11-60.
HW-67803	Unclassified	GT Haugland CE Bonham	12-15-60	A Review of the NPR Connector Coupling.
--	Unclassified	WJ Love	12-21-60	Model Laws for the NPR Lift-Load Test.
HW-67473	Unclassified	JS McMahon	12-1-60	Evaluation of Beloyarsk (URAL) Reactor.
HW-67473 SUP	Unclassified	JS McMahon	12-20-60	Supplement to HW-67473, Evaluation of Beloyarsk (URAL) Reactor.

TRIPS

<u>Name</u>	<u>Firm &amp; Location</u>	<u>Date</u>	<u>Purpose</u>
ER Rudock	Whitlock Manufacturing Co. Hartford, Conn.	11/26 - 12/3/60	Discuss KER heat exchanger fabrication problems.
	New York City		Attend ASME annual meeting.
	General Electric Company, Industrial Control Dept. Roanoke, Virginia		Discuss KER safety circuitry problems and electronic control for conveyor type magazine handling systems.
	General Electric Company, Specialties Control Dept. Waynesboro, Virginia		
DF Watson	H. E. Bovay, Jr. Spokane, Washington	12/28/60	Discuss detail design for Project CGI-844.
EL Etheridge	Joy Manufacturing Co. New Philadelphia, Ohio	12/12/60	Witness fan performance test and discuss schedule for modifying fans for 117 Buildings.
M. Pociluyko	Norfin, Inc. Seattle, Washington	12/2/60	To witness testing of centering flange cutting machine which is being purchased.

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HW-68039

<u>Name</u>	<u>Firm &amp; Location</u>	<u>Date</u>	<u>Purpose</u>
CH Gydesen CA Munro	Norfin, Inc. Northwest Carbide Tool Co. Haywood Cutter Co. Seattle, Washington	12/8-9/60	To discuss graphite cutter design and review design in connection with Contract DDR-109.
CA Munro	Norfin, Inc. Seattle, Washington	12/19-22/60	To discuss overboring in connection with Contract DDR-109.
CH Gydesen M. Pociluyko EA Wegener	Norfin, Inc. Seattle, Washington	12/27-29/60	To observe acceptance tests on machinery being furnished by Norfin (Contract DDR-109).
MJ Veal	Chandler Evans Corp. Hartford, Conn.	12-12-60	Evaluation of vendor progress - NPR Inlet and Diversion Valve.
	Mason Neilan Corp. Norwood, Mass.	12-13-60	Prototype program
	Atwood & Morrill Salem, Mass.	12-14-60	Prototype program
	Philadelphia Gear Corp. King of Prussia Township, Penn.	12-15-60	Evaluation of actuator program for Atwood & Morrill prototype valves.
	Crane Company Chicago, Ill.	12-16-60	Evaluation of vendor progress - NPR inlet and diversion valve prototype program.
RR Henderson	A. O. Smith, Corp. Milwaukee, Wis.	12/18-20/60	Explain development requirements for the process tube welding machine.
E. Hollister	ASME Convention New York City	11-28-60 thru 12-2-60	Attend ASME Convention
A. McDonald	GE Apparatus Service Shop Seattle, Washington	12/7-16/60	To observe and record data relative to 4500 HP Rehabilitation Program.

<u>Name</u>	<u>Firm &amp; Location</u>	<u>Date</u>	<u>Purpose</u>
RT Jaske	National Conference on Water Pollution Washington, DC	12/12-16/60	To obtain information relating to future policy.
	Savannah River Plant Savannah, Georgia		Review operating exper- ience with plant equip- ment.
RR Bloomstrand	Germantown, Md.	11/29- 12/4/60	Attend AEC Meeting on Mathematical Analyses of Atomic Energy Operations.
WE Vetter	Panellit Corp. Skokie, Illinois	12/2-8/60	Consult on problems relating to Panellit gauges
	Hamlin Switch Co. Lake Mills, Wisc.		
OH Greager	San Francisco, Calif.	12/5-10/60	Attend GE Technical Hazards Council Meeting
WL Smalley	San Francisco, California	12/10-17/60	Attend ANS Meeting
	Vallecitos Atomic Lab. Pleasanton, California		Discuss radiation shielding problems.
RD Carter	San Francisco, California	12/10-16/60	Attend ANS Meeting
	Vallecitos Atomic Lab. Pleasanton, California		Discuss reactor operat- ing efficiency and control.
WD Gilbert	San Francisco, California	12/11-16/60	Attend ANS Meeting
	Bechtel Corporation San Francisco, California		Discuss reactor safety
SS Jones	San Francisco, California	12/11-16/60	Attend ANS Meeting
	Atomic Power Equip. Dept. San Jose, California		Discuss thermal hydraulics problems.
	Vallecitos Atomic Lab. Pleasanton, California		
FW Van Wormer	San Francisco, California	12/11-16-60	Attend ANS Meeting
	Vallecitos Atomic Lab Pleasanton, California		Consult on in-reactor testing methods and equipment.

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<u>Name</u>	<u>Firm &amp; Location</u>	<u>Date</u>	<u>Purpose</u>
JM Fouts	San Francisco, California	12/11-17/60	Attend ANS Meeting
	Vallecitos Atomic Lab. Pleasanton, California		Consult on hot cell operation & equipment.
WR Conley	Burns and Roe Hempstead, New York	12/11-16/60	Discuss NPR design.
RW Benoliel	National Carbon Co. Clarksburg, W. Va.	12/12-15/60	Technical discussion on graphite
	Speer Carbon Co. Niagara Falls, N. Y.		
	Great Lakes Carbon Co. Niagara Falls, N. Y.		
ML Smith	Tracerlab Reactor Monitoring Center Richmond, California	12/13-16/60	Discuss radiation detec- tion instrumentation
	Technical Associates Burbank, California		
DH Curtiss	Wah Chang Corp. Albany, Oregon	12/19-20/60	Consult on zirconium scrap recycle.
JE Stice	Yuba Consolidated Industries Benecia, California	12-1-60	Review progress in the fabrication of the pri- mary shield.
CE Love	Harvey Aluminum Co. Los Angeles, California	12-8-60	Review progress on NPR zirconium tubes.
CE Love	National Carbon Co. Clarksburg, W. Va.	12-13-60	Review progress on graphite procurement.
	Speer Carbon Co. St. Marys, Pennsylvania	12-14-60	Review progress on graphite procurement
DL Condotta HR Kosmata FJ Mollerus, Jr.	Burns and Roe, Inc. Hempstead, New York	12/13-15/60	Review specifications for the instrumentation and control systems for the primary and secondary cooling systems of the NPR.

<u>Name</u>	<u>Firm &amp; Location</u>	<u>Date</u>	<u>Purpose</u>
MH Russ	Burns and Roe, Inc. Hempstead, New York	12/13-15/60	To expedite design progress.
WJ Love	Mark Hopkins Hotel San Francisco, California	12/14-16/60	Attend ANS and ANS-7 committee meetings.
WJ Dowis	Kaiser Engineers Oakland, California	12/6-8/60	Discuss normalized capital and fuel cycle costs in connection with Russian Superheat Reactor Evaluation with Kaiser Engineers and the AEC.

VISITORS

H. Horsfall JE Larson	Manufacturing Services Schenectady, New York	12/15-16/60	To discuss flapper caps with CE Frantz.
JS Stutheit WM Taylor	E. I. duPont Savannah River, Ga.	12/6-7/60	DC Worlton, at request of Savannah River, arranged for Instrument Development and these visitors to meet and exchange information specifically on reactor nuclear instrumentation systems - generally on other reactor instrumentation.
(Virginia Hudson H. McCarthy RH Anderson-Arva,	Sigma, Inc. South Braintree, Mass. Seattle, Wash.	12-2-60	Magnetic amplifier circuitry and application and development of their components to fit Instrument Development system and instrument developments were discussed.
LI Kennedy	Gardner-Denver Company Denver, Colorado	12-14-60	To discuss applications of air powered equipment.
R. Loesby	Vanton Pump Seattle, Washington	12-9-60	To discuss possible applications of one of their pumps for sample feed device for NPR.

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RR Gatts	GE, General Engr'g. Lab. Schenectady, New York	12/6-7/60	Consult on thermal stress cycling study.
S. Yukawa	GE, Large Steam Turbine Generator Department Schenectady, New York	12/6/60	" "
Dr. EO Bergman	Piping Consultant Los Angeles, California	12/20-21/60	Consultation on NFR piping problems.
J. Magner C. Murray D. Uhlik	Weldex Corporation Los Angeles, California	12-5-60	Discuss procedures of non-destructive testing of primary pipe.
NR Hart	U. S. Steel Corp. Seattle, Washington	12-19-60	Discuss manufacturing procedures for seamless pipe.
RE Donelson	P & K Valve Company Portland, Oregon	12-15-60	Valve type presentation



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