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IRRADIATION PROCESSING DEPARTMENT

MONTHLY REPORT

DECEMBER 1961

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HANFORD ATOMIC PRODUCTS OPERATION

GENERAL ELECTRIC

RICHLAND, WASHINGTON

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IRRADIATION PROCESSING DEPARTMENT
MONTHLY REPORT
DECEMBER, 1961

80860

Compiled By
IPD Personnel

January 15, 1962

RICHLAND, WASHINGTON

Work performed under Contract No. AT(45-1)-1350 between the
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SUMMARY

RESEARCH AND ENGINEERING

Power levels at B, C, D and H Reactors are restricted by bulk outlet temperature limitations. DR, F, KE and KW Reactors are being restricted by tube corrosion considerations.

Twenty additional channels at C Reactor were overbored and fitted with Zircaloy-2 smooth-bore tubes. This installation brings the total number of overbored channels to the 62 authorized for the C Reactor test facility. Post-irradiation examinations of overbore fuel and observation during charging operations have revealed some damage to the support rails while charging was in progress. Changes have been made to correct the situation and further investigations are in progress.

A draft copy of the NPR Hazards Review, Volume I, has been distributed for review. The publication of the report is expected in January.

The first test specimens of the recently authorized irradiations of NPR core graphite at GETR were charged on December 1, 1961. Performance of the irradiation capsule to date has been satisfactory and a second unit will be ready for charging by January 1, 1962.

NPR primary loop piping problems were reviewed with an ACRS Subcommittee and with the full Committee during December.

MANUFACTURING

Production

Reactor input production (MWD) was 5.6 per cent below forecast; 15.8 per cent below at the six old reactors and 8.4 per cent above at the K's. Production for the fourth quarter was 2.1 per cent below forecast and the calendar year production was 0.2 per cent below forecast.

Over-all time operated efficiency was 72.1 per cent (80.0 per cent forecast); 67.9 per cent at the six old reactors and 84.9 per cent at the K's. Efficiency was low at the six old reactors due to the overbore program at C Reactor, process tube water leaks and tube replacement.

There was no increase in the combined reactor instantaneous power level. The individual reactor record power levels were increased 130 megawatts at KE (4085 to 4215) and 10 megawatts at C (2265 to 2275). A monthly production record was achieved at KW Reactor, exceeding their January, 1961 record by 4.9 per cent.

Seven ruptures, five I&E enriched and two I&E regular metal, were removed from the reactors. Four of the enriched ruptures were at H and one at C. The two regular metal ruptures were at DR.

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FACILITIES ENGINEERING

Compression and flexural test specimens of various ceramic VSR channel liner materials have been installed in the 105-C Reactor for radiation testing. Off-reactor testing of a prototype 105-C Reactor size flexible VSR has been started.

Engineering studies to evaluate the costs and feasibility of alternate methods to provide substantial reduction or elimination of radioactive discharge from the reactors to the Columbia River have been initiated.

An additional 20 process channels were overbored in the 105-C Reactor completing the planned fuel test facility. No unexpected problems or unusual difficulties were encountered.

The rear face piping of 105-3 Reactor was decontaminated with a bisulfate formulation. This is the first departure from more expensive sulfamic acid compositions and the first use of material from a competitive vendor.

The re-weighing of all reactor charge platforms has been completed except for 105-F. Work is also continuing to support the general functional and safety upgrading of these platforms.

The Physical Completion Notice for Project CGI-791 (Reactor Confinement) was issued on December 15, and for Project CGI-906 (Poison Spline Coilers--All Areas) on December 27.

NPR PROJECT

Work continues on the General Electric Laboratory technical appraisal of the NPR cooling system.

Updating of NPR conversion data is in progress to assist in current WPPSS studies.

Steps have been taken to resolve Velan valve difficulties on hydrostatic testing and cleanliness requirements.

The Commission has requested cost studies of savings to be realized from proposed 100-N railroad provision.

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Efforts have been successful in cost adjustments for the Avien flow controller proposal.

Difficulties in the request for inspection of Bailey Meter procurement items have been rectified.

AMF fuel handling equipment is essentially fabricated and ready for testing.

Millwrights employed by Kaiser Engineers walked off the job December 14 and returned on swing shift December 27. This has seriously affected the completion of the process unit work required prior to the packing operation. The millwrights have only returned with a minimum force, which is not sufficient to adequately perform the remaining work.

Thermal-shield installation on the reactor sides and outlet have been completed. Six plates are remaining for the completion of the inlet assembly. All biological shield crates have been installed and the high density concrete placed. Work items remaining prior to packing are the completion of the thermal-shield plate installation and the installation of the inlet-outlet cast iron thermal-shield blocks.

A total of 1,048 zirconium process tubes have been delivered and 975 have been prepared and accepted for installation.

Layer 11 has been tailored to match the "as-built" reactor shielding dimensions. Remachining has been completed and the layer is being packaged for delivery to the 105 Building. All other incidental moderator graphite shop work is essentially complete.

Installation of the rupture monitoring turrets in the 105 Building has been started and all turrets have been set in place in the left side rupture monitoring room.

GENERAL

RESPONSIBILITY

In the NPR Project Operation, W. W. McIntosh was appointed Principal Engineer - Primary Piping, effective December 1, 1961.

FORCE SUMMARY

	<u>Exempt</u>	<u>Non-Exempt</u>	<u>Total</u>
General	7	1	8
Research and Engineering	106	59	165
Manufacturing	408	1381	1789
Facilities Engineering	111	41	152
NPR Project	99	32	131
Financial	19	13	32
Employee Relations	1	1	2
TOTAL	751	1528	2279

SAFETY, SECURITY AND RADIATION EXPERIENCE

There were 75 medical treatment injuries, three security violations, and no disabling injuries or 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>Name</u>	<u>Date</u>	<u>Title</u>
C. E. Frantz	12/20/61	Sleeve and Shuttle Valve for reactor charging machine.
R. D. Gilbert	11/29/61	System for Water Leak Detection.

General Manager

A. B. Greninger:DLD:kn

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RESEARCH AND ENGINEERING

PROCESS AND REACTOR DEVELOPMENT

REACTOR FUELS

Present Reactor Technology

Overbore Fuel Development

Installation of twenty more overbore channels into C Reactor during the 12/8/61 outage completed the authorized test facility and brought the number of overbore channels to 62. The twenty new channels, located in the central flow zone, completed the central zone block pattern which will be used to obtain preliminary conversion ratio data in addition to providing further qualitative data to characterize the irradiation behavior of the large diameter fuel elements. The overbored channels were fitted with Zircaloy-2 smooth-bore process tubes and charged with 19 CVINS fuel elements each.

Fourteen columns of overbore fuel were discharged during the 12/8/61 outage. All columns were discharged with charging machine forces without difficulty. The fuel discharge exposures ranged from a high of about 1000 MWD/T to a low around 700 MWD/T.

Combining the results of observations made during post-irradiation metal examinations and metal charging, it is concluded that some of the self-support rails are currently being damaged during the charging operation. Work is in progress to correct the situation.

Fifteen central zone charges will reach a scheduled discharge goal exposure of 800 MWD/T during January, 1962.

Self-Supported Fuel Development

Some support rail damage at C Reactor was observed during charge-discharge operations while using the displacement charge-discharge method, i.e., the irradiated fuel being discharged with the new fuel charge. When the irradiated material was discharged using dummies, the new material could be charged satisfactorily. The problem is under investigation.

Examination of the initial two KVN-S columns has been completed at 105-C metal examination facility, and the data have been forwarded for machine processing. Two replacement fuel columns charged on 11/14/61 have reached approximately 225 MWD/T exposure.

Bumper Fuel Development

Examination of the ten columns of KIVN-B fuel elements discharged from KW Reactor on 11/14/61 has been completed at 105-C, and the data have been forwarded for machine processing.

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Seventeen columns of OIIIN-B fuel charged in D Reactor under authorization of PT-IP-310 to evaluate the UT-2 fuel core tester will reach their scheduled discharge exposure goal of 900 MWD/T during January, 1962.

Twenty columns of OIIIN-B fuel elements, ten with current production type bumpers and ten with new streamlined "elliptical" bumpers, were charged into D Reactor during the 12/16/61 outage. The columns were charged into new process tubes in pairs, i.e., adjacent columns, each with a different bumper rail.

Nickel Plated Fuel Program

Seventy columns of nickel plated OIIN fuel charged in DR Reactor during the 9/5/61 outage have reached an estimated exposure of 650 MWD/T. Seventeen columns will be discharged at half goal during the 12/31/61 scheduled outage at the request of Operations, since they are in thin tubes which have been scheduled for replacement. Fuel from these tubes will be specially picked up and examined.

Coextruded I&E Fuel

Four columns of coextruded I&E fuel charged into KW Reactor on 8/14/61 have reached an estimated average tube exposure of 1000 MWD/T. One column has reached 1025 MWD/T and is scheduled for discharge and special pickup during the next outage (currently 1/2/62).

Advanced Reactor Technology

N Reactor Fuel Development

The five 17-inch NIE1 elements charged in KER-1 on 10/29/61, PT-IP-377-A, to obtain low exposure swelling information were discharged 12/14/61 at an exposure of 740 MWD/T.

KER-1 was recharged with five 23-inch NIE1 elements on 12/14/61 to evaluate the effect of pre-irradiation warp condition on fuel behavior. The elements were authorized by PT-IP-455-A. Current exposure is 60 MWD/T.

Five 23-inch NIE1 elements, charged in KER-2 on 9/17/61 under PT-IP-377-A to evaluate high exposure fuel element distortion and swelling, have reached an exposure of 1390 MWD/T.

KER Loops 3 and 4 remain out of service for modification.

NOMENCLATURE: NIE1 = NPR-sized inner tubes - enriched uranium.

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-216-A	Normal prod. natural and enriched fuel elements	88	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-263-A Supp. A	Nickel plated OIIN fuel	70	DR	Twice normal variable goal	650 MWD/T	Demonstrate on a pilot scale that satisfactory nickel plate adhesion has been attained and that reducing nominal plate thickness from .6 mil to .2 mil does not affect this parameter. Seventy columns were charged into DR Reactor on 9/5/61.
IP-272-A	CIVN geometry I&E self-supported fuel	69	C	Variable + 200		Provides for testing of CIVN geometry fuel in C Reactor ribless zirconium tubes.
IP-310-A	OIIINB three-rail bumper in new tubes	17	D	Variable	850 MWD/T	Determination of the dimensional stability of uranium fuel cores classified by the fuel core tester (UT-2). Obtains process tube corrosion data from bumper fuel elements with various mixer arrangements.
IP-381-A & IP-431-A	CVIN geometry I&E overbore-size fuel		C	800 MWD/T		Provide preliminary qualitative data regarding irradiation behavior of larger fuel element designs. PT-IP-431 expands the test facility up to 65 tubes. Twenty tubes installed on 12/8/61.
	a) CVINS	60				
	b) CVINB	2				

<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-377-A	Five 17-inch NIEl elements, KER-1	1	KE		740 MWD/T	Elements charged in KER-1 on 10/29/61 to obtain swelling information. Loop discharged 12/14/61.
	Five 23-inch NIEl elements, KER-2	1	KE	3000 MWD/T	1390 MWD/T	Elements charged in KER-2 on 9/17/61 for high exposure test.
IP-397-A	Zircaloy clad enriched I&E fuel elements	4	KW	Variable	1000 MWD/T	Provide irradiation experience for elements fabricated by NPR manufacturing process.
IP-409-A	KVNS geometry I&E self-supported fuel in K Reactor	2	KW	800 MWD/T	225 MWD/T	Provide qualitative data to confirm the fuel geometry design. Metal charged 11/14/61.
IP-432-A	OIIIIN-B elliptical vs. regular bumpers	20	D	Variable		Provide a comparison of corrosion characteristics of "elliptical" bumper rails to current bumper rail design to determine their feasibility. Test charged during 12/16/61 outage.
IP-455-A	Five 23-inch NIEl elements, KER-1	1	KE	<1000 MWD/T	60 MWD/T	Elements charged in KER-1 on 12/14/61 to evaluate pre-irradiation warp.

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REACTOR ENGINEERING

Present Reactor Technology

C Reactor Overbore

Twenty-three smooth-bore, overbore size Zircaloy-2 process tubes were installed in the C Reactor during the outage of 12/11/61. Twenty of these were installed to complete the central block of forty, under the provisions of Production Test IP-431-A. Three were installed to replace smooth-bore aluminum tubes. Of the tubes (38) delivered by Reactive Metals Inc., 31 have been installed, one destroyed, five rejected on dimensions, and one remains in inventory. Of the five rejects, two have been reclaimed by pickling the internal surface, increasing the internal diameter about 0.004 inch.

A purchase requisition has been prepared, providing for the procurement of eight to twelve Zircaloy-2 overbore tubes to replace currently installed aluminum tubes and to serve as spares.

Export System Test

Production Test IP-412-AI, "B and C Reactors Export Line Test," was conducted 12/15/61 to determine the flow available to B and C Reactors in the event of a demand on the export system from the dual reactor area. Data obtained are being analyzed. Of interest is the fact that the opening of the export Groves valve caused the surge suppressors to cycle at all reactor areas because of the resulting low pressure wave transmitted through the system.

Advanced Reactor Technology

NPR Process Tubes

Detailed technical discussions were held with representatives of Harvey Aluminum on 12/11/61 concerning the feasibility of repairing some of the NPR process tubes fabricated by Allegheny Ludlum Steel Corporation on their pilot order. The tubes, inspected at HAPO following pickling and sometimes autoclaving, were found to have ID surface defects. Subsequent conditioning at HAPO reduced the wall below the required minimum thickness. The "heat and squeeze" technique developed by Harvey can probably be adapted to the ALSC tubes. The number of tubes to be considered ranges from a minimum of 10 to a maximum of 21 tubes. HOO-AEC representatives participated in the discussions.

NPR Hazards Review

A smooth rough draft of the NPR Hazards Review, Volume I, was assembled and distribution was initiated on 12/1/61. Three copies were delivered for informal review by HOO-AEC. (It is anticipated that the final rough draft will be released for formal publication on 12/26/61.)

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NPR Graphite Irradiation

The first capsule for test irradiation of NPR core graphite was charged into the GETR and irradiation started on 12/1/61. Performance of the capsule to 12/20/61 has been satisfactory. A second capsule has been constructed and will be available for charging into the GETR by 1/1/62.

ACRS Review

A review of NPR primary loop piping problems was held for members of a Subcommittee of the ACRS in a meeting at Hanford 12/8/61. The same information, in abbreviated form, was presented to the full Committee in Washington the following week.

REACTOR PHYSICS

Present Reactor Technology

Spline Poison Assurance

The spline sections used in the PCTR reactivity measurements were damaged during irradiation at KE Reactor. Replacement samples are being obtained for irradiation and subsequent measurement of boron burnout.

Safety Circuit Grounds

On 11/30/61, 105-C was shut down because of an indicated short in the LX safety circuit which could not be located and corrected during operation. The cause was later found to be moisture collection on electrical circuitry. On 12/1/61, 105-H reported a ground in the LX safety circuit which was, however, traced to a defective VSR clutch circuit and corrected during operation.

General reactor safety criteria governing the treatment of safety circuit grounds and the use of ground detectors are currently being generated.

E-N Loading

The second E-N core loading at 105-H is approaching 70 percent of goal exposure and will be discharged during January, 1962. Separation of tritium from the first core loading is proceeding at Savannah River. Conversion ratio values are not yet available.

Brandy

Two groups of E metal discharged under Production Test IP-420-A (MGR-I material) have been shipped to the Redox plant for special dissolution and complete isotopic analyses.

The amount of MGR-I enriched fuel in each reactor and the amount discharged in November are shown below as a percent of total E-metal inventory and discharge:

	<u>B</u>	<u>C</u>	<u>D</u>	<u>DR</u>	<u>F</u>	<u>H</u>	<u>KE</u>	<u>KW</u>
Nov. 30 Status	57	82	80	47	59	65	99	98
Nov. Discharges	24	41	33	17	31	52	93	96

RADIOLOGICAL ENGINEERING

Radiation Control Experience

The following table summarizes the radiation exposure experience of critical IPD classifications through 48 weeks of the 1961 badge year:

<u>Classification</u>	<u>Total Dose</u>	<u>No. of Employ- ees</u>	<u>Average Dose/ Employee</u>	<u>Extrapo- lated Year End Average</u>	<u>No. of Employ- ees over 3r Extrapolated Exposure</u>
Radiation Monitors	213122 mr	83	2568 mr	2781 mr	4
Processing Operators	585722	254	2306	2497	5
Pipefitters	198356	97	2045	2215	4
Millwrights	163573	82	1995	2161	5

Lapse of Radiation Control

Lapse of Radiation Control Distribution by Reactor and Component

	<u>B</u>	<u>C</u>	<u>D</u>	<u>DR</u>	<u>F</u>	<u>H</u>	<u>KE</u>	<u>KW</u>	<u>IPD Total</u>
Processing	0	0	0	1	0	1	0	1	3
Maintenance	1	0	0	0	0	1	0	2	4
Power	0	0	0	0	0	0	0	0	0
Supplemental Crews	0	0	0	0	0	0	0	0	0
Research and Engineering	0	0	0	0	1	0	0	0	1
Facilities Engineering	0	0	0	0	0	0	1	0	1
Central Maintenance	0	0	0	0	0	0	0	0	0
Reactor Areas	0	1	0	0	0	0	0	0	1
Assigned Totals	1	1	0	1	1	2	1	2	9
IPD General									

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 column.

Effluent Water Data

The table below shows the average concentrations of radioisotopes in reactor effluent water from samples taken during November, 1961. Concentrations are in units of 10^{-12} curies/cc.

<u>Reactor</u>	<u>As⁷⁶</u>	<u>p³²</u>	<u>Zn⁶⁵</u>	<u>Np²³⁹</u>	<u>Cr⁵¹</u>
B	57	5.9	*	*	*
C	100	7.6	32	120	590
D	86	7.0	19	100	580
DR	80	10.4	20	130	730
F	67	8.4	84	240	840
H	66	5.1	7	75	510
KE	52	8.0	12	67	490
KW	92	13.0	18	90	620

* No valid samples

The alum feed rate at KW Reactor was held at 12 ppm to December 6 when it was increased to 18 ppm. Thereafter, all reactors were feeding alum at 18 ppm.

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PROCESS TECHNOLOGY OPERATION

REACTOR POWER LEVEL LIMITATIONS

Power levels at B, C, D, and H Reactors are restricted by bulk outlet temperature limitations. DR, F, KE and KW power levels are being restricted by tube corrosion consideration.

PROCESS STANDARDS

HW-46000 H - Process Standards, Reactor

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

Process Standard A-030 - "Pressure-Flow During Reactor Shutdown"

This standard was revised as follows:

1. TORP Table (Top-of-Riser Pressure) - This table shows the required TORP pressure versus outage time that is necessary to overcome inadvertent boiling and sweep the steam from process tubes should boiling occur during shutdown conditions. This table was updated to reflect present higher tube powers.
2. Poison Outage - Reference to poison outages was deleted from the standard since this method of xenon transient control is no longer used due to development of the more productive method of transient control by poison splines.

Conditions and specific requirements for throttling front crossheader valves before the reactor has been down two hours, which were formerly associated with poison outages only, were retained in the revision for use on other occasions following short operating periods.

3. Outlet Temperature Monitoring - Tube temperature monitoring requirements were relaxed for the periods following four outage hours since after four hours of shutdown the heat generation is less than two per cent of the original heat generated at full power level.
4. Pressure Table - A table was reinstated that lists front and rear crossheader pressure differential required under certain conditions.
5. Corrective Action Times - Boiling Suppression Table - Corrective action times were deleted from the boiling suppression table. The revised requirement specifies immediate corrective action when boiling is detected.
6. Crossunder Line Requirements - Conditions that must be met prior and during use of the crossunder line were specified in the revised standard.

PROCESS CHANGE AUTHORIZATIONS

The number of process change authorizations issued during the month was three

to permit temporary deviation from Process Standards - Water Plant, HW-27155 Rev1; one to permit temporary deviation from Process Equipment Standards, HW-41000; and fifteen to permit temporary deviation from Process Standards - Reactor, HW-46000. These were:

PCA #1-85 - "Water Leak, B Reactor"

Process Standard B-010 specifies the maximum permissible daily water collection rate from the reactor gas atmosphere. During November, a water leak developed in the reactor which produced a condensate collection rate slightly in excess of the maximum permissible rate. Authorization was given to continue operation for a two-day period provided the following requirements were met:

1. The dewpoint of the inlet gas to the reactor should be maintained below 0 F. If the dewpoint of the inlet gas exceeds 15 F, the reactor shall be shut down.
2. The inlet dewpoint should be recorded a minimum of once every hour.
3. Upon any indication of tube power reduction which can be attributed to water in the moderator, the reactor shall be shut down.

PCA #1-86 - "Temporary Removal of Automatic Crosstie Backup, K Reactors"

Process Standard A-080 requires that the high pressure crosstie line between the two K Reactors be in automatic service at all times during reactor operation.

During completion of Project CGI-844, "100-K Coolant Backup System," it is necessary to install anchors on the concrete base of a check valve near the V-73 valve. This work requires drilling into the concrete base with a pneumatic hammer. Because the vibration which accompanies the drilling may inadvertently actuate the V-73 valve, it is desirable to temporarily place the V-73 valve on manual control.

This process change authorized (1) placing the V-73 valve at KE Reactor on manual for one two-hour period, and (2) placing the V-73 valve at KW Reactor on manual for one two-hour period, provided the procedural controls specified in the PCA are met.

PCA #1-87 - "Zone Temperature Monitor, B Reactor"

The zone temperature monitor (ZTM) equipment is designed for improved reactor control and nuclear safety during changing operating conditions such as incurred during reactor startup. The maximum number of RTD's in this system which can be faulty without reducing its reliability is considered to be ten. Therefore, Process Standard C-050 specifies that a cold startup shall not be made with more than ten faulty zone temperature monitor resistance temperature detectors.

B Reactor has been losing an average of five ZTM points per month, which

resulted in a total of 15 inoperable points during an unscheduled outage in November. Repairs would have required extension of down time at premium cost since several other reactors were also down.

This process change authorized, until December 15, 1961, reactor startup with 15 inoperative RTD's in the ZTM system.

PCA #1-88 - "Gas Composition, C Reactor"

On November 15, 1961, the gas atmosphere analyses at C Reactor showed N₂ and O₂ content to be slightly in excess of the quantities authorized in Process Standard B-010. The PCA authorized continued operation provided gas pressure to the reactor was increased and the inlet gas radiation monitor indicated a continually decreasing gas activity level down to normal readings.

PCA #1-89 - "Loss of Emergency Steam Export Pump at H Reactor"

Process Standard HW-27155 Rev1 specifies that "Upon loss of normal electrical power at B, D, F, or H, an emergency steam pump shall be placed on the export system, in the area losing power, within ten minutes." This specification is necessary to ensure the backup system is adequate in case of electrical power loss at all areas and steam loss at one area (i.e., the export system would be supplied only by steam driven pumps).

Recent tests of the emergency raw water steam pump at H area disclosed a faulty governor and overspeed trip condition which necessitated removal of this unit from service for repairs. Due to the extremely remote possibility of an extended loss of BPA power at the four old reactor areas, concurrent with steam loss at one of the three old reactor areas, which have their steam turbines available, continued operation for short periods of time at reactors (B, D, and F) where backup adequacy is adversely affected is believed justified.

This process change authorized until November 18, 1961, continued operation of B, C, D, DR, and F Reactors while the steam emergency export pump at H Reactor was removed from service for necessary repairs.

PCA #1-90 - "Poison Spline Substitution for Horizontal Control Rod Removal - K Reactors"

Process Standard C-100 permits withdrawal of any one horizontal control rod eight hours after an outage provided three poison splines are charged in the near side enrichment ring, as close to the rod channel as possible, and each spline is not further than one lattice unit from an enriched charge. A re-examination of the poison substitution necessary to compensate for a horizontal control rod has shown that the above poison substitution is not conservative. Therefore, to ensure compliance with the total control criterion, it is necessary to remove the above specification from the standards.

This process change authorization voids specification A, (3) in Section 100.03 of Process Standard C-100.

PCA #1-91 - "Pressure Monitor-Flux Monitor Interlock, F Reactor"

Process Standard C-060 prohibits by-passing the Panellit system up to 2 MW during startup unless the flux monitors are interlocked with the Panellit to automatically un-bypass the Panellit when the flux monitors are ranged to permit an indicated reading at full scale which is equivalent to more than 2 MW.

The design change which will accomplish the above interlock has not been completed at F Reactor. A stop-gap Design Change #483 F has been approved, which will interlock the outlet temperature signal from the ten-tube average outlet temperature recorder with the Panellit by-pass circuit. The Panellit will be automatically un-bypassed whenever the ten-tube average exit temperature exceeds 5 C above the inlet water temperature.

This PCA authorized temporary by-passing of the Panellit system up to 2 MW, provided the stop-gap equipment authorized by Design Change #483 is in service.

PCA #1-92 - "Panellit Gauge Trouble-Shooting Equipment, H Reactor"

During a recent startup at H Reactor, six Panellit scrams from one row of gauges occurred. Because there is no coordinate indication in the Panellit gauge system at H Reactor, it is often impossible to determine which Panellit gauge is responsible for a reactor shut down.

Equipment has been developed by Component Testing Unit which will detect the specific gauge switch bottle that opened the circuit when the row producing the scram is known. This was done by series placement of fuses across each Panellit switch in the offending row. The fuses selected had lower current carrying capacity than the Panellit switch and would therefore blow, allowing visual identification if a Panellit switch opened. The resistance of the fuse was specified sufficiently high to permit the row relay to drop out if a single Panellit switch opened.

Use of this device is permitted only on one row at a time and only under carefully controlled provisions of a PCA.

Authorization was given to use this identification device until December 22, 1961, or until the next minimum outage, whichever occurred sooner.

PCA #1-93 - "Water Leak, DR Reactor"

The circumstances of this water leak into the graphite moderator and the required provisions of this PCA are identical to those described in PCA #1-85. This process change was authorized on November 27, 1961, and expired on November 29, 1961, when the reactor was shut down for leak testing.

PCA #1-94 - "Purge Material, D-DR Reactors"

Water Plant Standard 183-A-070 specifies the type of diatomaceous earth that may be used for a process tube purge. Through an error in a purchase order,

another grade of this material was received. The chemical composition was identical but the calcination period was shorter in the material received. Particle sizes are similar for both types.

Authorization was given to purge process tubes with the "as received" diatomaceous earth.

PCA #1-95 - "Process Tube Temperature Monitoring During Shutdown - B,D,F,&H"

Process Standard C-050 specifies hourly temperature monitoring of the outlet water temperature on process tubes once per hour during reactor shutdown. This specification for hourly temperature monitoring during a reactor outage was designed to minimize hot header incidents arising from flow being reduced to a header without control room personnel being cognizant of the flow reduction. Since any stated monitoring frequency will not eliminate a hot header incident, and the frequency is subject to considerable difference of opinion as to what is adequate, this specification has been removed from the K Reactor standards and is being removed from the remaining process standards books. The revised standards specify that after the reactor has been down four hours, temperature monitoring will be done as necessary to maintain tube temperatures below 60 C.

This process change authorized omission of the hourly process tube temperature monitoring requirements during reactor outages.

PCA #1-96 - "Flow During Reactor Shutdown, F Reactor"

Process Standard A-030 specifies that front crossheaders may not be throttled before two hours after shutdown except for a poison outage. This exception is possible for a poison outage due to the relatively lower fission product heat output rate at a comparable down time which results from a short operating period and lower power levels prior to the poison outage.

F Reactor shut down on November 28, 1961, after short operating periods for further helium leak testing. Calculations of the heat decay in process tubes at F Reactor based on the above conditions showed the heat generation to be about 55 per cent of normal.

This process change authorized, until December 1, 1961, throttling front crossheader valves before two outage hours for helium leak testing, provided specific requirements of the PCA are met.

PCA #1-97 - "Horizontal Bowing Measurements - B, D, and F Reactors"

Process Standard G-010 specifies that horizontal bowing shall be measured annually in channels located on both the near and far sides of the reactor near the horizontal centerline. The purpose of these data is to monitor trends in moderator distortion.

Recent traverses have been incomplete due to equipment limitations in severely bowed graphite channels.

Authorization was given until February 28, 1962, to delay taking these data to allow further time for development of equipment which will be adequate to obtain the desired data.

PCA #1-98 - "Removal of Emergency Steam Export Pump at B Reactor"

Circumstances and requirements in this PCA for B Reactor are essentially identical to those stated in PCA #1-89 for H Reactor.

This process change authorized removal of the emergency steam pump from the raw water export system for about three and one-half hours until repairs could be made.

PROCESS ASSISTANCE

One engineer audited conformance to process standards by making 20 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 (MWD/T)</u>	<u>Type of Failure</u>
12/8/61	3762-C	KC-087-A	I&E E (0.94%)	595	Side Hot Spot
12/13/61	2864-H	KY-087-D	I&E EB (0.94%)	605	Split-Long.
12/14/61	3264-DR	HZ-036-H	I&E N	780	Side Hot Spot
12/23/61	4177-H	KY-030-D	I&E EB (0.94%)	1050	Side Other
12/27/61	0867-DR	KZ-083-A	I&E N	750	Side Hot Spot
12/28/61	2872-H	KH-830-D	I&E EB (0.94%)	760	Hole
12/31/61	2667-H	KH-831-D	I&E EB (0.94%)	793	Hole

Legend

I&E N - This is the symbol for 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.

I&E EB - This is the symbol for internally and externally cooled production reactor fuel elements which have projections (bumpers) welded to the fuel element jackets. The uranium cores are enriched in U-235 and the weight per cent U-235 in the core material is stated.

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

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

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

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

OPERATIONAL PHYSICS OPERATIONPILE PHYSICS ASSISTANCE

Although a number of operating problems and loading variations during the past year have tended to reduce flattening efficiency, a general improvement has resulted recently as a result of operation at or approaching specific power limits. Incentives for closer flux distribution control increase as inlet water temperatures go down and bulk outlet temperatures are correspondingly relatively less restrictive.

SUMMARY OF OPERATING DATA OF PHYSICS INTEREST
FOR THE MONTH OF DECEMBER, 1961

Reactor	B	C	D	DR	F	H	KE	KW
ECT in November (1)	1500	1655	1460	1475	1485	1505	2445	2500
12-Month Average ECT	1505	1685	1485	1495	1465	1540	2535	2550
Equil. Scram Time (2)	14-16	30-35	14-16	11-15	14-20	35-45	20-25*	20-25*
No. of Scrams and Recoveries (3)	0/0	0/0	2/2	0/0	2/2	3/3	0/0	1/0
No. of Non-Scram Outages (4)	2/2	1/0	1/0	1/1	0/0	6/4	0/0	0/0
Recording Period -								
From:	11-17	11-20	11-23	11-21	11-17	11-18	11-21	11-17
To:	12-19	12-20	12-18	12-19	12-19	12-18	12-20	12-19

*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 power 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 - J. H. Ferguson

Flattening efficiency continued to be limited by frequent outages, primarily for water leaks, and thin-wall tubes maintained out of service. The average nonequilibrium loss increased to nearly 0.4 equivalent day reflecting more conservative approaches to equilibrium level and scram-caused interruptions during the approaches to full power level.

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C Reactor - D. E. Newbrough

Operating stability was good with the new downstream rod configuration and charge location. Longitudinal flux traverses, obtained from monitoring splines, show that while a significantly improved over-all flux distribution improvement has been achieved the flux is now peaking up to 25 per cent above a normal cosine distribution maximum about 3-4 slug lengths upstream of the charge center. It was observed that the maximum flux peaking existed in regions of the reactor where a definite downstream flux depression, apparently a result of residual balls in the lattice, is present in the rear of the reactor. The presence of balls in this location was indicated from previous data; however, the depression became more sharply defined as the downstream movement of the charge was completed. Although the movement of the charge has resulted in transfer of the flux depression from the front of the charge to the rear of the charge, the present condition is more desirable because of the reduction of slug rupture potential and the reduced front face radiation levels.

Flattening efficiency has not been hindered by the 40-tube overbore block; however, 60 additional E-columns were required to compensate for the reactivity loss of the overbore lattice plus the short charges therein.

D Reactor - D. W. Constable

Operation was interrupted by five full length outages; however, a 10-day operating period represented the longest continuous operation since May. Nonequilibrium losses were maintained at about 0.25 equivalent day. Flattening efficiency was lower than normal, primarily as a result of continued inoperability of number 8 HCR; little production loss has resulted since power levels continued to be limited by bulk effluent temperatures. Replacement of number 8 HCR has been scheduled for January.

DR Reactor - J. W. Hagan

Operation was relatively steady with only two full term outages interrupting continuity. Nonequilibrium losses increased to nearly 0.6 equivalent day, primarily as a result of the high residual exposure near the end of the current central zone uranium cycle. Graphite temperatures approached limiting conditions, particularly in the top rear quadrant of the reactor; this condition has been aggravated by the downstream flux peaking condition caused by a greater concentration of 3X balls in the front portion of the lattice. With nearly 100 per cent helium in the pile atmosphere bulk effluent temperatures rather than graphite temperatures have continued to limit power level.

About a day after one startup the reactor was manually scrammed when a sharp power increase of about 6 per cent was experienced. Subsequent evaluation indicated that the poison charge in a PCCF tube probably flushed downstream out of the active zone; previously the seating dummies in this tube had flushed out of the reactor but the poison had remained in place during an attempted discharge. The magnitude of the power rise was consistent with the calculated reactivity increase, and the response of the nuclear and temperature instrumentation confirmed that existing process standards specifying PCCF use provided adequate protection from damage during such events.

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DR Reactor - J. W. Hagan (Cont'd.)

A modified enrichment column charge was designed to help correct the flux distortion from the predominately upstream concentration of the 3X balls. Plans were completed for charging several such columns during the "block discharge" scheduled for early January.

F Reactor - R. B. Heiple

Flattening efficiency continued to improve steadily with a 1500 ECT achieved during one operating period; the main incentives for high flattening efficiency were reduced specific tube temperature limits, imposed by the current tube corrosion problem; the outward displacement of the top-to-bottom enrichment ring also contributed to improved flattening. Flexowriter malfunctions limited startup efficiency occasionally.

H Reactor - L. L. Grumme

Although the operation continued to be limited by numerous scrams and water leaks, the reduced minimum downtime and increased scram recovery time associated with the E-N loading continued to provide greater operating flexibility. Low nonequilibrium losses were largely the result of the decreased reactivity transients and greater stability, with the E-N load as compared with natural uranium, and the transition to greater use of splines in place of PCCF for startup control. Repair and return to service of the stop-gap power rate meter aided in the successful achievement of four hot startups.

KE Reactor - A. R. Kosmata

Although the rate of testing 3X hopper operability has increased, the backlog of untested hoppers required the additional conservative assumption that for total control requirements one hopper be considered inoperable in each of the four reactor quadrants. This restriction necessitated replacing some enrichment in the radial ring with central spike enrichment during a period of low uranium exposure; although poorer flattening and operation on graphite limits resulted, the loss in gross power level was not large.

Recent flux distribution data show that the flux level in the front of the reactor where graphite temperatures are a maximum increased 25 per cent as a result of the rod configuration change and of the charging of mixers in the rear of all tube charges. With the decision to remove mixers it was estimated that this increase would be reduced to 15 per cent with the only variation from the previous operation being the transition to inboard rods for upstream control during equilibrium operation. Steady operation with the upstream inboard rods increased the confidence for continuing operation with this configuration.

KW Reactor - R. A. Chitwood

Primarily as a result of the water mixers causing an upstream shift in the flux distribution, maintenance of graphite temperatures within limits became increasingly difficult as power levels increased; the problem is being resolved by the removal of the mixers, which has been scheduled from tube

KW Reactor - R. A. Chitwood (Cont'd.)

corrosion considerations, and the additional enrichment being charged to maintain reactivity with a higher helium concentration. Replacement of solid metal with I&E in the fringe zone last summer reduced the peripheral reactivity sufficiently to cause a marked reduction in flattening - a factor which became apparent as the power level reached specific power limits. Radial enrichment is being increased to regain the flattening efficiency.

PROCESS PHYSICS STUDIESSafety Control Studies

The production test to evaluate effective vertical system control strength at DR Reactor is still routing for signatures. Bids for the necessary gamma-compensated neutron-sensitive chamber have been received and reviewed.

The digital computer program "trip 002" is now working and giving results which agree with analog runs on reactivity ramps and associated trips. Work is proceeding on a third version of a trip program which will contain equations describing various delays in temperature and rate-of-rise effects, and will permit later inclusion of nuclear period instrumentation delays. Convergence of the "trip" digital programs on the correct ramp will permit more rapid progress on the instrumentation criteria study. Runs are currently being made on the analog computer to determine distortion effects. These results will provide information to be used in determining geometric coverage of safety instrumentation.

Pile Reactivity Studies

Recent 200 Areas isotopic determinations based on mass spectrograph analyses only recently made available, indicate plutonium-240 buildup to be 4-10 per cent greater than would have been predicted from test batch data to which prediction tables have been normalized. The possibility is being considered of extending tube-by-tube accounting to plutonium-240 content as well as to the normal total plutonium prediction.

Considerable effort has been spent during the month on analyzing in detail the partial calibration of the horizontal control rod system at the H Reactor. Results indicate that the HCR's are approximately 20 per cent less effective in the E-N loading than was observed in the 1957 test in a natural uranium loading. These results are due in part to the blacker lattice in the E-N loading and in part to the reduced value through the fringe poison blanket. Reductions in local safety control strength of the observed order of magnitude have previously been assumed in safety control calculations for the E-N load.

Documents, procurement, testing, liaison, and scheduling for the NPR graphite stack purity test are proceeding on the basis of estimated stack completion in early March.

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Control Efficiency Studies

The second core of the H Reactor E-N load is nearing goal exposure and will be replaced with natural uranium early in 1962. The blanket loading will be continued during most of 1962. Twenty-four E-metal columns from the sixth lattice unit and twenty-four from the fifth lattice unit were picked up separately for scheduled conversion ratio determinations.

Preliminary investigation has been made at the request of Manufacturing of basic requirements for lithium-containing splines for routine use in central columns. Even with isotopically pure lithium there would likely be a conflict between incentives for spline blackness and spline thinness, or cooling requirements.

Shielding Studies

A comprehensive manual on prints and descriptions of present reactor shields was issued during the month as HW-71109, Shielding Reference Manual, Hanford Production Reactors.

Reactor Fundamentals Training

Four-session series of classes were completed during the month for both Reactor Specialists and Pile Operators. Each series was given during the fall months for each of the rotating shifts. An average of six attended each of the Specialist sessions, and an average of eleven each of the Pile Operator sessions. Due to a sudden illness of the instructor the beginning of the next sessions will be delayed.

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TESTING OPERATION

IRRADIATION TESTING OPERATION

DR-1 Loop

The DR-1 Gas Loop was operated continuously throughout the report period with the exception of 39 hours during reactor outages. Test conditions were maintained on the test element for 544 hours. The total time at test reference conditions is now 4549 hours, with 2912 hours at 1500 F, 130 hours at 1550 F, 180 hours at 1600 F, 136 hours at 1650 F and 1191 hours at 1700 F. The test element was cycled twice from reference conditions to ambient temperature for a total of 33 cycles.

C-1 Loop

The out-of-reactor portion of C-1 Loop operated for 900 hours with one interruption during the report period. The loop has been shut down for routine maintenance and the installation of additional instrumentation.

H-1 Loop

The three renovated KER pumps have been fully installed and operationally tested at room temperature. Instrument and electrical check-out work was approximately 90 per cent completed. All relief valves have been checked and found adequate except for the one on the water-to-water heat exchanger and one of the two on the surge tank. The clean-up ion exchanger column resins were changed. The test section closure nozzle assembly was essentially completed.

NAA-111

The irradiation of specimens of U-Mo alloys in the 2D test hole at KW Reactor continued at reference conditions. The maximum surface temperatures of two specimens were maintained at 700-732 F and 900-930 F, respectively, during equilibrium reactor operation. The test is being performed for Atomics International.

Borescoping Activities

Process channel 2868, C Reactor was inspected before and after overboring to determine the damage, if any, to the graphite moderator from overboring. The channel was in excellent condition prior to the overboring, with the exception of two separations. After overboring, four trunion blocks were cracked and partially broken out.

Sample Irradiations

The following irradiation samples were handled:

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<u>Reactor</u>	<u>Test Hole</u>	<u>Facility</u>	<u>Request No.</u>	<u>No. of Samples</u>	<u>Material-Purpose</u>
KE	2B	Magazine	HAP0-119	28	Graphite (radiation damage study)
KE	2D	Quickie	HAP0-172	3	Effluent water (activation analysis)
KW	2B	Hot Graphite	HAP0-177	12	Graphite (radiation damage study)
KE	2D	Quickie	HAP0-184	9	Washington Designated Program
C	B	Hot Graphite	HAP0-250	12	Ceramics (rod channel liner material study)
KE	2D	Quickie	HAP0-254	5	Arsenic and phosphorus (tracer isotope production)
KE	2D	Quickie	HAP0-256	1	Plutonium (fission yields of heavy plutonium isotopes)
KW	4B	Snout	HAP0-243	3	Reactor structural materials (fission damage study)
KE	2D	Quickie	HAP0-252	1	Arsenic (tracer isotope production)
F	E	Quickie	HAP0-223	1	MoO ₃ (radioactive buildup and decay study)
H		PCCF	HAP0-223	1	Effluent water (standards for whole body counter)
		*Gamma	HAP0-171	5	Plastics and rubber (gamma radiation damage studies)
		*Gamma		1	pH electrodes (gamma radiation damage studies)
		*Gamma		12	Reagent solutions (gamma radiation damage study)

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

Vertical Bowing Measurements

A summary of the results of vertical bowing measurements follows. All distances were measured from the inlet tube flange.

<u>Date</u>	<u>Tube</u>	<u>Distance</u>	<u>Remarks</u>
10-31-61	4676-F	36 feet	Up .06" at 9' since 7-13-61 Up .03" at 20' since 7-13-61
11-27-61	1486-H	35 feet 8 inches	No previous data
11-18-61	4574-B	35 feet	Up .14" at 9'4" since 8-18-61 Up .02" at 20' since 8-18-61
12-16-61	2257-H	36 feet	No previous data
12-19-61	4674-C	36 feet	Down .02" at 10' since 5-16-61 Down .32" at 21'4" since 5-16-61

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COOLANT TESTING OPERATION

KER Loop Operation

KER-1 - Testing of the swelling characteristics of five 17-inch NIEL fuel elements as authorized by PT IP-377-A was completed with discharge of the tube during the December 14 outage. The tube was recharged with five 23-inch NIEL fuel elements as authorized by PT IP-455-A. The objective of the test is to compare the irradiation behavior of N Reactor inner fuel tubes having negligible warp after beta heat treatment to the behavior of elements with extensive warp after beta heat treatment which were straightened and beta heat treated a second time. Loop operating conditions were 1600 psi, 230 C, and pH 10.

KER-2 - Testing of five 23-inch NIEL fuel elements as authorized by PT IP-377-A was continued. Irradiation of these elements to high exposures is planned. A reactor scram occurred on December 3 as a result of a failure of the main loop flow controller. An intermittent short in a flow controller vacuum tube caused the main loop flow control valve to open fully which resulted in a high flow trip. Loop operating conditions were 1600 psi, 210 C, and pH 10.

KER-3 and KER-4 - The loops remained shut down for Project CGI-839 revisions.

1706-KE Single-Pass Tube Operation

All eight tubes were supplied normal process water from Building 105-KE.

SP-1 (2952-KE) was discharged on December 4 and recharged with 28 CIVNS elements.

Trace additions of sodium silicate to SP-3 (4355-KE) and SP-4 (4456-KE) began on December 20 as authorized by PT IP-437-A. The test is part of the research and development program to develop a process for reducing the biologically significant radioisotopes in reactor effluent water.

KE Reactor Outage Time Requirements

One unscheduled outage was charged to production testing. A total of 9.3 hours was charged to production tests as listed below.

<u>Production Test</u>	<u>Description</u>	<u>Hours</u>
PT IP-377-A	Reactor shutdown caused by failure of KER-2 flow controller	6.7
PT IP-455-A	Charge KER-1	0.9
PT IP-377-A	Tray discharge KER-1	1.7

A total of 4.4 hours was charged to Project CGI-839 during the outages of December 3 and 14 for installation of rear-face piping.

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Out-of-Reactor Facility Operation

TF-1 - Cyclic decontamination test #6 for corrosion testing of carbon steel welded to stainless steel, normal carbon steel, stainless steel, Zircaloy-2, Stellite 6 and 12, and Haynes Alloy 41 was completed. Stressed samples of AMS 5616 for evaluation of stress cracking continued. Additional stressed samples of AMS 5616 were charged on December 9.

TF-2 - Fretting corrosion testing of Zircaloy-2 at 300 C and pH 10 was completed on December 12.

TF-3 - Testing of the behavior of aluminum X-8001 cladding under conditions of heat transfer and corrosion testing of aluminum X-8001, 304 stainless steel and Zircaloy-2 coupons continued. Loop operating conditions are 600 F, 3200 psi and pH 7.

TF-4 - Cyclic decontamination test #6 to evaluate the corrosion of carbon steel welded to stainless steel, normal carbon steel, stainless steel, Zircaloy-2, Stellite 6 and 12, Haynes Alloy 41 and stress crevice samples of AMS 5616 was completed. Stress cracking evaluation of prestressed samples of 17-4 PH stainless steel and 406 stainless steel at 300 C and pH 10 began on December 15.

TF-5 - Neutral pH corrosion testing of carbon steels 1031, 1051 and A-212, sensitized and non-sensitized 304 stainless steel, C-1 alloy aluminum and Zircaloy-2 began on November 30.

TF-6 - Corrosion testing of aluminum X-8001, Zircaloy-2 and 304 stainless steel at pH 4.5 using chromic acid as an inhibitor and for pH control continued.

TF-7 - Corrosion testing of components and materials listed below using 400 ppm sodium nitrite as a corrosion inhibitor continued.

1. Suit-case-handle supports of two Zircaloy-2 clad fuel elements and two Zircaloy-2 dummy pieces
2. One KSE3 element
3. Fretting corrosion testing of a PRTR fuel element
4. Coupons of A-212 carbon steel, Jones and Laughlin heat No. 313472, carbon steel, Zircaloy-2, 304 stainless steel and 9Cr 1Mo steel

Corrosion testing of aluminum X-8001 coupons was completed.

TF-8 - Corrosion testing of 304 stainless steel, Admiralty metal, 70-30 copper nickel, A-212 carbon steel and silicon bronze coupons was resumed after heat exchanger repairs were completed on December 9. Loop operating conditions are 160 C and 1000 psi with addition of ammonium hydroxide for pH control and hydrazine for oxygen scavenging.

TF-9 - One rupture test of an N-Reactor inner fuel tube was completed.

TF-10 - Seventeen decontamination scanning tests were completed.

TF-11 - One gross fission product contamination-decontamination test was completed on stainless steel, carbon steel and Zircaloy-2 test coupons.

TF-13 - Testing of the effect of raw water film buildup on the heat exchanger tubes and corrosion testing of carbon steel, 304 stainless steel and 70-30 copper nickel coupons continued. Corrosion testing of stressed Admiralty coupons began on December 1.

TF-15 - Installation of the facility in 1706-KE was completed on December 27.

COMPONENT TESTING OPERATION

Irradiation Fuel Element Examination

Examinations were completed on fuel elements from the following 59 tubes:

<u>Number of Tubes</u>	<u>Production Test</u>
20	PT 183-A, Projection Fuel Elements
15	PT 216-A, Quality Certification Program
9	PT 310-A, UT-2 Characterization Test
9	PT 380-A, Reduction of pH of Process Water
3	PT 381-A, Oversize Fuel Elements - C Reactor
2	PT 409-A, Self-Supported Fuel Elements - K Reactor
1	Regular I & E Fuel Elements

Process Tube Corrosion Monitoring Program

In-reactor measurements of 1007 process tubes were completed. Listed below are the tubes measured for each reactor and document numbers of reports issued.

<u>Reactor</u>	<u>No. of Tubes Probologged</u>	<u>Report No.</u>	<u>HW-Number</u>
F	188	111	71796
KE	82	112	71797
D	76	113	71878
B	89	114	71926
DR	78	115	71931
KE	21	116	71940
H	11	117	71951
KW	20	118	71959
F	57	119	71975
C	216	120	72058
B	110	121	72064
DR	59	122	72078

Visual examination was completed on 12 process tubes as follows:

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Tube No.	Reason Removed	Location of Leak	Cause of Leak	HW Number Unc.Report
1565-D	Leaker	Not found		72019
2086-D	Leaker	Top half, 13 1/2 - 14 feet from TOF*	IC**	72019
3973-D	Leaker	Bottom half, 11 1/2 - 12 feet from TOF	IC	72019
1183-DR	Leaker	Top half, 10 feet from TOF		71952
3278-DR	Leaker	Bottom half, 9 1/2 - 10 feet from TOF	IC	71952
1687-F	Leaker	Bottom half, 10 - 10 1/2 feet from TOF	IC	Not reported
2661-F	Leaker	Bottom half, 10 - 10 1/2 feet from TOF	IC	Not reported
2663-F	Leaker	Bottom half, 10 - 10 1/2 feet from TOF	IC	Not reported
3277-F	Leaker	Bottom half, 10 - 10 1/2 feet from TOF	IC	Not reported
3762-F	Leaker	Bottom half, 10 - 10 1/2 feet from TOF	IC	Not reported
2778-H	Leaker	Bottom half, 10 - 10 1/2 feet from TOF	IC	Not reported
2666-H	Leaker	Bottom half, 10 - 10 1/2 feet from TOF	IC	Not reported

*Tube outlet flange

**Internal corrosion and external corrosion

Critical Reactor Component Examination

All the snap rings on the inlet tube sleeve flanges on KW Reactor were examined. There were gaps 3/8 inch and larger in 17 rings and one ring was cracked.

Panellit System Programs

Gages repaired, calibrated by maintenance	-	68	
Gages meeting calibration criteria	-	45	(66%)
-previous month	-		(70%)
In-board gage reliability examination	-	46	
Gages meeting examination criteria	-	42	(91%)
-previous month	-		(97%)
-average for past year	-		(91%)
Response time determination	-	46	
Gages meeting examination criteria	-	42	(91%)
-previous month	-		(100%)
-average for past year	-		(82%)

In-board Bourdon coil examination - 2 327
 Non-leaking coils - 2 326 (99.9%)
 -average rate for past two years - (99.6%)

Gage failures receiving failure analysis totaled 57.

Nine-hundred sixty-six gages were received and examined as part of the exchange gage program. Results were as follows:

	<u>Model 154-100-C</u>	<u>Model 154-100-K</u>	<u>Model 156-100-H</u>
Examined	365	475	126
Rejected	80	75	48
Rejection rate	22%	16%	38%
Previous month	12%	11%	16%

Sixteen rows of the new exchange gages have been installed in reactor panels. Location and number of rows are listed below.

<u>Location</u>	<u>Number of Rows</u>	<u>Number of Gages</u>
KW	5	248
KE	3	174
C	5	230
H	3	136

Gages removed from panels, to permit installation of new gages, and prepared for shipment to the vendor as exchange gages totaled 800.

 Manager, Research and Engineering

MANUFACTURING

PRODUCTION OPERATION

PRODUCTION PLANNING & SCHEDULING

Discharge Concentration

The discharge goal exposure for regular metal was reduced to lower the Pu-240 content of the end product. Reductions were 50 MWD/T at B, C, DR and F Reactors and 25 MWD/T at the K Reactors. The Pu-240 content of December discharges showed a reduction of 4 per cent as a result of these adjustments.

Discharge Exposure Comparison (MWD/T)

	<u>Regular Uranium</u>		<u>Enriched Uranium</u>		<u>Over-all Exposure</u>
	<u>6 Old</u>	<u>2 K's</u>	<u>6 Old</u>	<u>2 K's</u>	
October	696	736	796	756	733
November	712	715	817	768	726
December	681	668	890	712	696

Off-Plant Shipments

Fourteen casks of polonium were shipped to Mound Laboratory.

ESSENTIAL MATERIALS

Rail and truck shipments received in December were as follows:

Carload shipments for IPD	-	233
Carload shipments for other Depts.	-	204
Truck shipments for IPD	-	<u>201</u>
Total		638

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MONTH		REACTOR OPERATION STATISTICS - PROCESSING																					
December, 1961		B	C	D	DR	F	H	SIX OLD	KE	KW	K'S	TOTAL											
INPUT PU (% OF FORECAST)		74.7	54.4	79.3	104.3	99.6	102.8	84.2	101.1	115.3	108.4	94.4											
TIME OPER EFF. (% OVERALL)		65.1	47.6	63.4	80.0	75.3	75.7	67.9	78.0	91.7	84.9	72.1											
NEW TUBES INSTALLED		30	1	104	2	36	11	184	5	0	5	189											
WATER LEAKS - TUBE		4	0	4	1	6	5	20	0	0	0	20											
- VAN STONE		5	0	0	0	0	6	11	0	0	0	11											
SLUG RUPTURES		0	1	0	2	0	4	7	0	0	0	7											
HELIUM CONSUMED - M.CU.FT.																							
CAUSES OF REACTOR OUTAGES		NUMBER OF REACTOR OUTAGES AND HOURS																					
		NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.		
SCRAMS	OPERATIONAL CAUSES						1	0.3					1	0.3	1	0.4			1	0.4	2	0.7	
	FAULTY INST. OR CIR.													1	59.6			1	59.6	1	59.6		
	FAULTY PROC. EQUIP.	1	1.6			1	38.7			1	0.9			3	41.2					3	41.2		
	UNEXPLAINED			2	1.2	1	0.2						3	1.4						3	1.4		
	LOOSE CONNECTOR			1	35.8								1	35.8						1	35.8		
	OSCILLATING GAUGE															1	0.4	1	0.4	1	0.4		
	1706-KER														1	42.3			1	42.3	1	42.3	
	CHARGE - DISCHARGE	1	101.2					1	24.0					2	125.2	1	61.3	1	61.1	2	122.4	4	247.6
	RUPTURE							2	94.5			4	68.1	6	162.6						6	162.6	
	WATER LEAK	3	157.0			2	83.0	(2)	30.0	2	182.6	4	112.9	11	565.5						11	565.5	
TUBE REPLACEMENT					1	150.1							1	150.1						1	150.1		
MAINTENANCE			1	39.4										1	39.4					1	39.4		
PT OVERBORE			1	*313.3										1	313.3					1	313.3		
TOTAL		5	259.8	5	389.7	5	272.0	4	148.8	3	183.5	8	181.0	30	1434.8	4	163.6	2	61.5	6	225.1	36	1659.9
UTILIZATION OF REACTOR OUTAGE HOURS																				TOTAL HOURS	% OF TIME		
CHARGE - DISCHARGE		33.5	55.8	36.2	50.9	40.8	15.8	233.0	58.1	38.5	96.6	329.6	5.5										
RUPTURE REMOVAL		0	2.1	0	17.7	0	19.3	39.1	0	0	0	39.1	0.7										
WATER LEAK		102.9	0	59.8	18.7	52.4	107.9	341.7	0	0	0	341.7	5.7										
TUBE REPLACEMENT		44.0	21.2	100.8	38.9	50.7	17.6	273.2	16.9	2.7	19.6	292.8	4.9										
MAINTENANCE		62.6	**129.9	56.1	12.9	39.6	19.9	321.0	17.9	16.6	34.5	355.5	6.0										
STANDARD CHECK		2.9	2.8	.2	0	0	0	5.9	0	0	0	5.9	0.1										
PRODUCTION TEST		6.1	(1)171.7	2.0	2.7	0	0	182.5	46.2	2.3	48.5	231.0	3.9										
PROJECT WORK		7.8	5.0	1.3	7.0	0	0	21.1	24.5	1.0	25.5	46.6	0.8										
OTHER		0	1.2	15.6	0	0	0.5	17.3	0	0.4	0.4	17.7	0.3										
TOTAL		259.8	389.7	272.0	148.8	183.5	181.0	1434.8	163.6	61.5	225.1	1659.9	27.9										

*One rupture removed during this outage.

**Includes 42.3 hrs. for replacing all front pigtails.

(1) Includes 149.7 hrs. for overboring (IP-431-A).

(2) Continuation of Nov. outage.

MONTH December, 1961		REACTOR OPERATIONS STATISTICS — POWER								SHEET 1
		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.	14999		1723		2210	2415			21347
TO FILTER PLANT (BLDG. 183)	GPM AVG.	54520		83643		77886	70000	179590	183963	649602
TO FILTER PLANT (C&DR)	GPM AVG.	84810		63163						147973
TO R & E (KER & FEO)	GPM AVG.			203				380		583
TOTAL	GPM AVG.	154329		148732		80096	72415	179970	183963	819505
TOTAL	M GAL.	6667.0		6425.2		3460.2	3128.3	8293.0	8477.0	36450.7
RESERVOIR WATER (BLDG. 182)										
TO POWER HOUSE (BLDG. 184)	GPM AVG.	50		80		307	59			496
TO COND. SYSTEM (BLDG. 190)	GPM AVG.			773		1836	2356			4965
TO COND. SYSTEM (100DR & 183F)	GPM AVG.			870		67				937
TO EXPORT SYSTEM Incl. NPR	GPM AVG.	14949		0		0				14949
TOTAL	M GAL.	647.9		74.4		95.5	104.3			922.1
FILTER WATER (BLDG. 183)										
TO POWER HOUSE (BLDG. 184)	GPM AVG.	195		201		111	149			656
TO PROCESS (BLDG. 190)	GPM AVG.	60660	67260	65943	76376	72245	64300	174421	179226	760431
TO 108	GPM AVG.	2500	4500	436		1094	1060			9590
TO 108DR	GPM AVG.			436						436
TO FILTER PLANT (BLDG. 183DR & 183B)	GPM AVG.		10235	14587						24822
TO F & S SYSTEM	GPM AVG.	102		228		315	125		50	820
TO R & E (KER) & FEO	GPM AVG.			153				161		314
BACKWASH	GPM AVG.	1298	2815	1659	1374	4121	4366	5008	4687	25328
TOTAL	M GAL.	2797.4	3663.8	3613.3	3358.8	3364.7	3024.0	8275.5	8477.0	36574.5
PROCESS WATER (BLDG. 190)										
TO REACTOR	GPM AVG.	60260	66860	65543	75976	71865	63800	167100	173300	744704
TO REACTOR	GPM NOR.	86000	99000	88000	88000	89200	84300	184300	184800	903600
POWER HOUSE (K AREA)	GPM AVG.							19	11	30
108 (KE - KW)	GPM AVG.							6902	5515	12417
TO R & E (KER)	GPM AVG.							0		0
BUILDING USAGE	GPM AVG.	400	400	400	400	380	500	400	400	3280
TOTAL	M GAL.	2620.5	2905.6	2848.7	3299.4	3121.0	2777.8	8037.3	8258.7	33869.0
RIVER DATA										
ELEVATION (MSL, FT.)	(MAX.)	385.5		381.5		368.0	370.6		380.9	
	(MIN.)	383.0		376.1		364.0	369.0		378.0	
	(AVG.)	384.5		377.5		364.5	369.6		379.2	
TEMPERATURE	AVG. °F	44.7		49.3		49.3	48.9		46.0	

Note: KE-KW Reactors were based on 32 days. The other reactors on 30 days.

MONTH December, 1961		REACTOR OPERATIONS STATISTICS — POWER								1. 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	MM GALS									
BLDG. 183	MM GALS	2355.3	3663.8	3613.3	2728.6	3364.7	3024.0	8275.5	8477.0	35502.2
<u>CHEMICAL CONSUMPTION</u>										
CHLORINE (BLDG. 182)	LBS.	12190	15030	7850	4100	14342	16259	42840	50422	163033
(BLDG. 183)	LBS	0.6	0.5	0.3	0.2	0.5	0.6	0.6	0.7	0.5
	AVG PPM									
ALUMINIA	LBS	87765	126534	130962	113390	98897	114890			672438
	LBS	610	15746	78135	30389	105697	90119	1417362	1166915	2904973
ALUM	AVG PPM	* 17.9	* 17.1	* 20.0	* 21.3	* 17.9	* 21.8	* 20.6	* 16.5	* 19.1
SEPARAN	LBS	275	775	750	300	500	800	2350	2350	8100
	AVG PPM	.014	.025	.024	.013	.018	.032	.034	.033	.024
SULPHURIC ACID	LBS	218673	342027	383919	293314	374006	380420	1212381	1418298	4623038
(A ₂ 100%)	AVG PPM	11.1	11.2	12.8	12.9	13.3	15.1	17.6	20.1	14.3
DICHROMATE	LBS	21483	33399	26010	30122	25950	23505	110902	113025	384396
<u>PURGE MATERIAL CONSUMPTION</u>									(Filter Aids)	
SOLIDS	LBS	0	6000	0	0	0	0	0	550	6550

*Alumina & Alum combined for PPM in Alum Column.

MONTH December, 1961		REACTOR OPERATIONS STATISTICS — POWER							SHEET 3
ANALYTICAL DATA		100-B	100-C	100-D	100-DR	100-F	100-H	100-KE	100-KW
<u>RAW WATER</u>									
PH	PH AVG	7.90	7.90	8.15	8.15	8.17	8.03	7.14	7.14
TURBIDITY	PPM AVG	3	3	3	5	3	3	4	5
<u>FINISHED WATER</u>									
PH	PH AVG	7.00	7.00	7.01	6.97	6.91	6.95	6.60	6.61
TURBIDITY	PPM AVG	.003	.004	.003	.003	.003	.003	.006	.006
Cl ₂ RESIDUAL	PPM AVG	.05	.05	TRACE	TRACE	.01	.14	.19	.19
DICHROMATE	PPM AVG	.99	1.39	1.10	1.10	1.00	1.02	1.65	1.64
<u>STEAM DATA</u>		100-B	100-D	100-F	100-H	B-D-F-H TOTAL	KE	KW	KE-KW TOTAL
GENERATED (MAX)	LBS/HR	223000	152000	86000	76000	537000	55000	53000	108000
(NOR)	LBS/HR	81000	81000	56000	60760	278760			
(AVG)	LBS/HR	101000	100201	58388	57273	316862	34500	31300	65800
TOTAL	M LBS	72854	72145	42040	42611	229650	26520	24234	50754
TO PLANT	M LBS	61780	61178	36995	36134	196087	23868	21811	45679
COAL RECEIVED	TONS	4088	3816	0	2253	10157			
CONSUMED	TONS	4039	4100	2690	2387	13216			
IN STORAGE	TONS	15368	17312	6850	6731	46261			
GEN. STEAM/LB. OF COAL		9.02	8.80	7.81	8.93	8.69			
OIL RECEIVED	GALLONS						296302	220902	517204
CONSUMED	GALLONS						207031	259650	466681
IN STORAGE	GALLONS						1365823	1417116	2782939
GEN. STEAM/GAL. OF OIL							128.1	93.3	108.8
<u>ELECTRICAL DATA</u>									
TOTAL GENERATED KW HRS.							1672100	1694800	3366900
Peak Demand Control							136100	158800	294900

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APPLIED REACTOR ENGINEERING OPERATION

MAINTENANCE PRACTICES OPERATION

Rear Face Connectors

Approximately 1,815 Inconel connectors were installed on the front face of 105-C Reactor utilizing the B-D-F uninstalled and spare parts rear connectors. A requisition has been issued for bids on 2,000 rear connectors to replace the B-D-F and Spare Parts stocks.

Impellers - 190 High Lift Pumps

In February, 1961, inspection of the third generation pump impellers revealed cracking problems. The vendor believed that repairs were feasible, and on June 15, 1961, an alteration to the original purchase order and warranty was accepted. This alteration provided for repair of defective impellers at a favorable cost to HAPO. Prior to the negotiation of the alteration, Applied Reactor Engineering Operation ordered ten spare impellers. In December, 1961, because of the vendor's failure to repair impellers (one to date), Applied Reactor Engineering Operation ordered three additional new spare impellers.

Training

Instrument Trainees - In December, 1961, twelve Irradiation Processing Department Instrument Trainees were awarded certificates for satisfactorily completing a two-year course in instrument maintenance. During the period these personnel had devoted eight hours per week to training and testing in instrument fundamentals and IPD instrument specialties.

PLANT EQUIPMENT ENGINEERING OPERATION

Inlet Connectors - C Reactor

Examination of the stainless steel spiral connectors removed from the inlet face disclosed significant reduction of the flare diameter. Testing disclosed that re-use of reduced diameter flares would be inadvisable. It was recommended that the connectors be replaced with Inconel spiral connectors which had been procured primarily for use on the rear of B, D, and F Reactors. Engineering inspection service was provided during the replacement work.

Replacement of Original Fringe Tubes

An analysis was completed and a recommendation was issued concerning the early replacement of original fringe zone tubes in the B, F, and H Reactors. Based on a comparison of the downtime resulting from Van Stone flange failure leaks and the extra downtime necessary to replace such tubes at a remaining wall thickness greater than the normal replacement value, it was concluded to be advantageous to replace original fringe tubes having less than a 40 mil wall thickness.

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Tube Replacement Outage Schedule

A recommended schedule for the tube replacement outages to be conducted by the Special Outage Services Operation during January and February, 1962, was issued. The schedule specifies an outage for DR Reactor for the first two weeks of January. Alternate schedules were included to provide for possible change of the currently scheduled block discharge outage at H Reactor.

Spline Identification

A uniform method of spline identification by color coding splines and plastic reels was developed with the concurrence of all Processing Operations. The method was transmitted to Research and Engineering to permit preparation of a Process Standard insuring that only splines of known poison value are used in meeting the total nuclear control criterion.

SPECIAL OUTAGE SERVICES OPERATION

Tool Van

The van previously used to house emergency equipment has been delivered to Special Outage Services Operation. The equipment installation in the van, necessary to provide a mobile service unit for process tube replacement, is 50 per cent complete.

Initial Tube Replacement Tooling

A full complement of the special hand tools required for tube replacement is now available.

The first complement of tooling from Central Maintenance Operation was delivered to Special Outage Services Operation December 28, on schedule.

B-C REACTOR OPERATION

OPERATING EXPERIENCE

At C Reactor the individual reactor record power level was increased 10 megawatts (2265 to 2275) on December 7; also, the resulting 24-hour average level (2274) represented an increase of 15 megawatts over the previous record.

Equilibrium power levels at C were limited by bulk outlet water temperatures during the first eight days and by nonequilibrium conditions thereafter. Nonequilibrium conditions limited power levels at B Reactor.

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EQUIPMENT EXPERIENCE

A functional test (PT IP-412-A1) of the B and C Reactors export water system was successfully made on December 15. Details will be provided in a separate report.

Thirty new tubes were installed at B Reactor to replace 22 with thin walls and eight with leaks.

Inspection of the east 107-C retention basin revealed significant splitting of the tank bottom along center seams. Minor Construction forces are currently performing necessary repair work.

At C Reactor 1,815 stainless steel connectors on the front face were replaced with Inconel connectors to eliminate the failure potential represented by substandard flaring in a majority of the steel connectors.

IMPROVEMENT EXPERIENCE

Bumper fuel element nozzles were installed on eighty B Reactor tubes and fifty additional Inconel pigtails were installed to replace J-type rear face connectors.

The final diversion box was installed in Project CGI-889 modifications of the 100-B/C effluent system.

Twenty C Reactor channels were overbored and fitted with overbore size zircaloy tubes and hardware. To date, 62 overbore size tubes have been installed; all are in operation.

The interchange of export water system pumps (Design Change No. 497) for improvement of system reliability was essentially completed; beneficial use was obtained.

RADIATION MONITORING EXPERIENCE

No personnel overexposure occurred.

Total exposure used for the 20-channel overbore work at C Reactor during December was 12,693 mr, 24.4 per cent less than total exposure experienced during the August, 1961 overbore outage. The reduction was accomplished through continued application of decontamination techniques plus an improved method for graphite chip removal.

Particulate contamination (40,000 c/m) was removed from an employee's eyebrow.

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D-DR REACTOR OPERATION

OPERATING EXPERIENCE

Equilibrium operating levels at D Reactor were limited primarily by bulk outlet water temperature. At DR Reactor the predominant limitation was tube power.

Of five shutdowns at D Reactor, one was scheduled and four were unscheduled. The unscheduled shutdowns resulted from two process tube leaks and two Panellit scrams. DR Reactor had one scheduled and three unscheduled shutdowns in addition to the process tube leak outage in progress at the beginning of December. The unscheduled shutdowns resulted from the rupture of two I&E natural slugs and a Panellit scram. An extended shutdown was begun on December 31, 1961, for block discharge and tube replacement.

At D Reactor, binding of No. 8 horizontal rod continued to adversely affect operation during startup periods.

Slight earth tremors were felt throughout 100-D Area facilities on December 10 and 11.

The addition of dichromate to process water for D and DR Reactors was reduced from 2.0 to 1.0 ppm (nominal) on December 13, based on economic considerations.

EQUIPMENT EXPERIENCE

The installation of Inconel rear face pigtails is 26 and 36 per cent complete at D and DR Reactors, respectively. Bumper nozzles have been installed on 34 per cent of the DR Reactor process tubes. Replacement of rear face thermocouples at D Reactor is 48 per cent complete.

A total of 104 process tubes was replaced at D Reactor during December.

Due to discovery of rubber expansion joint cracking in the 190-DR water pumping system, piping alignment checks were made on all pumps at 190-DR and all expansion joints in both 190-D and 190-DR were checked for cracking. Two additional (four total) cracked joints were found at 190-DR and four at 190-D. Misalignment, apparently existing since construction, was discovered at two of eight joints in 190-DR. Coupling flange spacing also appears to have contributed to the failures. X-rays indicate only superficial cracks in the rubber and that the steel reinforcing is holding satisfactorily.

IMPROVEMENT EXPERIENCE

A Beckman-Panellit intertie (Design Change 498) was completed at D Reactor. This system will improve reactor startup efficiency by allowing adjustment of Panellit system until a power level of 2 MW is reached.

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Beneficial use of the rear face crossunder piping system (Project CG-884) at DR Reactor was achieved.

RADIATION MONITORING EXPERIENCE

One lapse of radiation control occurred. This involved unplanned high exposure of a Processing employee during removal of a spline coil which had fallen onto the C work platform floor. D Reactor rear face piping was internally decontaminated; exposure reduction achieved was approximately 68 per cent.

F REACTOR OPERATION

OPERATING EXPERIENCE

Power level at F Reactor was controlled by the tube temperature limits for the major portion of the month. Graphite temperature limits were the controlling factor at month end.

The reactor was down at the start of the month and experienced three additional outages during December. One of the outages was due to excessive water collection and two resulted from Panellit scrams.

EQUIPMENT EXPERIENCE

A cycle timer was used to accurately measure the drop times on all vertical safety rods. In addition, selected measurements were made between the opening of the Panellit safety relay and 90 per cent insertion on eight rods. Measurements were also made between initial motion and 90 per cent insertion on seven rods. All but one vertical safety rod met current specifications for drop times.

The No. 27 vertical safety rod channel was partially broached during the December 6 outage. A new cable was installed and it was returned to service.

The Mercoild oil pressure switch was replaced on the 190-Annex 3-A motor to restore automatic operation under low oil pressure conditions.

Two hundred fifty-seven tubes were probologged in December. Significant items replaced during the month were: 36 process tubes and 60 regular rear connectors. In addition, 12 rear face thermocouples were repaired. Three hundred thirty-five Panellit gauges were adjusted and three Panellit gauges were replaced.

IMPROVEMENT EXPERIENCE

The 183-F pump room annunciator alarm was extended to the operator station located on the filter floor to provide an additional operating aid.

Work is in progress on installation of pressure gauges on the filter floor in the 183-F Building to aid the operator.

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One charging machine was converted to handle various types of fuel elements.

To more accurately measure the insertion time for vertical safety rods, in accordance with Process Equipment Standard D-020 (HW-41000), a cycle timer system was designed and fabricated. The system employs a cycle timer with two limit switches. The lower limit is mounted on a portable stand that holds the switch at the point of 90 per cent insertion. This is the equipment that was used to measure the drop times mentioned above.

The No. 4. Bauxite Feeder reaction chamber has been revised by replacing the lead pot and enlarging the glass top. Studies are being made to determine if temperature bulb location is critical.

RADIATION MONITORING EXPERIENCE

One lapse of radiation control was sustained in F Area during the month; however, responsibility was not charged to F Reactor Operation.

A whole body radiation count was scheduled for a Maintenance employee who incurred low level skin contamination including 400 c/m activity in his nasal passages. He had been performing routine overhaul of the process tube guillotine cutter. Contamination was readily removed.

H REACTOR OPERATION

OPERATING EXPERIENCE

Equilibrium power levels were limited by bulk outlet water temperature. The highest power level attained was 1850 MW.

Production was limited by a series of eight unscheduled outages. Four of the outages were caused by water leaks in process tubes and the remaining four by ruptured fuel elements.

EQUIPMENT EXPERIENCE

Eleven leaking process tubes were removed during the reactor outages. Five of these had internal leaks and six had rear Van Stone leaks. Eleven new tubes were installed; five to replace leaking tubes and six were placed in air channels from which thin-wall tubes had previously been removed.

Four bumpered, enriched fuel element ruptures occurred during the month. Two were classified as hole ruptures, and one as a split rupture. The other resulted from charging machine damage.

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Recurrent binding of No. 14 horizontal control rod was experienced, which, at times, prevented its being completely withdrawn from the reactor. Exercising the rod during outages helped reduce the problem, but failed to eliminate it. Investigation is underway to determine the cause of the binding. On December 12, an annunciator trip indicated low cooling water pressure on No. 13 horizontal control rod. Investigation revealed a kinked outlet water hose. The condition was corrected and the rod returned to service.

No. 42 vertical safety rod winch was removed from service because of an electrical ground in the magnetic clutch mechanism. The winch was overhauled, and the condition eliminated.

Silica gel was replaced in the No. 3 gas dryer tower. This completed the renovation to the gas dryer system.

Rebuilt 4500 hp motor stators were installed in No. 5 and No. 7 process water pumps in the 190-H Building Annex. This completes stator changes in seven of the eight pump units.

Bauxite utilization decreased from 94 per cent in November to 84 per cent in December because of outages for repairs, including the 183-H feeder floor drainage system and minor leaks in the reaction chambers. Repairs were completed, and the system returned to normal operation by the end of the month.

IMPROVEMENT EXPERIENCE

Replacement of Panellit gauges, MJA-29, "New Front Adjust Panellit Gauge", continued during the month. A total of 368 gauges has been installed to date.

Production Test IP-412-AI, "Export System Test", was completed during the month. No equipment malfunction was experienced.

New cast steel lug rings have been installed on all of the remaining original front face nozzles. An additional 500 remain to be placed on broached nozzles to complete the program.

KE-KW REACTOR OPERATION

OPERATING EXPERIENCE

Equilibrium power levels were limited by tube power based on tube corrosion control.

A new record power level of 4215 megawatts was established at KE Reactor, exceeding the previous high by 130 megawatts.

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EQUIPMENT EXPERIENCE

Inconel crossheaders and expansion loops were installed on KER Loops 3 and 4 under Project CGI-839. The N Reactor type tubes of the loops were placed on a recirculation flow following pressure testing at 4000 psi.

Four hundred twenty-two rebuilt, front adjustment Panellit gauges were installed in the two reactors. Under the change-out program, 15 rows of gauges are completed in 105-KE and 11 in 105-KW.

A front-to-rear graphite thermocouple stringer was installed in process tube channel 2871-KE under Production Test IP-465-I to obtain temperature measurements in the 0.130 coring zone of the graphite stack for correlation of graphite temperatures as a function of neutron flux.

SUPPLEMENTAL CREWS OPERATION

Sixteen additional pile operators were transferred from the various Processing Operations to the Supplemental Crews to provide improved efficiency of manpower usage.

Manager, Manufacturing

OC Schroeder:DLD:bam

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FACILITIES ENGINEERING

REACTOR MODIFICATION DESIGN

Compression and flexural test specimens of various ceramic materials being considered for use as VSR channel liners have been installed in test holes at 105-C Reactor for radiation exposure evaluation. The specimens include aluminum oxide, aluminum silicate, and silicon carbide (silicon nitride bonded).

Testing of the prototype 105-C Reactor size flexible vertical safety rod in the 195-D VSR test tower has started. Power testing of the rod has indicated that it possesses sufficient flexibility to pass through a section of VSR channel which has been distorted three inches horizontally in a six foot length. This distortion is substantially greater than any known VSR channel distortion. Drop tests of the rod in a distorted channel section are currently underway following completion of the power driven tests. The fabrication of a second flexible VSR assembly for installation in 105-C Reactor on a test basis is approximately twenty-five per cent complete.

An additional 20 process channels were overbored in the 105-C Reactor, completing the planned 40 tube fuel test facility. The process tube assemblies installed in this group of channels are of a different design and contain a number of alternate features from the equipment previously installed. These alternate designs are utilized to provide comparative evaluations of seals and other process tube assembly features. No unexpected problems or unusual difficulties were encountered during the installation of the process tube assemblies in the 20 additional channels and the performance of the equipment has been satisfactory to date.

The Type 420 stainless steel snap rings utilized in attaching the lug rings to the front and rear process tube nozzles on the previously installed overbored channels have been removed and replaced with cadmium plated steel rings. Approximately one-half of the rings which were removed from the rear face nozzles were found to have cracked from stress corrosion after approximately three months service. Purchase requisitions have been issued for both Type 302 stainless steel and Inconel snap rings for possible use as replacements for the carbon steel cadmium plated rings now being used if additional cracking problems are encountered.

Engineering studies to evaluate the costs and feasibility of alternate methods to provide substantial reduction or elimination of radioactive discharge from the reactors to the Columbia River have been initiated. The following process systems have potential application to the problem and will be studied in detail to assess their relative economic and technological feasibility.

1. Open cycle recirculation systems with effluent circulated from existing retention basins through cooling towers, cooling ponds or heat exchangers cooled by raw river water.

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2. Closed cycle recirculation systems with effluent circulated in a closed loop through heat exchangers cooled by raw river water.
3. Reactor effluent disposal through an artificial lake which would provide increased hold up time and additional radioactive decay.
4. For recirculation systems, both pressurized and non-pressurized reactor coolant loops will be considered. Pressurization would be required for recirculating systems in order to maintain existing or increase individual reactor production levels because of the increased inlet water temperature of the reactor coolant loop.

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EQUIPMENT DEVELOPMENT

VSR Channel Overhaul

Equipment is being developed to prepare 105-C Reactor vertical safety rod channels for installation of liners. Design of a thermal shield and ball guide boring machine prototype is nearly complete; test models of graphite channel enlarging tools are being fabricated; and a test mockup for installation in the 195-D test tower has been designed.

Chemical Decontamination

The rear face piping of 105-C Reactor was decontaminated with a bisulfate formulation. This is the first departure from more expensive sulfamic acid compositions and the first use of material from a competitive vendor.

Temperature Monitoring

Engineering work has started on replacement of worn-out stepping switches in the tube effluent temperature monitor systems. These will be complementary to and compatible with the analog-to-digital converter equipment being provided under CGI-939. The 105-B Reactor prototype of the latter equipment has required moderate trouble shooting during more than one year of operation.

The high-speed scanner, a 116 point partial prototype of a prospective tube temperature limit monitor, has operated a total of 9427 hours. No significant difficulty with the solid-state circuitry has been experienced in nearly a year.

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PLANT ENGINEERING

DRAFTING

Services provided during the month:

New and revised drawings	148
Layouts and sketches	79
Microfilm prints reproduced	290
Microfilm drawings voided	306
Microfilm drawings added	1518
Ozolid check prints reproduced	1053
Catalogs added to files	31
Customers serviced - Microfilm files	217
Customers serviced - Catalog files	38
BPF's and Specifications added to files	8

EQUIPMENT APPLICATION ENGINEERING

Reactor Charge and Discharge Work Platforms

The re-weighing of all reactor charge platforms has been completed except for 105-F. Work currently underway in support of general functional and safety upgrading includes the following:

1. Establishment of optimum load distribution for existing platform structure based on maximum allowable hoisting machinery capacity.
2. Examination of alternatives to permit increased loadings by redistribution of counterweight function, and truss reinforcement.
3. Negotiation of a service contract which provides for detailed functional inspection of a lead reactor area as a guide to intensified maintenance activity.
4. General review of safety features and supporting engineering to assure continued function as combined platform and manned hoisting capability.
5. Technical support of work in progress aimed at reducing platform live and dead loads.

REACTOR, PLANT ENGINEERING

Production Test IP-352-AE, Rear Face Piping Examination

Production Test IP-352-AE, authorizes removal of necessary specimens to provide for evaluation of mechanical and metallurgical integrity of rear face crossheaders and fittings at B, D, F, DR, and H Reactors.

Fabrication of the replacement crossheader for DR Reactor has been completed. All procured items for the replacement assembly have been received and the

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last received group of 3/4-inch aluminum connectors is currently being dye-checked by Hanford Laboratories Radiographic Testing Operation. Initial flow testing of the 3/4-inch connectors, matching nozzle, and header fittings has been completed with satisfactory results. Actual piping replacement is now awaiting scheduling.

WATER PLANT & UTILITIES ENGINEERING

Engineering in Support of Power Forecasting

Coordination effort was made for more extensive use of "split-month billing" of interruptible power from the Bonneville Power Administration. This procedure could not be utilized in December as peak electrical demands were obtained on the second day. Procedures are being developed which will reduce power costs in those months in which the peak demand is delayed more than five or six days from the beginning of the month.

Columbia River Studies

River flows vary daily from near 36,000 - 40,000 cfs to 105,000 - 115,000 cfs. The high flows are due to the daily drawdown of Priest Rapids reservoir to meet peak demands. Close contact is maintained with the dam operators to insure no harmful effects to HAPO. There is no spilling at any dam at this time.

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PROJECT ENGINEERING

PROJECTS

CGI-791 - Reactor Confinement

Phase III

The acceptance test on the Sample Building instrumentation has not been run. Replacement parts have been received and are being installed. All the filter frames and pallets have been received.

Pressure recording instrumentation has been installed at the 105-F Reactor Building to evaluate the variations in confinement zone pressure differentials which occur during normal reactor operating conditions. The test results obtained to date indicate that the confinement zone pressure differentials are satisfactorily maintained during normal reactor operating conditions. However, during periods of high wind velocity, relatively large zone pressure fluctuations occur within the building. It is not feasible to eliminate these fluctuations without extensive architectural renovation of the reactor buildings.

The Physical Completion Notice was issued December 15 and indicates an underrun of \$200,012.

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

Out of pile acceptance test procedures were completed for KER Loops 3 and 4. Front and rear face tubing from the loops to the in pile tubes is being installed as of December 29.

The preparation of design for Phase II of this project, the two-out-of-three trip safety circuit system, has been initiated. A Certified Design Schedule indicating a design completion date of September 1, 1962, has been prepared and is being forwarded for Atomic Energy Commission approval.

CGI-844 - 100-K Area Coolant Backup

A revised Construction Status Chart is being made to indicate revisions caused by late delivery of pipe.

The three diesels for the coolant pump have been mounted in place. 182-K Building steel framing is complete. The ditch for the line to the reactors is complete and pipe fabrication has started.

A test has been completed at the 105-KW Reactor to determine if fuel pieces would flush from a process tube supplied by an unthrottled cross-header when two low lift pumps were connected to the A and B risers. This test was to simulate a worst case spurious start of the emergency pumps being installed by this project. The results of these and other

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tests performed in the 189-D Coolant Test Facility indicate that no problems will result from spurious starts of the emergency coolant system.

Performance test results of the 182-K Building diesel driven pumps have been received from the vendor. Test data indicate that the pump and gear units require four per cent more power at the design point than allowed by specifications. Sufficient reserve horsepower is available in the diesel drives to accommodate the increased horsepower but with some reduction in system reserve coolant capabilities. The vendor has indicated that he is unable to improve the performance of these pumps.

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

All transformers at 105-B have been energized and 80 per cent of the loads have been transferred to the new switchgear.

At 105-F, two of the three transformers have been energized, three new load centers have been checked out and are ready for the loads to be transferred to them.

At 105-D, two of the three transformers have been energized and 75 per cent of the connections between the main switchgear and the motor control centers have been made.

CGI-871 - Improvements to Dummy Decontamination Facilities - 105-B, C, D, DR, F, and H Buildings

Fabrication of new bucket inverters is in progress. Installation of dummy sorting equipment is complete in all areas.

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

The raw water pumps' source of power has been transferred to the newly installed busses so that the new primary and secondary pumps may be installed without overloading the old busses. Installation of one pump set is now possible in each 100-K 190 Building.

The television camera installed in the 105-KE Reactor downcomer approach section has been used to observe the flow patterns in that section of the rear face piping. These observations have indicated that choking of the downcomer approach elbow is not occurring at present flow rates and that a stable flow pattern exists in this section of the downcomer. Flow data for correlation with the downcomer model studies currently being performed by Washington State University was obtained.

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

The final diversion box on the B effluent line was installed and modifications were made to an existing diversion box during a dual B-C shutdown. Usage of the facility is delayed awaiting report to the C west effluent basin.

CGI-904 - Improvements to Gamma Monitoring Systems, 105-B, C, D, DR, F, and H Buildings

Prefabrication and assembly work is completed for 105-C and DR. Coring of access holes from sample rooms to rear face at 105-D is in progress.

CGI-905 - Interim Modifications for Improved Coolant Backup, B, C, D, DR, F, and H Reactors

A Certified Design Schedule indicating a design completion date of May 15, 1962, has been prepared and is being forwarded for Atomic Energy Commission approval.

CGI-906 - Poison Spline Coilers - All Areas

The project Physical Completion Notice was issued December 27, 1961. Minor exceptions remain.

CGI-933 - Water Treatment Pilot Plant - 100-K Area

The Clearwell No. 1 has been painted and the coating applied to the partition wall of Clearwell No. 2. Work was started in the filter bed on December 15, 1961.

The Construction Status Chart has been forwarded to the Commission for approval.

The purchase order for the fabrication of the large settling basin tank was awarded.

CGI-939 - Analog to Digital Converter System for Temperature Monitoring, B, C, D, DR, F, and H Reactors

HOO-AEC is negotiating a contract for the six computer systems required for this project. The bid closure date is December 29, 1961.

MJA-21, 25, 29 - Pressure Monitor Modification and Repair, 105-C, KE-KW, and H Buildings

173 gages were installed at 105-KE during the period. Total gages installed are:

C	H	KE	KW	Total
652	368	565	798	2,877

AR-P-15030 - Flux Monitor-Pressure Monitor Interlock System at Reactors, 105-B, C, D, DR, F, KE and KW

The flux monitor-pressure monitor interlock system installation is complete in all areas. The remaining work consists of the "as-built" drawing revisions and minor clean-up work.

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CPFF CONSTRUCTION SERVICE CONTRACTOR-LIAISON

Issued five new work orders and supplemented eight old jobs for a total of \$90,021 to J. A. Jones Construction Company.

PLANT FORCES WORK REVIEW

The Labor Standards Board approved two jobs for assignment to plant forces, which are estimated to cost \$22,000.

PROJECT PROPOSALS

Project Proposals Submitted to AEC

CGI-889, Rev. 1 - Effluent System Modifications, 100-B/C

(Request for extension of time.)

Manager, Facilities Engineering

RT Jessen:dgm

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PROCESS DESIGN OPERATION

Research and Development

General Engineering Laboratory Technical Appraisal of the NPR Cooling System

The technical appraisal of the NPR cooling system being conducted by the General Engineering Laboratory continued throughout the month of December. Work has progressed with the detailed review of the designs of the various components of the cooling system, as well as the over-all control system. Mr. D. H. Brown of the General Engineering Laboratory and E. M. Kratz visited the Burns and Roe offices at Hempstead on December 5 to obtain design information required by GEL. Mr. Brown was primarily interested in the Burns and Roe bases for the method of controlling the secondary system, particularly after a scram, and in the level control instrumentation for the main heat exchangers. Discussions were held with Combustion Engineering at Chattanooga, Tennessee, on December 6 to obtain information on the bases for the curves of heat exchanger level as a function of feed water to steam flow ratio following a reactor scram. The Combustion Engineering development tests using the model of the NPR heat exchanger were reviewed.

NPR Conversion

All General Electric conversion data developed to date are being reviewed and updated for use in the current WPPSS studies. In addition to the updating, a review of problems associated with plant operation by two organizations has been requested. A similar study was reported in HW-64946 for a power plant operated and owned by the federal government. Other items have also been requested to be included in the study, such as plant factor effect of a second turbine-generator in the 184-N Building and various alternates of a 230 kv cross-tie line.

Project CAI-816

Velan Valve Company

Fabrication and testing problems continue on the Velan Valve order. Over 500 small valves placed on this order are utilized to isolate the many small drains and vents of the primary loop in the 109 Building. Each phase of manufacture and testing of these valves has presented problems. The current difficulties involve hydrostatic leak testing and final cleanliness requirements. The vendor has resorted to extremely high hand wheel torques in order to meet the valve leakage requirements and these tests have been run a shorter time than specified. Inspection has refused to accept these valves; however, some 30 have been shipped to N-site. Meetings have been held and attempts are being made to clarify and resolve the problems. These valves will be important during

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the critical hydrostatic tests of the primary loop in that their function is to isolate the many branch systems. Poor sealing ability of these valves could also present a major problem from a maintenance or operability standpoint.

100-N Railroad

On December 18, 1961, a letter and marked-up drawings were received from the AEC requesting study of a proposed revision to NPR railroad system estimated to save \$40,000. This proposal suggested revision of helium and two cask car tracks north of 105-N Building, the addition of new track section which crossed above three tracks to facilitate switching of tank cars to fuel oil unloading area, and the elimination of storage track north of fence and the relocation of the fence.

The above revisions were discussed with the Transportation Section on December 20 and comments were forwarded December 21. Further discussion will be necessary by the Project Representatives concerning criteria changes involved. An analysis of cost savings, which would result, is being made, along with the impact of these changes upon the planned usage of the area involved.

Flow Monitor Control

The purchase of the controller portion of the process tube flow monitor system is being negotiated with Avien, Incorporated. General Electric has participated in meetings with this vendor to resolve the difference between Avien's quoted price and the fair cost estimate. A reduction of approximately \$250,000 in the quoted price has been accomplished, which includes a reduction of the vendor's estimate of engineering costs, a curtailed component testing program (without relaxation of the reliability specified by HWS-6507), and deletion of a controller test facility.

Bailey Meter Company

Meetings were held on December 4 at Cleveland to cover significant problem areas on the Bailey Meter contract. Inspection of the Bailey-procured components is a major difficulty. Bailey, for instance, has ordered 16 30-inch steam control valves and the valve castings are now ready for inspection. Inspection has not been notified of this valve order through the normal channels and steps are being taken to correct this situation. However, many inspection problems could result from this late action.

Fuel Element Handling System

The discharged fuel and dummy elements, after striking the trampoline, fall onto the discharge conveyor. This conveyor moves the elements approximately 100 feet under water to the segregation area where the segregation equipment is located. AMF Atomic has contracted to design, fabricate and test both the discharge conveyor and the segregation equipment.

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A prototype conveyor duplicating a portion of the discharge conveyor at full size has been fabricated and tested. Minor changes were made to the baffles and the conveyor sections to improve performance. These changes were incorporated into the design of the discharge conveyor now being fabricated. The prototype conveyor has been shipped to Hanford for integrated tests with the trampoline system.

The segregation equipment, consisting of a segregation conveyor, gage stations, diverting stations, segregation table, canister loading turrets, canister storage tables, and the associated hydraulic and electrical control systems, has all been fabricated. This equipment is being assembled in Greenwich, Connecticut, for the component and system tests. Some of the dry component tests have been performed on the segregation conveyor and its diverting stations. According to AMF Atomics' schedules, the dry tests will continue through February, 1962, and the underwater system tests will extend into April, 1962.

DEVELOPMENT AND TESTING

At the end of December, 1961, development and testing was 92 per cent complete, on schedule.

Final reports were issued on the following design tests: DT-1127 - NPR Fuel Canister Functional Test; DT-1130 - NPR Inlet Nozzle Key Wear Test.

The Component Test Loop was operated for 24 hours at cold flow conditions in the performance of the fuel element spacer test. With the rear cap removed, 50 per cent of full tube flows did not move downstream dummies. Major activities during the month included the calibration of loop instrumentation for cold flow tests and installation of a 30-HP pump.

Supplemental testing of static gas seals between shield faces and nozzles was initiated as a result of spot-face misalignment problems on the shields. Additional testing has shown leakage rates up to 2 cc/minute can exist for flanges if diametrically misaligned 0.030 inches.

In the field of tooling, Design Development and Research Contracts 114 and 132 were completed. DDR-114 with the Gray Tool Company provided connector-size Grayloc flange redressing equipment. DDR-132 with the Western Gear Corporation provided an internal cut-off tool for the NPR process tube. The NPR tooling program was accelerated with development activities on eight specific tools undertaken by Equipment Development.

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FIELD ENGINEERING OPERATION

Construction

105-N and 109-N Buildings

General painting is now in progress throughout most of the 105 Building. The application of the elastomeric coatings is again underway in the inlet and outlet pipe spaces after completion of several blockouts.

The confinement seal program is continuing and it is now estimated that between 35 and 40 per cent of the Zone I seals have now been completed and satisfactorily tested.

The erection of structural steel supports for the thermal barrier in the inlet and outlet pipe spaces has been started. Work is also underway on the installation of the catwalks in the pipe spaces.

The Bay Company's efforts to flush the reactor gas piping system were unsuccessful because the available water supply was totally inadequate for flushing the sizes of pipe involved. Consequently, the large piping was mechanically cleaned after the hydrostatic testing was completed. Some additional effort may well be necessary in cleaning this system at a later date.

Work has continued on the supply ventilation systems with the major portion of Zone IV supply ductwork now installed. The sheet metal subcontractor has continued to work on correcting the deficiencies and making necessary repairs on the ducting which had been previously installed.

Work was started this month on the installation of the rupture monitor turrets. The first one that was installed received some very rough handling in the process and may be damaged. The entire turret was visibly deformed during the time it was being moved through the rod room blockouts. The turret now appears to be all right and the potential damage, if any, will only become apparent during testing. The rupture monitor heat exchangers and cabinets have been moved in position in the right side inner rod room.

The portion of the flow monitor tubing now installed was hydrostatically tested and numerous leaks were found. Tube wall cracks were found in four straight runs of tubing. Samples of this material have therefore been requested for further analysis and investigation of validity of the certifications. Cleaning procedures have now been approved for the tubing which has been installed and also for the tubing which has been returned to the factory. The cleaning and hydrostatic testing of the tubing returned to the factory will be witnessed by Off-site Inspection.

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All of the motor control centers for the 105 Building have now been received and nine of a total of 11 have been installed. Relay and terminal cabinets have been installed in the electrical and instrument equipment room for 109 Building equipment. All of the condensate, condensate booster, and turbine lube oil pumps and steam jet air ejectors have now been set in place in the 109 Building. The dump condensers have been tied into the raw water supply and drainage systems.

117-N Building

Concrete placement continued in this building through the reporting period with pouring now completed on the east and west walls. It is estimated that approximately 80 per cent of the imbedded conduit has now been installed.

181-N Building

A subcontract was awarded to J. P. Head for setting up and running the pump tests on one of the primary pumps. The installation of the 30 inch emergency raw water lines to the storage tank is now nearly completed.

182-N Building

The zero level floor slab has been completed and the structural framing for the superstructure is in progress. The piping work in this building has been started.

163-183-N Buildings

The building ventilation system has been completed and the piping of the ion exchangers has been started.

184-N Building

Three instrument and service air compressors and the air dryers have been installed and work is underway on the compressed air piping. Work is also underway on the condensate piping, deaerator piping and steam piping. The condensate pumps have been installed and the steam jet air ejector for the turbine condenser has been installed.

Outfall Structure

An 80 foot length of slab end walls has now been placed on the outlet end of the condenser-water discharge flume. The form work and re-steel is being placed for the slab from this section to the existing end of the discharge flume. The subcontractor started delivering sheet piling to the job site in preparation for the excavation of the jetty for the river effluent line.

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Underground Piping and Electrical

This work has continued throughout the month and the underground electrical ducts have now been installed to the 181-N river pump house.

Pile Erection

Installation of all the biological shielding crates has been completed with the installation of the inlet left corner crates. The boron steel thermal-plate installation has been completed on the right, left, and outlet sides of the process unit. As of this writing, six plates remain to complete the inlet.

Millwrights were absent from December 14 to the swing shift of December 27. Only a minimum number of millwrights have returned and lack of this craft is seriously affecting the work of installation of the inlet - outlet cast iron thermal-shield.

Weekly meetings are continuing on the preparation work and planning necessary for the process unit packing, now tentatively scheduled for January 22, 1962 pending the return of an adequate number of millwrights to complete necessary work.

Cleaning and pressure testing of the zirconium side to side cooling tubes has been initiated at the White Bluffs' tube shop.

Graphite Moderator

Layer 11 has been re-machined and placed on the mock-up pad for final check. It was about 70 per cent removed and palletized at the time of the millwright walk-off on December 14. A few other minor items remain to be completed before start of packing which will be delayed until at least January 22 pending return of millwrights.

Zirconium Process Tubes

Of the 1,048 process tubes on plant, 975 have been accepted as complete, 41 have been rejected as not meeting specifications, and 32 are in process.

Eleven tubes were received from Harvey Aluminum on December 18, 1961. This shipment included six new tubes and five tubes which had previously been returned to Harvey for repair. The six new tubes completes the minimum requirements of the Harvey production order; however, Harvey has advised that they intend to ship the eight additional tubes allowed under the purchase contract.

Nine tubes were returned to Harvey December 28. This included three Harvey production order tubes returned for repair and six tubes produced by Allegheny-Ludlum Steel Corporation. The Allegheny tubes are being sent for possible repair of localized thin walls by Harvey's induction heating method.

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Administration

The following material has been issued during the period of November 27, 1961, through December 24, 1961:

Drawings	141
Criteria	1
Specifications	8
Requisitions	82
ATP's	2
Other	18
Total	252

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

Drawings	6
Specifications	0
Scope	0
ATP's	0
Total	6

Bailey Meter material process as of December 24, 1961, is as follows:

Released as Noted for Fabrication drawings	21
Released for Comments drawings	43
Released for Fabrication drawings	12
Total	76

PRIMARY PIPING

HUICO work in the field was terminated effective December 16, 1961, at the direction of Kaiser Engineers. Work in the HUICO shop has been at a very low level. Pipe shipped to the field now totals 56.7 tons. Shipments of pipe to HUICO from suppliers now total 830.9 tons, of which 261.7 tons are high pressure piping.

Following is the status of approval data for the HUICO subcontract as of the end of December, 1961:

Total Number Received	1967 (include 1255 received for information only)
Number Approved	560
Number Approved With Exceptions	38
Number Not Approved	38
Number Currently Being Reviewed	76
Number Received for Information Only -	1255
No Approval Required	

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PROGRAM EVALUATION

Design Status

	<u>Wt'd Total</u>	<u>Certified Schedule</u>	<u>Actual % Complete</u>
<u>Reactor Plant as of 1/1/62</u>			
<u>Title I</u>			
Scope		100	100 (1)
<u>Title II</u>			
Drawings	70	94.0	93.5 (2)
Specifications	8	100.0	97.2
Requisitions	8	90.5	86.0
ATP's	4	70.0	39.9
Development and Testing	<u>10</u>	<u>89.5</u>	<u>92.0</u>
Total	100	92.0	91.0

Heat Dissipation Plant as of 1/1/62

<u>Title I</u>			
Scope		100	98.8
<u>Title II</u>			
Detail Design		98.0	93.5
	<u>Req'd</u>	<u>No. Issued to 12/23/61</u>	<u>Scheduled</u> <u>Actual</u>
Preliminary Drawings (bid)	1199	1029	1026
Detail Drawings (for const.)	1199	1008	1007
Specifications (bid)	168	165	164
Requisitions	182	178	178
ATP's	13	5	0

Composite Design Completion as of 1/1/62
(Reactor and Heat Dissipation Combined)

	<u>Certified Schedule</u>	<u>Actual % Complete</u>
Total	95.5	93.1

- (1) This percentage represents only the completion of 44 criteria and does not include updating or revising.
- (2) The number of required drawings is changed from 2494 to 2501.

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Cost Estimate

During December 1961, Kaiser Engineers issued the 11/22/61 "NPR Project Interim Over-all Cost Estimate," totaling \$165 million.

Schedules

The construction status as of 1/1/62, based on the Preliminary Revision # 3 to the AEC Construction Schedule, dated October 26, 1961, is as follows:

	<u>Scheduled</u>	<u>Actual</u>
Temporary Construction	66	66
General Area Systems	47	46
105-N Building	58	30
109-N Heat Exchanger Building	41	39
163N-183N Water Treatment Facilities	92	88
181-N River Water Pump House	99	99
182-N High Lift Pump House	61 *	52
184-N Standby Power House	81	71
NPR Project (CAI-816)	55 *	39.3

* A Kaiser Engineers' figure and not in accordance with Preliminary Revision # 3 to the AEC Construction Schedule, which shows a scheduled 43 per cent complete for the 182-N High Lift Pump House and a scheduled 54 per cent complete for the NPR Project (CAI-816).

Manager, NPR Project

JS McMahon:mf

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SIGNIFICANT REPORTS ISSUED

<u>Number</u>	<u>Class'n.</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-71945	Unclass.	NF Fifer M Smith	12/5/61	PT IP-431-A, Supplement A Expansion of Overbore Test Facilities C Reactor
HW-71939	Unclass.	LM Keene MH Schack	12/5/61	Report of Testing Production Test IP-495-AM Project CGI-883 Proof Test 190-K High Lift Pump Impeller
HW-71991	Unclass.	GL Erickson	12/11/61	DT-1118 - Final Report, Differential Alarm Modules
HW-71915	Unclass.	GL Erickson	12/4/61	DT-1119 - Final Report, Count Rate Circuit Modules
--	Unclass.	AJ Lindsay	11/14/61	DT-1105 - Final Report, Proto- type Flow Monitor for Graphite Flow Monitor Systems
HW-72087	Unclass.	HF Jensen CJ Sandwith	12/27/61	PT Authorization IP-471-AE, Reactor Test of Van Stone Seal Insert Modifications
HW-71987	Unclass.	RK Smith	12/11/61	Design Test 1130 - NPR Inlet Nozzle Key Test Report
HW-72053	Unclass.	FR Standley	12/18/61	Nozzle Reinforcing Sleeve Tests
HW-70709 Sup. 1	Unclass.	WEB Lander	12/11/61	Design Test 1127 - NPR Fuel Canister Functional Test Supplemental Report
HW-71746	Unclass.	RL Jeffery	11/21/61	Methods of and Rotational Energized Cutters Used in Graphite Relief Drilling
HW-72129	Secret	CE Frantz	12/20/61	Sleeve and Shuttle Valve for Reactor Charging Machine
--	Unclass.	KP Wilkins	11/27/61	Interim Report - Development of a Rolled Centering Flange Adap- ter Joint (Overbored Reactors)
HW-72044	Unclass.	PH Hutton	12/15/61	Design Change No. 527, Installa- tion of 5/8 Inch Inconel Connec- tors on C Reactor Front Face

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HW-72179

Number	Class'n.	Author	Date	Title
HW-72027	Unclass.	HC Copeland	12/1/61	Completion Report for Development Test IP-254-E, Panellit Surge Suppressor Evaluation at 105-KW
--	Unclass.	WJ Love	12/4/61	Trip Report - ASME Annual Meeting, New York City, November 28-29, 1961
--	Unclass.	WJ Love	12/7/61	Analysis of Gas Filled Surge Accumulator Adjacent to a Suddenly Closed Valve
--	Unclass.	WJ Love	12/29/61	Load, Distortion, Stress Relations for Circular Retaining Rings
HW-71137 RD2	Unclass.	WD Bainard	11/30/61	Protection and Cleaning of NPR Water and Steam Piping Systems Prior to Operation
HW-71928	Conf.	GE Wade CW Ward	12/1/61	Rupture Monitor Sample Line Flows
HW-71929	Unclass.	WD Bainard	12/5/61	Proposal for Final Disposal of NPR Chemical Waste
HW-71989	Unclass.	GE Wade	12/4/61	NPR Confinement Steam Vent Test

TRIPS

Name	Firm & Location	Date	Purpose
JH Brown	Washington, D.C.	12/5-9/61	Confer with ACRS regarding reactor confinement
CJ Sandwith	Lamson Products Co. Seattle, Wn.	12/20-22/61	Discuss fabrication & expedite material procurement
LM Keene MH Schack	R. L. Albrook Hydraulic Laboratory Pullman, Wash.	12/12-28/61	Observe 105-K Downcomer Model Testing
E Hollister	GE - MSVD Philadelphia, Pa.	11/30- 12/1/61	Appointment for Interview

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EW-72173

Name	Firm & Location	Date	Purpose
WR Moon	GE - APED, San Jose GE - MSVD, Vandenburg California	11/1-3/61	Appointment for interviews
RR Cone	Lionel Electrics Brooklyn, New York	11/30- 12/7/61	Discuss ion chamber technology and existing ion chamber order
	E. I. DuPont Savannah River Plant South Carolina		Discuss reactor nuclear instru- mentation with respect to design, maintenance, construc- tion, and operating experience
JP Corley	R. L. Albrook Hydraulic Laboratory Pullman, Wash.	12/1/61	To review progress and de- tailed plans for current model tests under Contract DDR-131
VG Blanchette	Bonneville Power Administration Walla Walla, Wash.	12/21/61	To attend BPA customer mtg. relative to future electric power use and availability to IPD
A McDonald	Westinghouse Corp. Philadelphia, Pa.	12/12-15/61	To discuss uprating of Westinghouse turbines
	DeLaval Steam Turbine Co., Trenton, N. J.		To evaluate technical prob- lems encountered in the repair of DeLaval pumps
RC Morehardt	GE - DeKalb, Illinois, 12/3-5/61 and Burlington, Vermont		To interview for transfer
JM Fox, Jr.	ACRS Washington, D.C.	12/6/61	Discuss NPR piping metallurgy
	Phillips Petroleum Co. 12/18/61 SPERT III Site Idaho Falls, Idaho		Discuss metallurgy of materials in SPERT III pressurizer vessel
TR Riggins	Western Piping & Engrg. 12/12-13/61 Co., San Francisco, California		To assist vendor inspection in determining acceptance of graphite cooling system piping purchased on KE 9100, and to resolve design questions and fabrication difficulties
JE Stice	Todd Shipyards and Bumstead & Wolford Seattle, Washington	12/19-20/61	To discuss the limitations on access and work areas, in connection with elevator installation during the unit packing period

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Name	Firm & Location	Date	Purpose
WW McIntosh	ACRS Meeting Washington, D.C.	12/7/61	Presentation on primary loop fabrication problems
	Ladish Company Cudahy, Wisconsin	12/8/61 & 12/18-19/61	Meetings on metallurgical and fabrication problems
	GE - X-Ray Depart. Milwaukee, Wisconsin	12/19/61	Meetings on selection of equip- ment and techniques applicable to detecting small flaws in longitudinal pipe
	Taylor Forge & Pipe Works, Chicago, Ill.	12/20/61	Meeting on pipe fabrication quality requirements
JW Helton	Ladish Company Cudahy, Wisconsin	12/6-11/61 & 12/13-20/61	Provide technical liaison to NPR pipe vendor
	Taylor Forge & Pipe Works, Chicago, Ill.	12/12/61	Provide technical liaison to NPR piping vendor
DR Resner	Ladish Company Cudahy, Wisconsin	12/26-31/61	Provide technical liaison to NPR piping vendor
GL Swezea	Bailey Meter Co. Cleveland, Ohio	12/4/61	Discuss status of 109 instru- mentation and control system
	Burns & Roe, Inc. Hempstead, N. Y.	12/5/61	Attend 109 Instrumentation Task Force meeting
	Stromberg Carlson Rochester, N. Y.	12/6/61	Review status of order for instrument control panels
	BIF Industries Providence, R. I.	12/7/61	Review progress of heat treat- ment test program
	Englehard Industries Newark, New Jersey	12/8/61	Discuss clamp-on resistance temperature detectors
GA Newell	Premier Gear Portland, Oregon	12/12/61	Discuss design and fabrication problems on horizontal rod drive
JF Nesbitt	PEL Engineering Los Angeles, Calif.	12/4/61	Review ball system trip mechanism fabrication
	Todd Shipyards Seattle, Washington	12/12/61	Witness tests on shielding doors
	AMF Atomics Greenwich, Connecticut	12/13-14/61	Witness tests and evaluate fabrication status of under- water metal handling equipment

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Name	Firm & Location	Date	Purpose
RS Bell	Univ. of Wyoming Laramie, Wyoming	12/6-8/61	Recruit candidates for the Manufacturing Training Program
<u>VISITORS</u>			
RO Brugge	GE-APED San Jose, Calif.	12/11/61	Discuss reactor startup problems
L Harvey GA Moudry	Harvey Aluminum Co. Torrance, Calif.	12/11/61	Discuss NPR process tubes & NPR Zr tube & fuel components
BO Buckland	General Electric Schenectady, N. Y.	12/13-15/61	Attend meeting of Hanford Production Reactors Subcouncil of the GETHC regarding NPR design
FW Mezger	General Electric Cincinnati, Ohio	"	" " " "
WR Kanne RB Richards	GE-APED San Jose, Calif.	"	" " " "
JA Gilkey	Ratron, Inc. Van Nuys, Calif.	12/18-21/61	Discuss reactor gas analysis instrumentation
D Tuel DR Kelley J Schneider	Wyandotte Chem. Corp. Wyandotte, Michigan	12/8-11/61	To observe and consult with GE personnel about chemical decon- tamination
CG Kanen F Leins	Dage TV Division Thompson Ramo Wooldridge Corp., Salt Lake City, Utah	11/27/61	To discuss new closed circuit TV system
LI Kennedy	Gardner Denver Co. Seattle, Wash.	12/15/61	To discuss air tools and equip- ment
CC Lomax	A.L. Albrook Hydraulic Laboratory Pullman, Wash.	12/5/61	To provide consultation on engineering Contract DDR-131
WL Shannon	Shannon & Wilson Consultants Seattle, Wash.	12/8/61	To provide consultation on disaster planning problems
EO Bergman	Private Consultant San Marino, Calif.	12/1/61	Attend ACRS Subcommittee meeting
EF Potter	Large Steam Turbine General Electric Company Schenectady, New York	12/1/61	Attend ACRS Subcommittee meeting

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Name	Firm & Location	Date	Purpose
H Hart R Winship R Perry	National Tube Div. of U. S. Steel Ellwood City, Penn.	12/5/61	Discuss NPR connector tubing test results and to show them test data
JO Eberhard	EANCO, Inc. Philadelphia, Penn.	12/5/61	Discuss supplemental technical information regarding travelling wire flux mapping system.
TA Russell CL Pon AH Lawson	Burns & Roe Co. Richland, Wash. (Resident Engrs.)	12/1/61	Tour of 190-B and 190-C Bldgs.