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MONTHLY RECORD REPORT

71192

IRRADIATION PROCESSING DEPARTMENT

DECEMBER, 1958

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IRRADIATION PROCESSING DEPARTMENT
MONTHLY RECORD REPORT
DECEMBER, 1958
SUMMARY

RESEARCH AND ENGINEERING OPERATION

Two failures of depleted uranium fuel occurred bringing the total number of failures under PT, IP-132-AC to eleven. A status report, HW-58405, on the test was issued.

The initial test of self-supported fuel elements was discharged from B Reactor and three tubes of I and E self-supported elements charged. Visual examination of the discharged elements indicated there were no hot spots.

Designs for two-piece and three-piece cylindrical NPR fuel elements were developed to study the effect on operating characteristics and increasing the surface-to-volume ratio. A reduction of maximum heat flux over present reference designs was of particular interest.

The very small ID tube for NPR tube geometry fuel elements was successfully extruded by Nuclear Metals, Inc., indicating the tube-tube concept is feasible from a fabrication standpoint.

An eight-foot, wire wrapped, seven-rod cluster element assembly was discharged from KER Loop 2. It was accomplished without difficulty and the wire wrapped support system had sustained no damage.

The correlation of the exponential and PCTR measurements for cluster lattices was completed and will be summarized in document HW-58678.

PRODUCTION AND REACTOR OPERATION

Reactor input production for December represents a new high exceeding the previous record of June, 1958, by 0.5 percent. December's production was 10.0 percent above forecast; 20.2 percent above at the six old reactors and 4.2 percent below at the K Reactors. Production records were achieved at B, F, and H Reactors with F having the highest production ever attained by one of the six old reactors.

A new maximum power level (combined total for all reactors) was achieved, exceeding the previous record by 15 units. Seven of the eight reactors (KW being the exception) operated on ACRS limits at some time during the month.

Overall time operated efficiency, 87.2 percent, was the highest achieved during the operation of eight reactors. Forecast was exceeded by 7.2 percent with an efficiency of 88.8 percent at the six old reactors and 82.5 percent at the K Reactors. A 100 percent efficiency was achieved at both the F and H Reactors. Thirty reactor outages of which 15 were scrams occurred during December.

Ten ruptures were removed from the reactors during December. Three of these ruptures were solid enriched, two were I and E enriched, two were solid regular metal, two were I and E regular metal and one was I and E depleted metal.

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of these ruptures, three solid enriched and one solid regular metal, were apparently caused by a heat cycle during a start-up at DR Reactor.

Significant items of equipment experience were:

1. Ninety-six process tubes were installed.
2. Six water leaks, four tube and two Van Stone, were corrected.
3. The replacement of DR Reactor tube outlet thermocouples was completed.
4. A complete electrical power failure test was conducted at D and DR on December 16. Equipment operated essentially as expected under the test conditions.
5. A holding coil failed on an electric fuel oil pump at 165-KW, December 12. The recently-installed steam driven oil pump picked up the load avoiding the loss of boiler fires.

There were no disabling injuries or technical radiation over exposures. One security violation was incurred.

Processing, power and radiation protection statistics for individual reactor areas are tabulated on pages Ch-1 through Ch-6 of this report.

FACILITIES ENGINEERING OPERATION

The Expansion Design Council and the reactor plant and the heat conversion plant project representatives met regularly during the month. Scope matters relating to cooling water back-up systems, telephone and electric power tie-ins, construction fire protection, schedule of criteria preparation, steam back-up system and pile face nozzle arrangements were considered and acted upon.

Planning for NPR construction and for procurement of zirconium process tubes and graphite moderator continued. Studies were made of maintenance requirements of existing installations to assist in planning for NPR equipment installations.

The design effort on the New Production Reactor is finally being focused on a single set of ground rules and objectives. Design criteria are being considered for approval by the project representatives and the Design Council.

Work on the long-range existing reactor production capacity expansion continued and included progress on the design of a pump test facility.

Detail and scope design of the existing reactor confinement systems are receiving maximum effort possible. Detail design of the first phase is 47 percent complete.

Twenty-six uranium columns were discharged and charged at C Reactor while operating using charge-discharge-while-operating equipment.

Use of poison splines for equilibrium control was started at KW Reactor. Traveling wire and gamma chamber incore flux monitoring prototypes are being fabricated.

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Improvements in front-face material handling systems have been proposed.

Test data from the 105-DR downcomer experiment are now sufficient to prepare recommendations for downcomer alterations.

Advance power forecasts covering Fiscal Years 1959, 1960, and 1961 and involving an extension of our financial commitment to Fiscal Year 1960, have been transmitted to Utilities Operation, Relations and Utilities.

The results of an initial series of 4,500 HP pump inspections indicate that minor maintenance to take care of loose spacer rings and corona discharge will be required on a periodic basis.

Studies of coal purchasing standards indicate that our proposal to use total available heat with a moisture penalty as a payment basis is in keeping with general utility practices.

Testing of the gas-lubricated compressors for the Recirculating Gas-Cooled Test Loop is nearing completion, with the helium elements proved satisfactory and the nitrogen pumping on the final fifty-hour run. Revisions will be required to the diaphragm compressors to make them adequate for the load when pumping helium.

The DeLaval Company proposal for correction of the 190 Building process pump inadequacies was accepted with minor revisions and has been returned for their acceptance.

Procurement of engineered materials for the Pump Test Stand has been started.

The Ball 3X system under-pile trough has been removed from beneath 105-C Pile. This will facilitate the removal of the remaining ball valves.

EMPLOYEE RELATIONS OPERATION

Exempt personnel placement activities continued at a high level with efforts being continued toward locating an experienced Nuclear Instrument Development Engineer. To date, two qualified candidates have been contacted for this position through the Engineering Register. Transfer activities are also continuing at a high rate.

An Industrial Engineering Study, evaluating future duplicating needs in 101-P and 100-B, was completed this month. The study results will be used in determining whether duplicating facilities should be established in these two locations during CY 1959.

Mass communication activities included publication of eight Management News Bulletins, one Round Table Guide, three Memos from the General Manager, one CPM and five Advises; plus 179 column inches in the GE NEWS. Two Management Information Meetings were held during December.

Eighteen of the twenty-seven grievances received during the report period were on the subjects of jurisdiction and overtime. One non-unit grievance was received and settled satisfactorily at Step I.

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A Labor Management Relations course was presented to fifteen IPB exempt employees.

The HOO-AEC Labor Standards Board approved eight jobs for assignment to plant forces. Since this procedure for obtaining LSB approval was initiated in the Department, 112 jobs have been approved.

A new appraisal guide and appraisal form were issued and salary review plans for 1959 were officially launched.

All eligible employees were contacted for possible sign-up or revocation in the Savings and Security Program. The Department had a 95.2 percent participation as of December 15, 1958.

Thirty-three Suggestion Awards have been approved for payment this month; bringing the total award payments to \$21,532 for CY 1958. Of this sum, \$5,596 was chargeable to prior year's funds.

Safety representatives from all departments are meeting with Stores representatives on a monthly basis to discuss the current inventory of safety equipment, re-ordering and new purchasing procedures.

100-K Areas completed four consecutive years without a disabling injury.

The Fire Department responded to no fires in December.

A complete training course for new members and a refresher course for old members of the Rescue Crew was completed December 26, 1958, bringing the total number of instruction hours to 232.

FINANCIAL OPERATION

The quarterly custodial inventory of Precious Metals and Special Materials was taken as of December 31, 1958.

Discussions were held with Contract Accounting and the AEC Budget Division on implications of the revised financial plan received in December.

Current and historical maintenance cost information was prepared for T. M. Clement, Facilities Engineering Operation to be used in an article he is preparing for publication. Assistance was also given P. C. Cabell, of FEO on more detailed maintenance cost information.

W-1 forms reporting employees' 1958 earnings were delivered on January 9.

A report of the audit of the records and procedures pertaining to the accounting for special irradiation services for off-site customers was issued.

Cash fund maintained by Personnel Accounting for travel and salary advances was audited on December, 1958, and transactions since the last count were reviewed.

A revision was prepared of the Department's advice on forms control.

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IRRADIATION PROCESSING DEPARTMENT
MONTHLY REPORT OF INVENTIONS OR DISCOVERIES
DECEMBER, 1958

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, notebooks, records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

<u>Name</u>	<u>Title</u>
J. W. McLaughlin	Slip Joint Pigtail - H-1-11196, and Pigtail Adapter - H-1-11197. Wye Fitting for Slip Joint Pigtail, sketch on 9-2-58, Drawings H-1-111495 through H-1-111498. Breach Lock Ball Valve Rear Face Nozzle, sketch on 7-7-58. Redesigning of One-Fourth Inch Control Spool on Old Area Charging Machine, Drawing BPF-9198. 105-KF and KW Rear-Face Slip Joint Pigtail and Adapter, sketch on 6-1-58.
C. D. Emmons	Vertical Rod Drive Mechanism, November 17, 1958

General Manager
IRRADIATION PROCESSING DEPARTMENT

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RESEARCH AND ENGINEERING OPERATION

DECEMBER 1958

VISITORS AND BUSINESS TRIPS

Dr. K. W. Newman of Turco Products, Inc., Los Angeles, California, visited HAPO for decontamination discussions, 12/2/58.

E. C. Wood visited GE -- APED, San Jose, California to attend a conference on UO₂dioxide and discussions on fuel element problems, 12/2-5/58.

O. E. Adams visited at the Enrico Fermi Reactor at Monroe, Michigan and the University of Michigan Research Reactor at Ann Arbor, Michigan. He also attended the American Standards Association Meeting at Detroit, Michigan, and visited Atomic Energy of Canada, Ltd., Chalk River, Canada, to discuss zirconium process tubes, 12/6-14/58.

O. H. Greager visited at the Enrico Fermi Reactor at Monroe, Michigan, and the University of Michigan Research Reactor at Ann Arbor, Michigan, attended the meeting of the American Standards Association Sub-Committee 7 at Detroit, Michigan, visited AEC-Washington, D.C., for conferences on reactor safety, and also attended the information meeting at G.E., Crotonville, New York, 12/7-17/58.

C. R. Richey attended the ANS Meeting at Detroit, Michigan, and visited Atomic Energy of Canada, Ltd. to confer on reactor calculations, 12/7-14/58.

H. E. Book visited Vallecitos Atomic Laboratory, Pleasanton, California for an employment interview, 12/7-9/58.

D. H. Curtiss visited Reynolds Aluminum Company, Phoenix, Arizona, and Harvey Aluminum Company, Torrance, California, in regard to process tube procurement, 12/14-17/58.

ORGANIZATION AND PERSONNEL

	<u>*Permanent</u>		<u>Rotational</u>	
	<u>Nov.</u>	<u>Dec.</u>	<u>Nov.</u>	<u>Dec.</u>
Management and Administration	5	5	-	-
Process & Reactor Development	42	42	4	4
Process Technology	38	37	3	1
Operational Physics	18	19	3	3
Irradiation Testing	21	21	1	1
Component Testing	18	17	0	1
Coolant Testing	25	26	1	0
	167	167	12	10

* Includes one engineer on loan

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ORGANIZATION AND PERSONNEL (Cont'd)

Process & Reactor Development: Dorothy G. Murray, Secretary, was reactivated, 12/1/58. W. E. Niemuth, Engineer I, transferred to ANPD, Cincinnati, O., 12/5/58.

Process Technology: J. H. Gerety, Engineer II, resigned, 12/19/58.

Operational Physics: W. L. Smalley, Engineer I, transferred from D-DR Reactor Operation, IPD, 12/1/58.

Component Testing: Eleanor A. Webster, General Clerk, transferred to F Reactor Operation, IPD, 12/15/58.

Coolant Testing: Martha U. Sodorff, Secretary, transferred from B & C Reactor Operation, IPD, 12/15/58. J. C. Crume, Engineering Assistant, transferred from B & C Reactor Operation, IPD, 12/22/58. Barbara W. Collins, Secretary, was granted a Leave of Absence, 12/26/58.

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PROCESS AND REACTOR DEVELOPMENT OPERATION

Reactor Fuels

Present Reactor Fuels Technology

Projection Fuel Element Testing

Two columns of self-supported fuel elements were discharged from 105-B Reactor during December. These elements had operated under heat fluxes in excess of those expected for the annular surface of I & E fuel elements. Preliminary visual examination of the elements indicated no hot spots present; however, the size of the test would not make zero incidence unlikely. Examination of the elements and evaluation of the operating data are continuing.

Three charges of I & E self-supported elements were charged at the B Reactor during December. Heat split data from thermocouple probes were not available to evaluate the operating conditions, and probes will be installed during the next B-Reactor outage.

Depleted Fuel Element Failures

Two additional failures have occurred under PT IP-132-AC in the depleted metal under irradiation at the C-Reactor. Eleven failures have occurred to date under this test. A status report (HW-58405) was prepared indicating the probability of meeting the original goal. A decision has been made to continue the irradiation of the remaining charges.

Direct Cast Uranium Fuel Cores

Twelve columns of double Beta heat treated, direct cast uranium fuel cores were charged at C-Reactor under PT IP-93-A-93-FP to evaluate the dimensional stability of fuel elements prepared in this manner.

NPR and Advanced Reactor Fuels Technology

NPR Fuel Element Design

Heat generation data were calculated for several cylindrical NPR fuel designs. From these data 2-piece and 3-piece cylindrical element designs were developed to study the effect on operating characteristics and costs of increasing the surface-to-volume ratio. A reduction of maximum heat flux over present reference designs was of particular interest. A 30% decrease in heat flux is possible by variation in the design of the 2-piece concentric tube element or by using 3-piece concentric elements. The 2-piece element requires that the flow be restricted to the center hole of the inner piece in order to obtain the desired power-flow ratio. This reduction in heat flux, when obtained by dividing the element into three parts, is obtained at about 22% less pressure drop than with the 2-piece element.

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Preliminary physics data have been developed which indicate that it is desirable to design an element with 22-24 pounds of uranium per foot to obtain the most favorable operation of the reactor. With this restraint and consideration of expected pressure drop-flow restriction it appears that subdividing the fuel into more than three concentric parts, or into more than about seven rods in a cluster is not practical. Thus the lowest maximum heat flux that may be obtained in NPR fuel element concepts in a reactor operating at 4000 MW and under conditions which specify no flow or temperature maladjustments is about 550,000 Btu/hr-ft².

Co-Extrusion Development at Nuclear Metals, Inc.

Two shipments of co-extruded fuel material were received during the month, consisting of approximately thirty feet of rod for the rod-tube elements, ten feet of tube for either rod-tube or tube-tube elements, and five feet of small tube for tube-tube elements. These were all of the KER dimensions, and with the exception of ten feet of the rod were 2 w/o Zr alloy. The most significant fact of these fabrications was the successful extrusion of the small I.D. tube for the tube geometry. There had been some concern about the feasibility of extruding this extremely small I.D. tubing. This indicates that the tube-tube concept should be feasible from the fabrication standpoint. The above material is being assembled into fuel elements for irradiation. The first tube-tube element will be irradiated in the ETR-6x9 facility at Idaho Falls. Fabrication of full size NPR prototype elements will begin following receipt of tools now on order.

KER Irradiations

Examination of the aluminum jacketed Doe elements discharged as a failure from KER Loop 2, PT IP-190-A on November 17, 1958, failed to disclose the failure region on any of the fuel elements. None of the elements suffered appreciable weight loss.

The eight-foot long, wire wrapped, seven-rod cluster element assembly was discharged from KER Loop 2 on December 9. The assembly was discharged without difficulty and had sustained no damage to the wire wrapped support system.

Enriched Zr-2 jacketed seven-rod cluster elements were charged into KER Loop 2, under PT IP-214-A, on December 9. The exposure goal for these elements is 350 MWD/T.

Reactor Physics

Present Reactor Physics Technology

Pu-240 Program

Laboratory analyses were made of depleted fuel elements from tube 2079C for comparison of Pu-240 content with predicted values. The results were inconsistent, and are probably due to errors in sample identification. Four samples from a second tube, 3590C, are being analyzed and greater care is being given to sample identification.

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TABLE I
PRODUCTION TESTS - FUEL DEVELOPMENT

<u>Test Number</u>	<u>Type Metal</u>	<u>Tubes</u>	<u>Reactor</u>	<u>Goal Exposure</u>	<u>Current Exposure</u>	<u>Remarks</u>
IP-56-A	Low Hydrogen Dingot U Elements	58	D, DR, F, C	Variable		Semi-production scale testing of low hydrogen dingot uranium fuel, solid and I & E
IP-81-A	BNTL Regular	310	D	Variable 500		Provide for quantity charging of BNTL elements. (Solid)
IP-84-A	Projection I & E Nat. Elements	3	B	200,400 & 600 MWD/T	50	Preliminary evaluation of self- supported fuel elements. Process modifications permitted resumption of test.
IP-95-A	Lead Dip, 1.445"	4	D	800 MWD/T	500	Provides for preliminary testing of I & E elements in D-Reactor.
IP-123-A	7-Rod S.S. Jacketed 1.3% enriched clusters	1	KE	3500 MWD/T	3200 MWD/T	Charged 5-6-58 in KE front-to- rear test hole. Fuel elements are instrumented to measure uranium temperatures.
IP-146-A	Co-extruded Zr-2 jacketed 7-rod clusters Nat. Ur.	1	KE	1000	850 MWD/T	Charged in KER Loop 1, August 5.
IP-168-A	1.460" O.D. Natural I & E	9	C	Variable 800		Long term corrosion monitoring & refinement of operating limits.
IP-171-A	Solid M-388 & 1245 Clad Elements	12	B, DR, F	Variable 500	300	Provide for evaluation of alternate aluminum component vendors. Control columns are only ones carried special. Rest are lot charged.
IP-178-A	1.474" O.D. I & E Nat.	6	KE, KW	Variable 800		Provides for irradiation testing of KIII elements, water mixers, and long term tube corrosion monitoring.

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TABLE I (cont'd)

Test Number	Type Metal	Tubes	Reactor	Goal Exposure	Current Exposure	Remarks
IP-179-A	Olin geometry, 45 sec. delay quenched nat. uranium.	16	C	Variable 800	150	Provides for testing to optimize heat treatment of I & E fuel elements.
IP-186-A	Zr-2 jacketed 3-rod cluster elements 2 and 3 ft. long.	1	KE	1000-1200		Discharged Dec. 28, 1958 at 1300 MWD/T.
IP-205-A	Zr-2 jacketed Rod-and-Tube elements.	1	KE	2500	380 MWD/T	Charged Nov. 18, 1958 in KER Loop 4.
IP-213-A	Eight-foot wire-wrapped stainless steel jacketed cluster element.	1	KE	1 operating period		Discharged Dec. 9, 1958.
IP-214-A	Zircaloy jacketed 1.6% Enriched 7-Rod Cluster elements & a 3-foot, 3-rod, Zr-2 jacketed 1.6% enriched integral end closed cluster element	1	KE	3500	300	Charged in KER Loop 2 Dec. 9, 1958.
IP-221-A	Zr-2 jacketed natural uranium 7-rod cluster elements.	1	KE	2 weeks equilibrium operation	6 days equilibrium operation	Charged in KER Loop 3 on Dec. 29, 1958. Test is instrumented to measure flow channel temperatures in seven-rod cluster elements.

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Transmutation Tables and Equations

The relative conversion rates and associated constants utilized in the buildup equations have been determined theoretically and normalized to experimental data for natural and enriched slugs. The calculated constants are available for all fuel element dimensions normally used in the Hanford reactors.

Isotope Accountability for Nuclear Power Reactors

Studies are being conducted for CPD to evaluate improved methods of calculating isotope build-up necessary for an accurate accountability of uranium and plutonium in spent fuel elements shipped by power reactor operators to Hanford for chemical reprocessing. A first step in the study was a visit to the AECL Site at Chalk River to discuss methods of calculating long term isotope buildup.

Irradiations have been made in the NRX reactor in excess of 6000 MWD/T for natural uranium. Detailed studies of this fuel have included chemical and isotopic analysis and reactivity changes. Although the measurements have not yet been completed for the most highly irradiated material, they have provided accurate values for the prediction of the neutron balance in irradiated uranium up to 8000 MWD/T. This work will be followed closely in application to the problem of determining the uncertainties in predicting plutonium production and uranium burnout for power reactor fuels processed at Hanford.

Three Dimensional Flux Calculations

The theory for the one-dimensional, one-group problem has been completed and hand checked. The equations have been put into FORTRAN and will be submitted for computation upon availability of the 709 computer. The extension of this program to the three-dimensional case appears to be mathematically simple, and will be studied further.

Effect of Impurities in Uranium

The effect of several elements present as impurities in uranium on pile reactivity and conversion efficiency was assessed for FPD. The calculations have been completed and are available. These calculations take into account epithermal absorptions (i.e., Westcott cross sections were employed) which make the poisoning effect of some of the elements, particularly thorium and some of the rare earths which have pronounced epithermal resonances, much greater than previously calculated based on thermal cross sections alone.

NPR and Advanced Reactor Physics Technology

NPR Control

A recommendation that the minimum NPR control capacity be 65 mk was submitted to Design. The recommendation was based on the following physics aspects: 1) adequate cycling control and flux shaping ability, 2) short minimum downtime, 3) adequate scram recovery time, and 4) total

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control. A further recommendation was also made that a means of fine control be incorporated in the rods located in the longitudinal fringes. This would permit the control of axial oscillations without upsetting the radial flux equilibrium.

Fuel Element Rupture Detection System

Arrangements are being made to include fuel rupture and radiation detection test equipment in the ETR 3 X 3 fuel test loop. This equipment will be used in conjunction with the fuel testing program, and will consist of 1) a re-entry water sample line in the loop for NPR fuel rupture detection analysis, 2) radiation detection instrumentation in the 3 X 3 facility pumproom to monitor piping contamination and to monitor decontamination effectiveness, and 3) a corrosion test section to obtain data on corrosion and residual loop activity.

Temperature Coefficient Facility

The study of the hot pressurized exponential pile is continuing, and a cost estimate should be available by approximately January 1, 1959. Tests conducted to date indicate that resistance heating of the graphite stack will be feasible. It also appears desirable to obtain an accelerator neutron source sufficiently powerful to allow activation measurements of P.

Reactor Lattice Calculations

The correlation of the exponential and PCTR measurements for cluster lattices has been completed using the Pershagen model for calculating p, a P-3 method for f, Westcott's cross sections in calculating η , with appropriate spectral indices and experimental fast effects. The summary of this work will be documented in HW-58678.

Reactor Engineering

Present Reactor Engineering Technology

Zirconium Process Tubes

Four KER Zr-2 process tubes were received at HAP0 and are now being tested prior to installation.

Zirconium process tube technology was discussed with AECL personnel at Chalk River. Several process tubes were demonstrated that had been fabricated in France. These tubes were cold extruded using glass as a lubricant, and the resultant finish was excellent. Some Zr-2 tubes have been irradiated in a test loop, and white corrosion patches were found on the inner surface of the tube. Fretting corrosion was suspected.

Several excellent welds of Zr-2 to Zr-2 were demonstrated, and it appears that satisfactory welds can be obtained provided an atmosphere of dry helium is present. In the calculation of stresses in Zr-2 process tubes, the engineers at Chalk River have assumed that the thermal stresses relax out at operating temperature and need only be considered when the tube is cooled.

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Retubing Requirements

An analysis has been performed to determine retubing requirements at the reactors during the next five years. The results are summarized below:

a) B-Reactor

No major retubing effort.

b) C-Reactor

Central zone will require retubing starting in second quarter of CY-1960.

c) D-Reactor

No major retubing effort.

d) DR-Reactor

DR will replace approximately 300 tubes during CY 959. No added major retubing effort foreseen during remainder of five-year period.

e) F-Reactor

Will require replacement of 300 tubes per year until zirconium tubes are installed in the lower regions of the reactor. Retubing of the central zone of the reactor will be required starting in CY-1962.

f) H-Reactor

No major retubing effort.

g) KE and KW-Reactors

Major retubing programs will be required at these reactors starting in CY-1962.

Radiological Engineering

Radiation Control Experience

The radiation exposure status at the end of the 48th week shows the radiation monitors to have an extrapolated 12 month average of 2810 mr with 9 men over the desirable figure for that date.

The 1958 exposure reports for the 100-F and 100-D reactor areas are complete and show that no one in these areas exceeded the 3r annual limit during 1958. The maximum dose for the two areas was 2983 mr recorded for a radiation monitor. The 100-K Area exposure report for the badge year is also complete except for the radiation monitors, and so far no one in that area exceeded the 3r annual limit.

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In 100-B Area at the end of the 49th week one employee of the Component Testing Operation, Research and Engineering Operation, had a dose of 3110 mr for the year. The man was removed from radiation zone work for the remainder of the year.

No one in IPD received over-exposure to radiation during the month.

Eight Reports of Lapse of Radiation Control were issued during the month. There were three cases of spread of contamination to the skin or personal clothing of employees. There was one case in which an employee received uncontrolled exposure to radiation as the result of steam formation blowing out a dummy charge from the downstream end of a process tube. This was formally investigated and was reported in HW-58621.

One Lapse involved a high dose rate existing outside radiation zone boundaries. This involved a backup of effluent vapor due to 105 building ventilating fan failures. Other lapses involved: 1) A highly radioactive speck found in floor sweepings; 2) A contaminated 50 gallon drum and contaminated pipe found in excess scrap material; and 3) A gross contamination spread in a decontamination room.

Lapse of Radiation Control
Distribution by Reactor and Operation

	<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 Tot.</u>
Processing	0	0	0	0	1	0	0	0	
Maintenance	0	0	1	0	1	1	0	1	
Supplemental Crews	0	0	0	0	0	0	0	0	
Research & Eng.	1	0	0	0	0	0	0	0	
Facilities Eng.	0	0	0	0	0	0	0	0	
Central Maintenance	0	0	0	0	0	0	0	0	
Reactor Areas	<u>1</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	
Assigned Totals	2	1	1	0	1	1	0	2	8
IPD General									0

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

Effluent Water Statistics

This data is reported through the cooperation of the Radiation Protection Operation, HLO.

Columbia River and Sanitary Waters

	<u>100-F Area</u>							
	<u>Raw</u>				<u>Sanitary</u>			
	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>12 month</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>12 month</u>
				<u>average</u>				<u>average</u>
%MPE _{GI}	3.1	3.8	4.8	3.7	1.0	0.7	0.9	0.9
%HAPO Limit					10	7	9	9

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Pasco

	<u>Raw</u>				<u>Sanitary</u>			
	Sept.	Oct.	Nov.	12 month average	Sept.	Oct.	Nov.	12 month average
%MPE _{GI}	0.9	1.0	1.3	1.1	0.2	0.2	0.3	0.2
%HAPO Limit	18	20	26	22	4	4	6	4

Kennewick

	<u>Sanitary</u>			
	Sept.	Oct.	Nov.	12 month average
% MPE _{GI}		0.1	0.1	0.1
% HAPO Limit		2	2	2

Average Reactor Effluent Activity Output

	<u>December 1958</u>	<u>November 1958</u>	<u>December 1957</u>
107-B	32,000 μ c/sec	29,000 μ c/sec	27,000 μ c/sec
107-C	28,000 "	32,000 "	47,000 "
107-KW	19,000 "	*203,000 "	41,000 "
107-KE	55,000 "	52,000 "	28,000 "
107-D	28,000 "	37,000 "	22,000 "
107-DR	13,000 "	13,000 "	14,000 "
107-H	34,000 "	24,000 "	17,000 "
107-F	28,000 "	18,000 "	15,000 "

* This value represents the average of only 7 samples taken while the reactor was operating. One of these results was an unexplained high value. No samples were taken during the reactor outage nor was any other adjustment made.

Radiation Control Standards and Procedures

The following new Radiation Control Procedures were completed for distribution:

No. 3.1, "The Creation and Distribution of Radiological Records," defines the radiological records to be kept in IPD and the disposition of those records.

No. 6.2.3, "Lapse of Control Severity Determination," establishes a severity measure for lapses of control so they can better serve as a measurement tool. All lapses of control for 1958 have been reviewed and a severity number assigned to each. This will permit comparison of 1959 experience with that of 1958.

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Radiological Training

The 20 men who will be trained to present radiation protection information on an area basis have all been selected from the radiation monitor and journeyman classifications. Schedules for their training have been issued. A notebook containing an instruction letter, topic No. 1, and detailed instructions for using training aids have been distributed. Slides for the first lecture are being prepared.

A total of 238 copies of the new R. M. Handbook containing most of the first section has been issued.

The first seminar in the series scheduled for personnel of the Processing Operation was presented on December 23. It was titled "Radioactive Contamination of the Columbia River." Presentations were made by representatives from Chemical Effluents Technology Operation, HLO, Regional Monitoring Operation, HLO, and Radiological Engineering, IPD.

Instrumentation

Four calibrated channels were received from Victoreen as a part of the calibration comparison exchange. It appears that the calibration differences between Victoreen and Hanford have been resolved. One of these four chambers was inoperative when received, one was well within our $\pm 15\%$ accuracy requirements, and the other two, while not within our accuracy requirements, showed errors on both sides of the true readings. The calibration of all of the original shipment of equipment was approximately 30% low on all channels.

Five Victoreen chambers were installed on the discharge elevator of KE reactor early in the month and remained there during about three weeks of operation. At the end of this period, three of the chambers were inoperative. These were part of the original shipment of standard chambers. All future shipments of chambers will be constructed for high temperature operation. All chambers now on the plant are being returned to Victoreen for upgrading to high temperature operation. When the instruments are returned to the vendor, there will be only one acceptable channel on the plant.

The Victoreen Company has stated that it intends to ship the balance of this order by December 31. In view of the experience to date with this order it is doubtful that this shipment date can be met.

A report was issued which outlines Radiological Engineering's recommendations for the present and future use of remote monitoring methods. The report outlines a proposed step-wise program for the adoption and use of remote dose rate monitoring, pocket dose alarm, and remote air sampling equipment, and will serve as a starting point and guide for future programs in IPD.

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Projects

Project CG-791

Comments were submitted on several phases of project CG-791, "Exhaust Air Decontamination," mainly on instrumentation and instrumentation layout. Design plans to use a Kanne Chamber to trigger the discharge area fog spray system. Operating ranges and operating experience with the Kanne chamber installations at 105-KE and 105-H were examined. Unless proper precautions are taken, the following conditions could cause a false trip of the discharge area fog spray: 1) significant discharge area gas leaks, 2) small discharge area gas leaks with air in the reactor, 3) purging of reactor gas, and 4) gamma sources external to the Kanne Chamber.

Liquid Waste Disposal

Effect of Zircaloy Process Tubes on Effluent Water Activity

Results of analyses of water from process tube 3586-D which is made of Zircaloy indicate that the concentration of zirconium and niobium radioisotopes is not significantly different from the concentrations encountered in effluent from aluminum tubes. We are lead to believe that changing all process tubes from aluminum to Zircaloy would cause little if any change in rear face dose rates or river contamination.

Examination of sections from the dummies and pigtail from tube 3586-D did not indicate that zirconium-niobium radioisotopes were present in significant quantities. It did show that arsenic-76 on stainless steel surfaces is a significant and probably dominant contributor to rear face dose rates during the first 24 hours of an outage. Tests are planned which will add considerably to this information. These tests are in conjunction with decontamination studies.

Decontamination

The stainless steel loop #4 at KER was successfully decontaminated with a 40% solution of Turco 4501. Average of the dose rates obtained at 23 check points dropped from 115 mr/hr to 3.5 mr/hr. About 200 gallons of solution stored in a steel tank gave a dose rate of 50 mr/hr through the tank.

Exposure Reduction Task Force

The B, D, H and KE reactors plan to decontaminate discharge area piping during the first quarter of calendar year 1959. It is now estimated that if all reactors decontaminate discharge area piping, radiation exposure can be reduced by 160 r (about 10% of IPD's total exposure). Most of the reactors are or will be set up to use Gantt planning and performance charts for outages. A radiological training program will begin in January for the training of Processing operators and Maintenance craftsmen to make best effective use of time spent in radiation zones.

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PROCESS TECHNOLOGY OPERATION

REACTOR POWER LEVEL LIMITATIONS

Equilibrium reactor power levels were limited at the end of the report period approximately as follows:

<u>Reactor</u>	<u>Basis</u>
B	ACRS limit
C	ACRS limit
D	ACRS limit
DR	ACRS limit
F	ACRS limit
H	ACRS limit
KE	ACRS limit
KW	ACRS limit

All eight reactors are now operating on the ACRS limit during equilibrium operation.

WATER TREATMENT

Plant Tests

The two permanent bauxite feeders have been installed at 183-B and are in operation.

The special sand-filter coal filter at 183-D has been placed in operation.

PROCESS STANDARDS

HW-46000 B, Process Standards - Reactor

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

Process Standard A-023 - "Bulk Outlet Water Temperature"

The revision provides increased bulk outlet water temperature limits for B and C Reactors. The new limits are based on an analysis of the strength of individual components in the effluent system, and a change in philosophy permitting use of average rather than minimum barometric pressures in determining top of downcomer saturation temperature.

Process Standard A-060 - "Horizontal Rod Cooling Water"

The revision provides improved graphic data for use in determining high and low

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pressure trip settings for HCR cooling water. A limit was placed on the number of rods which may be withdrawn after loss of horizontal rod cooling water, to ensure total control requirements are satisfied in case of water loss to the reactor.

Process Standard F-060 - "Operational Charge-Discharge Facility, C Reactor - General Requirements"

Process Standard F-070 - "Operational Charge-Discharge Facility, C Reactor - Discharging Operation"

Process Standard F-080 - "Operational Charge-Discharge Facility, C Reactor - Charging Operation"

Process Standard F-090 - "Operational Charge-Discharge Facility, C Reactor - Special Operation"

The four Standards listed above formerly limited the use of the C Reactor Operational Charge-Discharge Facility. The revisions now permit complete facility operation, including charging of fissionable material.

HW-46000 D, Process Standards - Reactor

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

Process Standard A-021 - "Bulk Outlet Water Temperature Limit"

The bulk outlet water temperature limit was revised upward 0.5°C as the result of a philosophy change permitting the top of downcomer saturation temperature to be based on average rather than minimum barometric pressure.

Process Standard A-022 - "Tube Outlet Water Temperature Limits - TOA and HOLE CORROSION"

This is a new Standard covering operation with I & E slugs. Limits for natural and enriched slugs were specified. The necessary remedial action to be taken if limits are exceeded were included.

Process Standard A-040 - "Process Water Trip Settings"

The Standard specifies a new lower #1 Safety Circuit process water trip setting. The new setting will allow automatic re-setting of this trip when water pressure is raised for start-up. The revision also permits removing the LXX-LP trip from the #1 Safety Circuit under specified conditions. Removal of the LXX-LP trip from the #1 Safety Circuit will not effect reactor safety because the reactor is still fully protected against water loss by other water pressure trips.

Process Standard A-060 - "Horizontal Rod Cooling Water"

The revision is identical to that issued for HW-46000 B, above.

Process Standard C-050 - "Process Tube Temperature Monitoring"

The revision now permits start-up with faulty temperature circuits on tubes newly

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charged or subjected to maintenance provided the tube contents are non-fissionable, and the cooling flow is known to be adequate. The specification covering reactor operation for short periods when the temperature monitor is permitted out of service for maintenance has been re-written to clarify Processing Operation's responsibilities during such times.

HW-46000 F, Process Standards - Reactor

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

Process Standard A-021 - "Bulk Outlet Water Temperature Limit"

Process Standard A-040 - "Process Water Trip Settings"

These revisions are identical to those issued for HW-46000 D, above.

Process Standard A-060 - "Horizontal Rod Cooling Water"

This revision is identical to that issued for HW-46000 B, above

Process Standard C-050 - "Process Tube Temperature Monitoring"

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

HW-46000 H, Process Standards - Re ctor

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

Process Standard A-021 - "Bulk Outlet Water Temperature Limit"

Process Standard A-022 - "Tube Outlet Water Temperature Limits - TOA and HOLE
CORROSION"

Process Standard A-060 - "Horizontal Rod Cooling Water"

These revisions are identical to those issued for HW-46000 D, above.

HW-46000 K, Process Standards - Reactor

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

Process Standard A-023 - "Bulk Outlet Water Temperature"

New limits based on average rather than minimum barometric pressures are specified in the revision. The higher limit is valid only when circuitry is available which will reduce bulk outlet surges by initiating immediate shutdown upon loss of a process water pump or opening of a V-73 valve.

Process Standard C-040 - "Flux Monitors"

Because of difficulties in ball recovery from the reactor fringe zones, the ball 3X system at KW Reactor was split into an inner and outer system and on the inner system, a seismoscope flux monitor coincidence trip was added. With the coincidence trip, an earthquake severe enough to trip the seismoscope will not drop the inner

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system balls if rapid VSR entry is indicated by receipt of two or more flux monitor low trips. The Standard was revised to incorporate new low trip settings applicable to the coincident trip system. Obsolete material was deleted from the Standard and specifications concerning minimum amplifier readings were clarified.

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

Because of modifications in the ball 3X system and installation of the seismoscope-flux monitor coincident trip, it was necessary to revise the operating requirements of the ball 3X system. The required changes are specified in this revision. A new testing procedure for the 3X system was included that permits emptying hoppers by methods other than dropping into the channel.

Process Standard D-040 - "Earthquake - Seismoscope Operation"

With the seismoscope-flux monitor coincident trip in use the seismoscope initiates a #1 rather than #3 Safety Circuit trip. The Standard was revised to reflect this change in function of the seismoscope.

PROCESS CHANGE AUTHORIZATIONS

Thirteen Process Change Authorizations were issued during the month to permit temporary relaxation of Process Standards - Reactor, HW-46000. These were:

PCA #8-111 - "By-pass of Panellit Gauge - C Reactor"

Panellit pressure on a tube containing a solid aluminum charge drops rapidly during a purge, as opposed to the slow, gradual drop experienced on tubes containing uranium slugs. To eliminate unnecessary scrams during a purge, the PCA permitted C Reactor to by-pass Panellit gauges on tubes containing non-heat generating material. A manual reactor shutdown over a 10 minute period was specified if coolant flow to the tube(s) was interrupted.

PCA #8-112 - "Water Leak - B Reactor"

On November 8, 1958, B Reactor's daily water collection increased over the amount permitted by Standards. To permit effective outage scheduling, the PCA permitted B Reactor to operate for an additional two days provided certain conditions specified for protection of the moderator and tubes were met.

PCA #8-113 - "High Pressure Cross-tie - K Reactors"

During KW Reactor's extended outage it was necessary to inspect the clear wells. When the east clear well is out of service, KW cannot pressurize the high pressure cross-tie system which, under certain conditions, provides emergency cooling to KE. The PCA permitted KE Reactor to continue operating for six hours with the high pressure cross-tie out of service provided the low pressure cross-tie was pressurized, no generator maintenance was in progress, and no sub-normal critical power conditions occurred.

PCA #8-114 - "Process Water Pressure Trips - F Reactor"

The PCA permitted lowering the #1 Safety Circuit process water trip setting from 80 psi to 100 psi below operating riser pressure. This will ensure automatic re-

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setting of the trip when water pressure is raised for start-up. The change will not cause any significant delay in the automatic ball drop required upon rapid decay of water pressure.

PCA #8-115 - "Manual Control of V-73 and Cross-tie Cone Valves - KW Reactor"

During outages the cross-under cone valve is normally open at the K Reactors. The cone valve will close automatically when process water is lost and emergency water is demanded through the V-73 valve. The automatic closing of the cone valve on opening of the V-73 protects the reactor from inadequate cooling in the top part of the reactor. During the ball 3X circuitry modifications it was necessary to de-energize the circuits that automatically open the V-73 cross-tie valve and close the cross-under valve. Because restricting the use of the cross-under line could have seriously delayed reactor start-up, the PCA permitted placing the V-73 and cross-under cone valve on manual control for a four hour period when automatic control was not available. Pump power, pump configuration and control requirements to ensure reactor protection during the four hours were specified.

PCA #8-116 - "Temperature Monitoring System - KW Reactor"

All resistance temperature detectors and rear face wiring in the temperature monitoring system were replaced during the KW extended outage. The PCA was issued to provide special procedures for checking out the system during the initial stages of the cold start-up. Operability criteria to be met before raising to higher tube power were specified.

PCA #8-117 - "Automatic Scram Feature of the Temperature Monitors - KW Reactor"

The PCA extended the provisions of PCA #8-52. PCA #8-52 permitted by-passing the temperature monitor's automatic scram feature until the rear face monitoring and temperature detectors were replaced. Since a statistical number of wire and/or sensing element failures can be expected in the new components almost immediately, the PCA permitted by-passing the automatic scram feature for an additional period of two months for test purposes and prevention of unnecessary production losses.

PCA #8-118 - "Graphite Temperature Limit - B Reactor"

B Reactor was 18°C above the graphite limits permitted by Standards. Because a rapid graphite temperature reduction would have adversely affected production, the PCA permitted gradual reduction over a 30 hour period.

PCA #8-119 - "Rear Connector Failures, B, D, DR, F, and H Reactors"

The PCA was issued to provide specification for ensuring reactor safety during operation with leaking rear connectors provided specified limitations on tube power and Panellit pressures were met.

PCA #8-120 - "Seismoscope Circuit - KE Reactor"

The PCA extended the provisions of PCA #8-82 which permitted placing the seismoscope in the #1 Safety Circuit rather than the #3 Safety Circuit. PCA #8-82 was issued to eliminate inadvertent ball drops caused by failure of seismoscope circuitry. Manual trip of the ball 3X system under certain conditions was specified.

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PCA #8-121 - "Panellit Gauge Trouble-Shooting Equipment - F Reactor"

F Reactor experienced several Panellit trips traceable to a single row of gauges. Since the offending gauge in the row could not be located with present circuitry, the PCA permitted installation of a fast acting, very low current fuse across each gauge switch. The fuse on the offending gauge would burn out when the gauge tripped, thus revealing its location. Conditions under which the fuses could be used were specified.

PCA #8-122 - "Low Graphite Temperature - KE Reactor"

KE Reactor's graphite temperatures were below the Standard minimum because of an unfavorable rod configuration and heat cycles that kept power levels lower than normal. The PCA permitted operation with lower temperatures than specified in Standards until the next outage. Little additional growth was expected since graphite temperatures were rising due to improving operating conditions.

PCA #8-123 - "Leaking Rear Pigtails - KW Reactor"

A process tube outlet temperature detector blew out of its fitting when a retaining snap ring released. A rear face water leak resulted and temperature detection was lost on the tube. The PCA permitted continued operation since protection against excessive tube power was provided by the Panellit gauge flow monitor. Limiting conditions for operation with a failed temperature detector were specified.

PCA #8-124 - "Water Leak - F Reactor"

Following start-up on November 27, after an outage where tube leaks were repaired, the water collection rate remained above that permitted by Standards. Because there was some doubt that the leak was of such magnitude that it could be located, the PCA permitted continued operation under specified conditions.

PROCESS ASSISTANCE

Auditing

One Engineer audited conformance to Process Standards on all Processing Operations shifts.

Graphics

Graphics services prepared 31 graphs, charts, and visual aids for various IPD and HLO components.

RUPTURE EXPERIENCE

<u>Failure Date</u>	<u>Tube No.</u>	<u>Lot No.</u>	<u>Type Metal</u>	<u>Exposure</u>	<u>Type Failure</u>
12/3/58	0485C	KG-090-E	6" I&E E ⁽²⁾	956	Side Hot Spot
12/5/58	4176DR	VA-016-A	8" Solid Nat.	342	Split-Long
12/5/58	4466DR	KE-012-A	6" Solid E ⁽²⁾	850	Split-Long
12/5/58	4070DR	Unknown	6" Solid E ⁽²⁾	409	Unknown
12/5/58	4271DR	KE-061-E	6" Solid E ⁽²⁾	363	Unknown

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<u>Failure Date</u>	<u>Tube No.</u>	<u>Lot No.</u>	<u>Type Metal</u>	<u>Exposure</u>	<u>Type Failure</u>
12/8/58	4063KW	SK-601-B ⁽¹⁾	8" I&E Nat.	555	Hole
12/11/58	2453C	KA-123-B	8" Solid Nat.	602	Split-Long.
12/14/58	4067D	KH-003-C	8" I&E Nat.	688	Hole
12/27/58	3188C	KP-001-A	7" I&E Depl. (3)	733	Hole
12/28/58	3593KE	CK-032-B	8" I&E Nat.	743	Hole

- (1) Failure piece reprocessed from lot MK-003-B
(2) 0.94 per cent U-235
(3) I & E depleted being irradiated under PT IP-132-AC

Legend:

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

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

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

Unknown - Rupture piece could not be examined, probably lost among other metal.

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OPERATIONAL PHYSICS OPERATION

PILE PHYSICS ASSISTANCE

During December all piles except KW attained their respective ACRS-limited level; KE did so for only a few hours. The potential levels, limited by TOA considerations, were as much as six per cent higher.

The tendency for the flux distribution to be unstable and to cycle is apparent at all reactors; a simple, somewhat quantitative means for identifying the magnitude of these cycles has been devised and will be adopted for all piles, but with a slight variation at the K's. The daily maximum upward change in graphite temperature will be added to the maximum downward change (neglecting sign). Preliminary examination indicates the following scale would give a reasonable description of reactor conditions:

<u>Value</u>	<u>Condition</u>
< 20	stable
20-30	tending to cycle
30-40	slight cycle
40-50	cycling
50-70	strong cycle
> 70	serious cycle

Beginning with the January report the maximum and minimum cycle values will be shown in Table I.

Water takeout from the KW pile atmosphere has been very high, and every change of the dryers has caused a 20-50 ih change in pile reactivity. The resulting control problem during the month has been extremely difficult; the maximum level attained, in between outages to try to find the leak, has been ~90% of the ACRS limit.

Temperature monitoring requirements - including frequency and geometry, are being reviewed in order to prevent rupture rashes due to severe distortions during non-equilibrium conditions.

TABLE I

SUMMARY OF OPERATING DATA OF PHYSICS INTEREST
FOR THE MONTH OF DECEMBER, 1958

<u>Pile</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>DR</u>	<u>F</u>	<u>H</u>	<u>KE</u>	<u>KW</u>
ECT in Dec.*	1415	1670	1430	1510	1455	1550	2340	***
12 Mo.Avg.ECT	1430	1590	1440	1520	1434	1572	2410	
Equil.Scram Time**	20-25	30-35	20-25	15-18	20-32	32-37	18-20	***
No. of Scrams and Recoveries #	0/0	0/0	0/0	0/0	2/2	0/0	0/0	4/4
No. of Non-Scram Outages ##	2/0	2/2	1/1	1/0	0/0	0/0	1/0	1/0
Report Period	11/21	11/21	11/22	11/20	11/22	11/25	11/24	11/22
	12/24	12/26	12/23	12/24	12/24	12/25	12/26	12/26

Footnotes on following page.

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Footnotes for Table I

- * Effective Central Tubes; this value is defined as the pile power divided by the average of the ten most productive non-enrichment tubes in the pile.
- ** This is defined as the maximum time available in minutes between scram and the first indication of start-up.
- *** No satisfactory data available - See paragraph on KW.
- # The first pair of numbers shows the number of brief outages from which secondary cold start-ups would be made and the number of successful start-ups. The second pair shows the number of brief outages from which hot start-ups would be made and the number of successful recoveries.
- ## 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 Pile (W. R. Smit)

The ACRS limit on power level was reached. Two scrams occurred from equilibrium; deviations from Process Standards during one attempted recovery were pointed out and were reviewed thoroughly by the B Processing Operation. Both recoveries were lost after they were essentially complete because of secondary Panellit trips.

A multiple linear correlation was attempted between the degree of flattening, as indicated by ECT, and the four independent variables believed to have the greatest influence on flattening; these were (1) pile exposure, $\bar{E}$, (2) pile enrichment, (3) reactivity in rods, and (4) reactivity in flattening columns and splines. Data from B, D, DR, and F were used, but seemingly characteristic differences between these four reactors produced inconsistent results. This problem will be investigated further, with each pile taken separately, as soon as enough data are accumulated following the I & E changeover.

C Pile (R. D. Carter)

Pile power level has been limited by the ACRS restriction; the TOA corrosion limit would permit 4-6% higher level. There were two scrams from equilibrium during the report period; both caused by the Operational Charge-Discharge equipment; both recoveries were successful. Four additional outages occurred for rupture removal, one following the second scram within two hours. This rupture occurred in a solid natural uranium charge after the tube power, during recovery, exceeded the normal operating tube power by at least 11%. No operating limits were exceeded on this tube.

On December 13, shortly after a start-up, the reactor was shut down because of a large-scale temperature distortion resulting in high tube temperatures in the top and a shortage of usable control in the horizontal rods. Attempts have been made to correct this somewhat persistent occurrence by obtaining a reactivity balance between the top and the bottom of the reactor. This has met with some success but the problem appears to be more of a balance between the center and fringe and will only be corrected by enriching the center of the reactor and operating with a larger amount of control during equilibrium. This step would

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result in the use of temporary poison more often than at present, which may not be economical, but the problem will be studied further. One cause of the severity of the distortion may have been water in the bottom half of the reactor since there has been a high water removal rate since the outage.

The operational charge-discharge equipment was used for the charge-discharge of 26 uranium columns this month. Operation of the equipment over a longer period of time is necessary before any definite conclusion can be drawn, but effects to date indicate only minor control disturbances.

D Pile (A. D. Vaughn)

The limit to pile power has been the ACRS restriction. D Pile operated from 11/19 to 12/13 with no serious difficulty; 14 splines were charged during this time to absorb long term reactivity gains. On 12/13 a rupture (I & E²) occurred within a few minutes after a successful scram recovery - the scram was caused by an unexplained Panellit trip. On the start-up of 12/16, thirty splines were used for supplementary control; two were left in for flattening, and the remaining 28 were removed without notable incidents. During the best one-hour period of withdrawal, six were removed. The ACRS level was attained four days after start-up.

Some difficulties with the spline system still persist; they are almost entirely the result of failure to follow procedures and/or lack of adequate maintenance and can presumably be remedied.

The front-to-rear cycling problem associated with charging splines to absorb long term gains has apparently been solved by a change in the equilibrium rod configuration.

Deviations in timing of temporary poison charging relative to supplementary control needs were pointed out; D Processing Operation is reviewing their procedures and requirements.

DR Pile (D. I. Monnie and R. L. Ferguson)

The limit to pile power has been the ACRS restriction; however, water leaks have been the principal limit to production. The reactor was shut down on 11/23, 12/15, and 12/19 for water leaks.

An insufficiently monitored flux shift caused a rupture outbreak on 12/5. The reactor scrammed on 12/4 when poison was charged in an un-jumpered PCCF tube. During the start-up the following day the PCCF charging machine was "hung up" on a tube that was believed to be empty when the poison-charging began. At the time the charging machine jammed, reactor power was cut and the unit purged with helium to slow the gain in reactivity. The flux was distorted to the top, but the available data didn't show that the temperatures were significantly over limits. Soon after the charging machine was back in service the reactor was shut down because of rupture indications. Since there were several ruptures in the same region, an estimate was made of the maximum tube powers that may have occurred for a short period of time during the start-up. The solid natural uranium may have reached a tube power as high as 1100 KW. A total of 86 tubes of rupture-prone material were discharged in the region where the ruptures occurred.

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A wire that controls the inward movement of the shim rods came off the control switch during near-equilibrium operation. This condition existed for approximately one hour without causing any control problems; the general direction of rod movement was outward because equilibrium had not been reached.

F Pile (R. A. Chitwood)

The limit to pile power has been the ACRS restriction; pile operation has been continuous since 11/26 except for two scrams and successful recoveries during the first five hours of operation. This operating period was begun with an extreme reactivity shortage caused by I & E charging and unscheduled outages; steady operation has provided ample reactivity, and the ECT value has been increased from 1385 to 1460. There are now 1200 I & E charges in F Pile, and no further reactivity shortages are anticipated.

H Pile (G. R. Gallagher)

H Pile has been operating on the ACRS limit since 11/29; tube powers during this period have averaged 935 KW for the ten most productive. There has been considerable annoyance, though not any power cut, due to cycling, particularly in the top-to-bottom direction. The chapter on Instrumentation for the Pile Physics Manual was completed and is being published.

KE Pile (F. C. Franklin)

The KE equilibrium power level has been limited by the top of annulus corrosion limit on I & E natural uranium columns; the columns without mixing slugs being the most restrictive. The ACRS limit became the most restrictive limit on the last day of this report period. Front-to-rear graphite temperature cycling restricted the power level during the first part of the month. Graphite temperatures were never near limits but general control was not good because of the cycling, and it was thought best to keep tube outlet water temperatures somewhat below limits. Front-to-rear graphite temperature cycling during the latter part of the month made the approach to the maximum equilibrium level quite slow.

It is believed that the high average metal exposure and larger quantity of mixing slugs in the pile (approximately 2100), have caused a decrease in the stability of the front-to-rear flux distribution. The possibility of using two mixing slugs per column (one upstream and one downstream instead of one approximately in the center of the metal column) is being investigated. The reactivity cost of such a change would involve a loss of about 50 inhours.

KW Pile (C. E. Bowers)

The RTD and gas bellows outage ended 12/1; with 14 shutdowns between that time and 12/25, a normal operating level has not been attained. Power level was generally limited by an undetected water leak, which indirectly caused severe transients during "equilibrium" operation.

Water takeout has been very high, and every change of a dryer has produced a reactivity change of -5 to -50 ih for a short time. CO₂ purging just before dryer-changes has helped some, but the transient is still evident and unpredictable. Leak-testing on three separate outages has failed to locate the leak.

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During the 12/1 initial start-up a 10-15 second period was obtained. This has been traced to an extreme flux distortion toward the near-side as a result of (1) a large number of temporary poison columns distributed for good flux control at turnaround, (2) the rod withdrawal order used with the present operating configuration, and (3) the particular point in the rod order where critical occurred. The most simple and direct measure to prevent recurrence appears to be to put some of the temporary poison in the near side in the future.

Twenty spline caps have been installed and one spline discharged during operation. The results were generally satisfactory. A temporary sub-critical monitoring system has been provided by use of a BF_3 tube in a high-flux location; it is used only during the approach to critical and up to 100 MW. Super-criticality is generally indicated three to five minutes before the normal PC indication.

No further work has been done on removal from test holes of 3X balls left from ball drops.

PROCESS PHYSICS STUDIES

Pu-240 Program - PT-IP-132-C

A D metal rupture late in November and another late in December bring the total D ruptures in the loading to eleven. The AEC has requested that the 42 remaining columns (of the 84 originally charged) be brought to target exposure if possible; if D metal rupture rates again severely impede C Pile production as in November, further decisions by the AEC would be necessary. The material discharged to date averages approximately two-thirds of goal exposure; exposure of the 42 D columns left in the pile also averages about two-thirds of the nominal goal. The AEC is not interested in product for this program from the eight columns charged as replacements in November.

E Metal Usage

Recent goal cut recommendations by Process Technology for reduction of rupture rates would require more compensating enrichment than would be supplied during the next few months by present schedules. In view of the limited incentives for this goal reduction while ACRS limits remain in effect, it is not likely that an E metal shortage will develop prior to scheduled increases in E metal receipts.

Supplementary Control

Spline usage at the D pile has been increased, but a number of nuisance problems arose mainly from failure to change chopper blades at proper frequency and failure to charge upstream dummies in all spline-cap columns; presumably these problems can be resolved by adequate liaison, training, and procedures. Start-up usage of splines after the December 13th outage was encouraging. A single spline had been discharged at KW by Mechanical Development up to month's end, at which time splines were being inserted for experimental flattening control just prior to shutdown. A recent revision to the eductor hose reel and water supply assembly apparently permits it to operate satisfactorily.

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A recent transfer to Mechanical Development has the full time assignment of development work and expediting of the displacement column system. Continued cycling tendencies at the K's and indications of such tendencies at the older piles as levels have increased are strong incentives for making this development succeed as quickly as possible.

Safety Control Studies

An equation derived for predicting safety rod strength which incorporates a blackness correction for epi-thermal absorption has been found accurate to approximately five per cent in comparisons with B, H, and K start-up experimental results.

Calculation of the relative effectiveness of VSR's and ball columns in the DR Pile by the above method tends to over-estimate the ball column strength as 1.09 times old VSR strength, whereas the experimental relative value was 1.06. These results probably mean that the theoretically calculated one-third greater control of a ball 3X column in a B-D-F Pile relative to its VSR may be closer to one-fifth. An opportunity for measurement of this comparison in an old pile is still being sought under an already authorized production test.

Theoretical calculations of the NPR control rod and vertical ball systems have also been made by the above method.

Accountability for Tritium Buildup from He^3

Calculations were made for accountability purposes of the extra build-up of tritium in re-charged mint slugs from burnout of helium-3 which had been produced by tritium decay. In the extreme cases considered neglecting this effect made a difference in total product of approximately one per cent, a negligible quantity relative to other uncertainties in yield estimates and to the difficulties which would be involved in taking interim storage decay into account when mint slugs are re-charged.

Longitudinal Flux Distribution - Mixer Slugs

A theoretical calculation of the longitudinal flux distribution effects of mixer slugs indicates a five per cent flattening effect due to a single mixer element centered in each column. Use of two mixer slugs located up and downstream sufficiently to cause the same reactivity loss would cause a peaking of six per cent relative to no mixer slugs. The results of these studies together with observations on longitudinal cycling tendencies which tend to detract from flattening benefits are under discussion with Process Technology Operation which has the responsibility of specifying mixer slug configurations.

Shield Protection Studies

The current maximum operating temperatures in the biological shields of the five older reactors are:

Reactor:	B	D	DR	F	H
Top Shield, °C	140	100	140	145	150
Side Shield, °C	100	100	100	125	110

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It is anticipated that action will be taken to provide some further fringe poisoning before river temperatures come back up appreciably.

Potential Gains Studies

Potential equilibrium and non-equilibrium gains have been analyzed in the past from the standpoint of incentives for improved control techniques. The method employed for analysis does not point out the theoretical gains which could be made if flow, corrosion status, and exposure did not vary from tube to tube, nor is it refined for second order effects such as reductions in future outage requirements while a reactor is down.

Because these data are valuable to other components as well as our own, we will attempt to report efficiency losses more completely. However, the measurement of achievement and incentives in control techniques continues to be the item of primary operational physics interest.

The C Pile non-equilibrium loss of 31 per cent during November was due largely to the large number of D ruptures. Larger than normal losses for DR and F Piles were due to outages for water leaks and tube replacement. These data are reported along with that for the rest of the reactors for November in HW-58483.

Documents of Operational Physics Interest Issued During the Month

Chapter 2600 of HW-46100 - "Temperature Coefficients of Reactivity," by G. R. Parkos.

Sections 2.0, C Reactor, by R. D. Carter, and 3.0, D Reactor, by A. D. Vaughn, of HW-57000, "Pile Physics Manual of Transient Calculations," were issued in the latter part of November, 1958.

HW-58188 - "Post Changeover Economic Evaluation of E Metal for C Metal Substitution," W. S. Nechodom, November 14, 1958.

HW-58238 - "Reactor Neutron Flux Sensitivities - Interim Report No. 6, PT-IP-7-C, May through October, 1958," R. L. Ferguson, December 1, 1958.

HW-58319 - "Reactivity Balance and Associated Reactor Physics Data - November, 1958," D. E. Goins, December 5, 1958.

HW-58483 - "Potential Gains and Operating Efficiencies, November, 1958," D. E. Clark and W. S. Nechodom, December 8, 1958.

HW-58547 - "Tritium Accountability," letter to G. Hessney from G. R. Parkos, 12-15-58.

HW-58551 - "Axial Flux Distribution History of the H and K Reactors," D. E. Goins and G. R. Parkos, November 11, 1958.

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IRRADIATION TESTING OPERATION

KAPL-120 LOOP

The empty in-pile tube was on process water cooling during this period.

The final design of the three-flow-tube instrumentation is being circulated for approval. The pre-fabrication of the heat exchanger piping sections and supports is complete. The installation of the heat exchanger and associated instrumentation is under way.

The results of the examination of various Loop components following the decontamination are reported in KAPL-M-SMS-95, Decontamination of the KAPL-120 Loop by Alkaline Permanganate-Acid Treatments, F. C. Steiner, KAPL. No evidence of damage to the Loop components resulting from the decontamination chemicals was found by either KAPL or WAPD.

The discrepancies between HAPD's and WAPD's thermohydraulic analyses of the proposed KAPL-120-8 test have not been fully resolved. The analyses and comparison of methods are continuing.

DR GAS-COOLED LOOP

The construction activity on the DR Gas-cooled Loop was resumed after the completion of other IPD projects which had required the services of the CEO personnel. The estimated project completion date remains at July 1, 1959, with the delivery of the first compressor expected in January, 1959.

The detailed study of the coolant flow and heat transfer characteristics of the loop, to provide design information for the proposed test element and to analyze the operating characteristics of the loop was continued.

General Atomics, the materials contractor for the Maritime Reactors Branch, has requested consideration of CO₂ as the coolant in the Gas Loop. A preliminary study of this proposal has been initiated. Two problems are quite apparent:

1. The operational problem resulting from the high induced radioactivity in the coolant gas.
2. Extrapolation of available compressor data to predict operation with CO₂.

The General Engineering Laboratory has supplied performance curves for both helium and nitrogen as a result of tests conducted with the first of the Gas Loop compressors. In both cases, the performance exceeded the specification requirements. A thrust bearing failed during the test run with nitrogen. It was determined that the failure was the result of surging which occurred at a high head-low flow condition. An external bypass with a cooler is being added to the compressors which will prevent this type of failure and will also permit operation against a dead head without damage to the machines. The characteristics of the compressors (including the effect of the by-pass flow) will still meet the performance specifications.

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HAPO FUEL ELEMENT IRRADIATIONS

The present status of the process tube water stream temperature measurements which are being made in support of the I & E fuel element development program is as follows:

	<u>This Month</u>	<u>Last Month</u>	<u>Reactor</u>
Number of tubes monitored	8	8	C
	8	8	D
	0	0	KW
	3	3	KE

The irradiation of four enriched 7-rod cluster fuel elements in test hole 3674 KE (HAPO-195) continues. As of December 14, the fuel elements had reached 80 per cent of goal exposure.

The irradiation of one three-foot-long swaged UO₂ fuel element in test hole 3865 KE (HAPO-215) continues. As the customer (HLO's Ceramic Fuels Development) requested, the authorized goal exposure has been increased from 1735 MWD/T to 5000 MWD/T. As of December 14, the fuel elements had reached 20 per cent of this goal exposure.

OTHER IRRADIATION TESTS AND SERVICES

1. A total of ten sets of activation analysis samples were irradiated in the Poison Column Control facilities at D, DR and H piles. These samples are identified as follows:
 - a. Six sets of HAPO-184 samples in support of a Washington Designated Program assigned to HLO.
 - b. One set of effluent water residue samples (HAPO-172) in support of an HLO study of the radioisotopes in effluent water.
 - c. Three sets of natural uranium samples (HAPO-218) in support of an investigation of the release of fission products from uranium at high temperatures in oxidizing atmospheres.
2. A total of fifteen samples were irradiated or are undergoing irradiation in the Quickie facility (E test hole) in F pile. These samples are identified as follows:
 - a. One sample of UO₃ (HAPO-203) to provide a Np²³⁹ tracer in support of an HLO chemical separations study.
 - b. Two samples of boron-steel (HAPO-205) to determine the radioactive decay characteristics and energy levels of this material. The boron-steel is being considered for use in the NPR shield and the shielding characteristics will be tested in the 36" Shield Plug facility at C pile.
 - c. Five samples of effluent water residue (HAPO-172) in support of an HLO study of the radioisotopes in effluent water.
 - d. Seven samples of natural uranium (HAPO-224) in support of an HLO study of decontamination procedures proposed for the NPR.

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3. Two sets of graphite samples were irradiated in the Snout facility (4C test hole) at KW pile in support of an HLO study of irradiation damage to graphite.
4. Six isotope samples were charged and six samples discharged from the Magazine facility at KW area. The isotopes produced were:

Calcium³⁶
Sulphur³⁵
Antimony ¹²⁴
Tungsten ¹⁸⁵

These isotopes were produced in support of the Radioisotopes Distribution Program at ORNL.

5. A total of sixteen baskets began exposure and fifteen baskets completed exposure in the KE gamma facilities. The majority of these irradiations are being sponsored by the Non-Metallic Materials Development Operation, HLO.
6. The irradiation of two thermocouple leads, one insulated with quartz and the other with asbestos continues in the 4 B test hole at KW reactor (HAPO-199).
7. A thermocouple capsule designed to determine to what extent the electrical output of thermocouples is affected by the gaseous atmosphere which surrounds the thermocouples beads is operating in the 2 A test hole at KW reactor (HAPO-199). This work is being sponsored by HLO's Physical Metallurgy Operation.

TEST FACILITIES

Construction of a hot-cell to be used in conjunction with the KE reactor pneumatic facility has started. All off-site purchased components for the cell have been recieved.

The first of a series of chemical dosimeter measurements of the dose rate in the HAPO Gamma Irradiation Facility indicated a dose rate of approximately 5×10^6 R/hr.

BORESCOPING ASSISTANCE

Tubes 1060KW and 1785KW were inspected following the discharge of a light weight charge. No evidence of chattering was noted in the top section of either tube. A layer of water in the bottom of the tubes prohibited visual inspection between the ribs.

The 1 B test hole, KW reactor, was inspected to a depth of 19 feet from the rod room side following ball removal efforts. The area inspected was clear of balls. A two inch gap between graphite blocks was noted at approximately 12 feet. The inspection was terminated because of the poor work space available.

VERTICAL BOWING MEASUREMENTS

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

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<u>Area</u>	<u>Tube</u>	<u>Date</u>	<u>Results</u>
100-B	4574-B	12-23-58	Down .14" at 9'4" since 8-18-58 Down .09" at 20' since 8-18-58
100-B	4391-B	12-23-58	Down .15" at 9'8" since 8-18-58 Down .09" at 21' since 8-18-58

The above traverses, which produced the same data as a front and rear traverse, were taken from the front face using a spline to push the manometer head through. The two traverses required three hours elevator time to complete which represents a saving of more than one half hour of shutdown time. No access to the rear face was required.

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COOLANT TESTING OPERATION

Coolant Testing Operation Activities during December included the operation of the 1706-KE in-pile and out-of-pile facilities, operation of the KER loops, continuation of the organic program, planning of additional facilities and planning of revisions and relocations of existing facilities.

1706-KE Single Pass Tubes (PT-IP-197-A)

The six central zone single pass tubes continued to be operated under established programs for the determination of corrosion rates for X-8001 and C-64 aluminum jackets on I & E slugs. Coolant conditions for these tubes were as follows:

4355	7.0 pH filtered water and 2 ppm dichromate
4456	7.0 pH filtered water and 1 ppm dichromate
4557	7.0 pH process water with 1 ppm diatomaceous earth
4863	7.0 pH process water
4963 & 5063	6.5 pH process water

Tube 2943 continued to be operated with weighed, numbered dummies for corrosion tests on 1245 aluminum in preheated water at 90°C.

Mock-up Tubes

The mock-up tubes were shutdown all during the month for installation of improved heat exchangers to provide more efficient steam utilization. This revision has been completed and the tubes are being prepared for startup.

ELMO LOOPS

ELMO-1 - Elmo-1 was operated for one 1-1/2 hour test during December. This was a scale removal test in which the shell side of the heat exchanger was cleaned with 7-1/2% H_2SO_4 with Radine 81 corrosion inhibitor at 175°F outlet temperature. The carbon steel baffles and stainless steel tubes were effectively cleaned. Corrosion data has not yet been evaluated.

ELMO-2 - The loop was shut down on December 2 and has remained shut down during the rest of the month. The last run completed tests on aluminum corrosion at Elmo-2 operating conditions.

ELMO-5 - The loop was operated during the month at 290°C and pH 10.0 for corrosion tests on samples of A-212 carbon steel, sensitized and non-sensitized 304 stainless steel and Zircaloy-2. Also, stressed samples of 304 stainless steel and A-212 carbon steel which had been exposed to the Turco process are being corrosion tested.

During the month a test was initiated on the use of hydrazine as an oxygen inhibitor and to determine the resultant effect on corrosion samples. No unusual corrosion effects have been noted on any of the samples.

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ELMO-6 - The loop was operated during the month for corrosion testing of samples of M-388 aluminum, Zircaloy-2, and samples of sensitized and non-sensitized 304 stainless steel which had been exposed to the Turco 4501 process. The loop was run at 300°C and pH 4.5 using continuous clean-up through a phosphate-based resin bed.

ELMO-7 - Elmo-7 was operated at 580°F and pH 7.0 during the month for tests on (1) Corrosion of 316 stainless steel samples, (2) NPR cap tests with a Flexitallic gasket seal, (3) PRTR composite reactor connection test consisting of inlet, nozzle-to-tube, cap, outlet, and gas seal fittings under temperature cycling conditions. Leakage has occurred only on the nozzle-to-tube connection. (4) Solid-state diffusion of M-388 clad Alsi bonded slugs. (5) Bell-ring gasket cap test, (6) screwed NPR nozzle-to-tube connection, (7) NPR O-ring nozzle-to-tube connection on a sealed-up KER nozzle design, (8) Test on stainless steel thermocouples led into the core of a Pu-Al fuel element rod.

Tests completed during the month were: (1) Prototype Mark I Pu-Al fuel element with 2 Zr-2 clad rods. (2) NPR flared nozzle-to-tube joint. This joint failed on the 41st temperature cycle.

ELMO-8 - No further word has been received on this loop since it was returned to the vendor for repair of damage incurred during shipment.

ELMO-10 - Elmo-10 was used for two short-term tests during the month in which an alkaline permanganate process was tested for decontamination of Westinghouse SIW boiler samples.

Dowtherm Unit - Carbon Steel Heat Exchanger

The Dowtherm Unit was shut down during the month for pump motor revisions.

CEP-1 - (Corrosion Experiment Prototype)

Initial shakedown runs following installation were completed on December 23. During the balance of the month the loop has been conditioning at 300°C with 50 ppm dichromate in the loop water.

Organic Coolant Program

ORA-1 - The loop was operated with MIPB at 700°F for corrosion tests of a magnesium-beryllium alloy (magnox), zirconium coupons, and carbon steel coupons, with 20-30 ppm of water in the recirculating MIPB.

ORA-3 - The loop has been shut down during the month awaiting completion of the necessary equipment for a dry-seal thread test.

Carbon Steel Rupture Experiment

Detailed design is under way on a recirculating facility for tests on decontamination of carbon steel grossly contaminated with rupture material. Preliminary tie-ins to KER crib lines and electrical lines have been completed.

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KER FACILITY

Loop-1 - Operation of the loop at 270°C and a pH of 10.0 with LiOH addition continued until December 20, when the loop was placed on low temperature single pass operation due to a gasket failure on the pressurizer spray nozzle flange. Recirculation operation at normal conditions was resumed on December 31. The charge consisted of six stainless steel jacketed UO₂ four-rod cluster elements, and two coextruded Zircaloy jacketed natural uranium seven-rod cluster elements.

Loop-2 - Loop-2 continued operation at 185°C and pH 10.0 until December 9, when the 7' stainless steel clad oxide element was discharged and the tube was recharged with one 38" 3-rod Zr-2 clad enriched cluster element, two 18" Zr-2 clad, wire-wrapped, 7-rod UO₂ elements, and four 13" 7-rod Zr-2 clad enriched cluster elements with triangular end supports. The above charge was authorized by PT-IP-214-A.

During the balance of the month, the loop has been operated at 205°C outlet temperature and pH 10.0.

Loop-3 - In-pile recirculation continued at 185°C with high purity water until December 28 when the tube was discharged and recharged with eight stainless steel clad, triangular end supported, seven-rod cluster elements.

These were charged in conjunction with a thermocouple train with six thermocouples placed to most effectively measure water annulus temperatures in the aligned seven-rod cluster elements.

Loop-4 - Loop 4 continued recirculation at 220°C and pH 4.5 until December 12, when the loop was placed on single pass operation due to a severe valve leak. During the period of single pass operation, the out-of-pile portion of the loop was decontaminated using the Turco Process. An overall decontamination factor of 34.3 was achieved, resulting in a reduction of average cell activity, as indicated by 23 check points, from 115 mr/hr to 3.4 mr/hr.

In-pile recirculation was resumed on December 31 with the original charge of two rod-and-tube elements and one 15" Zr-2 clad seven-rod cluster.

KER Performance and Improvements

A total of 21.1 hours of KE reactor outage time was charged to CTO during the month. The charges are broken down as follows:

PT-IP-146-A - Loop 1 Effluent T/C replacement	2.7 hours
PT-IP-146-A - Scram from Loop 1 T/C check	0.7 hours
PT-IP-213-A - Loop 2 Effluent T/C replacement and Discharge of 7' cluster element	6.3 hours
PT-IP-214-A - Loop 2 - Charging of new in-pile charge	0.7 hours
PT-IP-186-A - Loop 3 effluent T/C replacement	1.4 hours
PT-IP-186-A - Special Discharge of long-rod cluster elements	3.0 hours
PT-IP-221-A - Charging of Loop 3 seven-rod T/C train	6.3 hours

TOTAL 21.1 hours

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The decontamination of Loop 4 resulted in a significant decrease in the routine daily exposure for 1706 personnel engaged in KER cell work. The total time required for the decontamination run was 31 hours.

Loops #1 and #4 were successfully switched to single pass operation without causing disturbance of normal reactor operation.

Loops #2 and #3 were successfully discharged using a special procedure for "catching" the fuel elements as they were discharged and lowering them gently into the basin. This procedure is used to prevent distortion of fuel elements from dropping into the basin.

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COMPONENT TESTING OPERATION

IRRADIATED MATERIAL EXAMINATION

The fuel elements from the following eighteen tubes were examined in the Metal Examination Facility during December. Tube and Production Test numbers are listed below:

<u>PT No.</u>	<u>Tube No.</u>	<u>PT No.</u>	<u>Tube No.</u>	<u>PT No.</u>	<u>Tube No.</u>
70A	2566-KW	132A	1176-C	132	3590-C
84A	1880-B		0785-C	172A	2468-C
84A	1881-B		2885-C	178A	2972-C
95A	1381-D		3476-C	178A	2876-C
95A	1573-D		3480-C	190A	4268-C
95A	2171-D		3677-C	64CE	3851-KW

PROCESS TUBE CORROSION MONITORING PROGRAM

In-pile measurements of 113 process tubes were made during the month. Listed below are the number of tubes measured per reactor and document numbers of the reports issued.

<u>File</u>	<u>No. of Tubes Probologged</u>	<u>Report No.</u>	<u>HW Number</u>
B	49	55	58536
D	28	56	58572
B	25	57	58642

Measurements of the remaining 11 tubes from DR and C as well as the tubes from C, DR and KW not reported last month were used to check the calibration of the Probolog instrument.

Metallurgical examinations were completed this month on seven tubes from DR, five tubes from C, four tubes from B, and one tube from KE. The leaks in tubes 3955-B and 3891-B were caused by external corrosion adjacent to the rear gunbarrel. The purpose of the examination of the five C Reactor tubes was to correlate actual process tube wall thickness with Probolog measurements and the calculated corrosion index values. This correlation will allow tubes to be selected for Probologging on the basis of their calculated corrosion index and then the Probolog data will be used to indicate when tube replacement is required. Actual measurements of the seven tubes from DR Reactor indicates that tubes on the near side thru vertical row 60 and on the far side thru vertical row 86 are corroding normally as contrasted with the accelerated corrosion reported last month.

PANELLIT PROGRAMS

Inspections were performed on 928 gauges which were processed in individual area instrument shops. Of these, 277 were rejected as failing to meet Process Standards.

In-Board Reliability Examinations were carried out in 4 areas during the month (KE, KW, C and D). 358 gauges were examined and 72 were found to be sub-standard and removed for repair and recalibration. Percent defective were:

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KE 28.6%, KW 13.0%, D 5.4% and C 34.8%. Removal rate has decreased, compared to last month.

A total of 2,608 Bourdon tubes were examined for leaks and 5 were removed and verified as leakers. The leak rate is showing a slight decrease.

Failure analysis was performed on 27 gauges removed from panels as being defective. The Failure Analysis Report for October and November was issued as document number HW-58446.

Design Change No. 242 - "Modification of 100-C Area Panellit Gauges and Component Systems" - was documented and signed. Publication will be held-up until agreement is reached to proceed with the modifications. All necessary action has been taken, with the exception of fund allocation, to obtain modified gauges from Panellit Inc., Chicago, Illinois. A decision to go ahead with current plans will result in acquisition of modified gauges for C Area, which are equal to CG-558 Panellit gauges, at a total cost of \$24/gauge. New CG-558 gauges would cost at least \$95 each.

A system was designed to permit an "X" minute scram delay for poison column control tubes. The system was designed for and at the request of 100-F operating personnel but will be made available to all areas. A verbal, tentative approval was obtained from Process Technology Operation personnel to institute a delay of from 2-3 minutes into the PCC Scram Circuit. Fabrication will proceed on this basis. Installation will then be by design change and Development Test procedures.

A system for accurately determining response times of Panellit gauges during In-Board Reliability Examinations was partially prototyped during the month. This equipment should be completed during the first part of January, 1959.

INVENTIONS

All Research and Engineering Operation personnel engaged in work that might reasonably be expected to result in inventions or discoveries advise that, to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during December 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.

Inventor (s)

None

Inventions

O. H. Greager

Manager, Research and Engineering
IRRADIATION PROCESSING DIVISION

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PRODUCTION AND REACTOR OPERATIONS SUMMARY

DECEMBER, 1958

Reactor input production for December represents a new high exceeding the previous record of June, 1958 by 0.5 percent. December production was 10.0 percent above forecast; 20.2 percent above at the six old reactors and 4.2 percent below at the K's. Production records were achieved at B, F and H Reactors with F having the highest production ever attained by one of the six old reactors.

A new maximum power level (combined total for all reactors) was achieved, exceeding the previous record by 15 units. Seven of the eight reactors (KW being the exception) operated on ACRS limits at some time during the month.

Overall time operated efficiency, 87.2 percent, was the highest achieved during the operation of eight reactors. Forecast was exceeded by 7.2 percent with an efficiency of 88.8 percent at the six old reactors and 82.5 percent at the K's. A 100 percent efficiency was achieved at both the F and H Reactors. Thirty reactor outages of which 16 were scrams occurred during December.

Ten ruptures were removed from the reactors during December. Three of these ruptures were solid enriched, two were I & E enriched, two were solid regular metal, two were I & E regular metal and one was I & E depleted metal. Four of these ruptures, three solid enriched and one solid regular metal, were apparently caused by a heat cycle during a start-up at DR Reactor.

Significant items of equipment experience were:

1. Ninety-six process tubes were installed.
2. Six water leaks, 4 tube and 2 Van Stone, were corrected.
3. The replacement of DR Reactor tube outlet thermocouples was completed.
4. A complete electrical power failure test was conducted at D and DR on December 16. Equipment operated essentially as expected under the test conditions.
5. A holding-coil failed on an electric fuel oil pump at 165-KW December 12. The recently-installed steam driven oil pump picked up the load avoiding the loss of boiler fires.

There were no disabling injuries or technical radiation overexposures. One security violation was incurred.

Processing, Power and radiation protection statistics for individual reactor areas are tabulated on pages Ch-1 through Ch-6 of this report.

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B-C REACTOR OPERATION
DECEMBER, 1958

I. ORGANIZATION AND FUNCTIONS - No change during December.

II. PERSONNEL

A. Force Summary

	<u>November 30</u>			<u>December 31</u>			<u>Net Change</u>
	<u>E</u>	<u>NE</u>	<u>Total</u>	<u>E</u>	<u>NE</u>	<u>Total</u>	<u>Of Total</u>
General	3	3	6	3	3	6	0
B Processing Operation	15	38	53	16	39	55	+ 2
C Processing Operation	16	34	50	16	34	50	0
Power Operation	15	97	112	15	97	112	0
Maintenance Operation	22	103	125	22	103	125	0
TOTAL	71	275	346	72	276	348	+ 2

B. Movement of People - Exempt roll changes consisted of the transfer in of W. J. Ferguson, 12-1-58, from Supervisor, Central Maintenance Engineering, H Reactor Operation, to Analyst, Reactor Operations, B Processing Operation. Nonexempt changes included eleven transfers in, one recall from lack-of-work status, and eleven transfers out.

III. PERSONNEL ACTIVITIES - The Department General Manager's Information Meeting, held by W. K. MacCready on December 23 at B-C, was attended by 14 exempt employees of B-C Reactor Operation.

IV. SAFETY AND SECURITY - 16 medical treatment injuries were reported during the month; no disabling injuries or serious accidents were reported. One security violation (improperly stored document) was incurred December 29.

V. NON-ROUTINE REPORTS - HW-58670, "Investigation - Hot Startup, 105-B - December 10, 1958" by R. G. Clough and H. G. Spencer, dated 12-26-58.

IV. INVENTIONS AND DISCOVERIES - All persons engaged in work that might reasonably be expected to result in inventions and 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 therein covered by this report; notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

VII. COMPONENT ACTIVITIES

GENERAL

A. Administrative Activities - Increased responsibilities and duties were accepted for the administration of the Suggestion Plan in B-C Reactor Operation, most important of which were: responsibility for approval of awards rather than IPD Suggestion Board approval; distribution of copies of suggestions; establishment of deadlines; making all investigation

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contacts; and directly answering suggestions (acceptance, rejection and status letters to suggesters). A preliminary review of exempt salaries was conducted for planning and budget purposes. Registration of B-C employees for attendance of First Quarter, 1959 IPD Training Program courses was completed.

- B. Personnel Development - Eighteen employees attended December sessions of seven IPD Training Program Courses. Seven employees continued attendance of PBM-I classes; three others attended December sessions of a Basic Economics course. Twenty-seven nonexempt employees participated in In-Plant Training sessions. One Technical Graduate was transferred in for a 3-month Rotational Program assignment with C Processing Operation.
- C. Cost Control Activities - A review of budgeted B-C Plant Costs for FY 1959 (supplemental to the Mid-Year Review of Oct.-Nov.) was completed December 10; plans for expenditures of planned maintenance and materials cost funds during the third and fourth quarters were revised and a reduction was made in budgeted Plant Cost funds.
- D. Landlord Activities - Due to a change in the project scope, the 108-B building probably will not be used for development and testing of equipment for filtering exhaust air from reactor buildings. There were several office moves in 1704-B, primarily involving personnel of the Facilities Engineering Operation and the Research and Engineering Operation.
- E. Suggestions - Under study at the start of the month, 91; received for study during the month, 39; completed during the month, 30; under study at the end of the month, 100.

B PROCESSING OPERATION

- A. Production - Input production (Pu) was 117.7 percent of forecast, and was limited by ACRS limits. The TOE for the month was 86.6 percent. The reactor established new records in operating level and daily production.

- B. Operating Experience - There were five (unscheduled) outages:

<u>Day</u>	<u>Outage Hours</u>	<u>Cause</u>
10	0.3	Panellit scram (faulty gage).
10	60.1	Panellit scram (valving error during PCCF work)
22	0.2	Panellit scram (ruptured Bourdon tube).
22	38.4	Panellit scram (excessive pressure increase from 190-B during hot startup).
24	0.5	Panellit scram (suspected malfunction of rear ball valve on PCCF Tube 2087).

- C. Equipment Experience - The reactor was leak tested, using the helium leak detector. Seven tubes were stinger leak tested; no leaking tubes were confirmed. Twelve tubes were probed; all successfully passed a

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10-inch probe. Sixty-nine tubes were probologged; 13 tubes were charged with solid aluminum due to thin walls and excessive external corrosion at the rear gunbarrel.

A total of 272 tubes were processed, including 189 I and E and two I & E² charges. The D Elevator failed due to faulty contacts, which were replaced. The slack limit switch on D Elevator failed and was replaced. One hundred eighty-four 10-90 trip Panellit gages were installed. Seven spare thermocouples on various graphite stringers were hooked up, replacing others which had failed. A defective rear ball valve on PCCF Tube 3279 was replaced. The No. 1 Safety Circuit and the Ball 3X water pressure mercurials switches were recalibrated. The venturi screens on two high-powered tubes were inspected; one was partially plugged with foreign material. The helium leak detector instrument failed during gas leak testing operation and is out of service due to insufficient parts for repair.

Five leaking Panellit gages were replaced. Two of these defective gages caused No. 1 Safety Circuit scrams. Twenty-five loop header flow meters were repaired. Vertical traverses were run on Tubes 4391 and 4574. The graphite temperature recorder failed during the last outage and was repaired. Seven rear gunbarrel movement monitors were installed.

- D. Improvement Experience - PT-IP-522 - "Process Tube Corrosion Program" - The four tubes removed last month were examined and showed that external corrosion between the ribs at the inner end of the rear gunbarrel had caused two leaks; the other tubes indicated severe external corrosion at the inner end of the rear gunbarrel but no indication of leaks. PT-IP-84-A, "Evaluation of Slugs Having Projections for use in Ribless Tubes" remained active; three tubes were charged with ribbed I & E pieces.

Project CG-740, "Replacement of Central Viewers" - The new viewer was installed, the grouting was completed, and Beneficial use has been available since December 23; installation of outside lead shielding is approximately 90 percent complete. MJA No. 2, "Rehabilitate Pile Gas Moisture Monitor System" - Installation of the modified dew cells continued. Installation of the improved and simplified poison column control facility was continued. A flapper valve was installed on the drain line from the rear face relief riser to expedite leak testing using the helium leak detector. Installation of new controllable control room lighting has been started.

- E. Radiation Monitoring Experience - Three employees received upper torso skin contamination up to 60,000 c/m while backseating special charges on the front face; decontamination of the affected skin areas was readily accomplished so that the exposure received was negligible. Following probolog work on the C Elevator, an employee was found to have 40,000 c/m on his shoe and 4,000 c/m on his skin; decontamination of the skin was done and the shoe was held for later cleaning. Four maintenance employees entered the discharge area without benefit of timekeeper notification; maximum individual exposure was determined to be 5 mrad. Maximum personnel exposure rates for various jobs were as follows: discharge operations - 200 mr/hour; PCCF charging - 50 mr/hour; dummy and tube burial - 1 r/hour; front face probologging

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operation - 1 r/hour; and draining of the expansion joints in the 115 building dryer rooms - 1 r/hour. Diffusion of reactor atmosphere gas from the front face leaks caused dose rates of: 150 mrads/hour in the valve pit; 20 mrads/hour in the lunch room; and 5 mrads/hour in the 190-B Annex basement. Proper air balance of the 105 supply air corrected the condition and personnel movement restrictions prevented unknown exposures. Thirty-nine air samples were taken during the month; none indicated activity densities greater than the permissible limits for respiratory protection worn. Of 87 vehicles surveyed, 3 patrol cars had radiators contaminated to 2000 c/m; source of activity (1 hr. half-life) was a short-lived insect breeding in 107 basin leakage ponds.

- F. Events Influencing Costs - Twenty-four exempt and eight nonexempt overtime man hours were utilized; no radiation monitoring man hours were required. No helium startups were made. Total helium used was 149,100 cubic feet, as compared to 128,160 cubic feet in November.

C PROCESSING OPERATION

- A. Production - Input production (Pu) was 113.3 percent of forecast. Power level was limited by the ACRS limit.

- B. Operating Experience - There were five (unscheduled) outages;

<u>Day</u>	<u>Outage Hours</u>	<u>Causes</u>
1	11.6	Continuation of November 30 outage (depleted metal rupture, Tube 1176).
3	31.8	Rupture - Tube 0485 (enriched I & E slug).
11	0.3	Scram - OCD low pressure trip.
11	39.4	Rupture - Tube 2453 (regular solid slug, stuck, required tube removal).
27	42.2	Rupture - Tube 3188 (depleted slug, Pu-240 Program).
29	0.5	Scram - Process water low pressure trip due to 190-C process water pump difficulty.
	<u>125.8</u>	

Equipment Experience - During the December 27 outage, Tube 1075 discharged reluctantly. A hydrostatic test of the tube indicated the tube to be leaking. The tube was removed and the channel was blanked off as an air channel. During the operating period prior to the removal of the tube, the condensate collected totaled 487 gallons. Three process tubes were removed during the month -- Tube 1075 (water leak), Tube 2453 (ruptured slug), and Tube 3973 (for corrosion study purposes). Three new process tubes (ribs reduced 13 mils) were installed in channels 2453, 3973, and 1176.

- C. Improvement Experience - PT-IP-132-AC Production of High Pu-240 Plutonium at C Reactor - One depleted metal rupture was experienced, for a total of 11 to date. A total of 50 depleted metal columns remain in the reactor. The enriched metal loading supporting the Pu-240 Program was reduced by 10 tubes leaving a total (Pu-240 enrichment loading) of

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137 tubes at month's end.

PT-IP-162-E - Routine Uranium Charging During Reactor Operation - On December 11, a scram occurred at the completion of the charging of six tubes with uranium, using the operational charge-discharge equipment. Although a low pressure alarm and trip indication were received, the exact cause of the scram has not been determined. During the month 40 tubes were processed utilizing the OCD equipment. Of this number, 24 were discharged natural uranium, 25 recharged natural uranium, two discharged solid aluminum and one recharged solid aluminum. The remainder consisted of test charge-discharge with solid aluminum on a single tube.

Project CG-741 - Renovation of the Ball 3X System - 105-C - The flange bolts were burned off of all remaining ball valves to permit removal of the ball recovery trough. The entire trough was removed and blank flanges installed on all valves except No. 19.

111-Tube Operational Charge-Discharge Facility - CG-651 - A new master water valve was installed and tested satisfactorily. Plans to charge-discharge 10 enriched I & E columns and 6 I & E columns were cancelled when dirty relay contacts resulted in faulty operation during test charging of Tube 1475 with solid aluminum.

- D. Radiation Monitoring Experience - While operating the vacuum producer, the circuit breaker energizing the switch gear contained in the heating and ventilating panel opened, causing a supply and exhaust fan to fail simultaneously. As a result, effluent vapor was forced out of the discharge area into stairwells and the storage area. The maximum dose rate detected was 400 mrad/hr. All personnel were removed from the affected areas immediately and no personnel received a dose greater than 5 mrem. The film badge of one member of the labor contractor force indicated that his exposure had exceeded 300 mrem/seven days and was reported on HW-58309.

External Exposure Experience

<u>Location</u>	<u>Type of Work</u>	<u>Personnel Dose Rates</u>	
		<u>Max. mrem/hr</u>	<u>Avg.</u>
Discharge Area	Quickie discharge	1,000	300
X-2 Level	Removing the steel plug from the 36" test hole.	600	75
Metal Exam. Facility	To decontaminate inside of basin.	300	25
Ball 3X Tunnel and Room	To remove ball trough and valves.	2,000	100

Fourteen vehicles were surveyed and none were found contaminated. There were two instances of personal clothing contamination, all items were decontaminated and released with the exception of one pair of shoes. There were no reported cases of skin contamination. A total of 75 air samples was taken; none indicated activity densities greater than the permissible limits for respiratory protection worn.

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- E. Events Influencing Costs - Twenty-six nonexempt and 20 exempt overtime man hours was required during the month. Five unscheduled outages totalling 125.8 hours downtime were incurred.

POWER OPERATION

- A. Operating Experience - Oscillograph readings were taken on the motor phases of all 190-B Annex units except No. 1-A; preliminary examination of these readings, which are similar to the readings taken last month on No. 5-A unit, indicate that the instantaneous overcurrent relay settings should be increased. The 105-B process water flow was increased 600 GPM after the December 11 reactor outage. Eight-pump operation in 190-C was necessitated for a period of twelve hours on December 29, as both the No. 1 unit, which was on the line, and the No. 4 unit, which was the spare unit, developed fluid drive trouble.
- B. Equipment Experience - Number 12-C unit in 181-B Building was taken out of service on December 29 due to severe vibration. The No. 13 north backwash valve in the 181-B Building was replaced. The revamping of the acid unloading facility at 183-C Building was completed. Cork tiling was laid in the 190-C Control Room to alleviate the extremely noisy condition which was interfering with vital communications.

C. Improvement Experience

CG-558 - Inspection of the No. 4-A bypass valve in 190-B Annex revealed a cavitation area on the downstream side of the valve body. Concurrent radiographic testing at several critical locations on all bypass piping did not disclose any serious cavitation damage. A similar inspection of No. 1-A bypass valve was negative. It was concluded from these inspections, and inspections in other areas, that the cavitation damage in the bypass valves occurred prior to the final improved design. Number 2-A speed increaser gear in 190-B Annex was inspected for wear. Photographs and gear impressions were taken. As recommended, 2 percent by volume of T.C.P. (Tri-Cresyl-Phosphate) was ordered to be added to the lubricating oil. The pitting is not severe or destructive in nature; however, continued inspections will be necessary to confirm these findings.

58-IP-47 - 3500 HP Induction Motor Power Loss Relays - 190-C - The job is now 90 percent complete. 58-IP - Aluminum Oxide - Sulfuric Acid Feeders - 183-B - The prototype Bauxite feeders were put in service on December 10; data is being compiled for a final design.

Project CA-696 - Coal Car Shakers - 184-B - Delivery of the hoisting equipment has been delayed by a strike; work is 80 percent complete.

- D. Events Influencing Costs - Revamping of the 183-C acid unloading facility, and the continued 190-B Annex exciter slip ring and commutator work have kept maintenance costs high.

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MAINTENANCE OPERATION

- A. Equipment Experience - The modification of the 105-B dewcel chambers has been completed and cells are in the process of being cleaned; the porcelain used to hold the heater windings had to be replaced with wax as the porcelain was causing a corrosion problem. Exciter inspections were completed on all eight motors at 190-B; all commutators were turned and new brushes were installed where necessary. New type slip ring brushes were installed on two of the motors. Stoning of the commutators proved superior to removing the commutator and turning it on a lathe; also, considerable time was saved.

The process tube rib reducing machine for C tubes was set up in the 185-B Building and the reduction of new process tube rib height by 13 mils is in progress. Adaptations on the C Elevator (C Reactor) to facilitate the overhead charging machine were completed; the charging machines have been installed in the carriage frames and are ready for elevator installation; the overhead charging machine installation is twenty percent complete at the end of the month. The 183-C acid pump station revision was completed. The No. 4 pump at 190-C lost oil pressure on an attempt to place the unit in service; the trouble was traced to a broken gasket on the fluid drive oil pump discharge and repairs were completed.

- B. Maintenance Engineering - A proposal has been issued recommending the gradual transition from iron-constantan wire to Geminol wire for monitoring the B graphite stack temperatures because test results of Geminol wire indicate that it is more stable and corrosion resistant than conventional iron-constantan wire and will have a longer operating life. As a result of Process Pump No. 5 (190-B Annex) being tripped off the line during start by the instantaneous relays, oscillograms of the starting current were made for all units except No. 1; preliminary examinations of the oscillograms indicate that the instantaneous relay settings should be increased slightly.
- C. Planning and Scheduling

Productive Maintenance - During December, 2,575 man hours of work were scheduled. This included 1,726 man hours scheduled for December and 849 man hours carried over from previous months. The total included 79 Class A overhauls, 239 Class B overhauls, 27 Class C overhauls, and 13 lubrications. Of this total, 2,046 man hours, or 80 percent were completed. Reasons for non-completion were: Jobs in progress - 4 percent, shutdown items - 4 percent, equipment not available - 2 percent, insufficient manpower - 10 percent; total 20 percent. During this period, equipment condition dictated changing 3 Class A overhauls to Class B, 4 Class B to Class A, and 3 lubrications to Class B.

A. R. Maguire

Manager
B-C REACTOR OPERATION

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D-DR REACTOR OPERATION
DECEMBER, 1958

I. ORGANIZATION AND FUNCTIONS

The Operation was assigned additional responsibility relative to suggestion evaluation on December 15. The most significant additions were IPD-wide evaluation responsibility for suggestions originating in the Level III Operation and correspondence directly with the suggesters in these suggestions.

II. PERSONNEL

A. <u>Force Summary</u>	<u>Nov. 30, 1958</u>			<u>Dec. 31, 1958</u>			<u>Net</u> <u>Change</u>
	<u>NE</u>	<u>E</u>	<u>Total</u>	<u>NE</u>	<u>E</u>	<u>Total</u>	
General	3	4	7	3	3	6	-1
D Processing	38	16	54	38	16	54	
DR Processing	35	15	50	35	16	51	+1
Power	102	15	117	102	15	117	
Maintenance	<u>123</u>	<u>22</u>	<u>145</u>	<u>124</u>	<u>22</u>	<u>146</u>	+1
Total	301	72	373	302	72	374	+1

B. Movement of People

Effective December 1, R. H. Nelson, Specialist, Reactor Operations F Processing Operation, was promoted to supervisor, 100 Operations I, DR Processing Operation, to fill a vacancy.

Effective December 1, W. L. Smalley, Specialist, Administrative Programs, D-DR Reactor Operation, was assigned to Research and Engineering Operation as Engineer I, Operational Physics Operation.

Nonexempt personnel movement during December included seven transfers in, and six transfers out.

III. PERSONNEL ACTIVITIES

A series of four Christmas Information meetings were held on December 23 for 100-D Area people. The year's accomplishments and some plans for 1959 were reviewed after which refreshments were served. A majority of the 100-D Area people on all shifts attended.

A potluck Christmas dinner, planned and prepared by the secretarial and clerical personnel, was participated in by 40 Building 1704-D people on December 17, 1958.

IV. SAFETY AND SECURITY

There were 17 medical treatment injuries reported during December. No security violations were incurred.

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V. NON-ROUTINE REPORTS

Special Incident Report, Operational Incident, DR Reactor, December 5 and 6, 1958 by J. H. Brown dated December 15, 1958 was issued during December.

VI. INVENTIONS AND DISCOVERIES

All persons engaged in work that might reasonably be expected to result in inventions or discoveries advise that, to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during the period covered by this report. 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.

VII. COMPONENT ACTIVITIES

GENERAL

A. Administration Activities

The study to evaluate the impact of proposed Employee Relations Operation functional changes on the work performed within D-DR Reactor Operation was completed.

Coordination was provided for planning 1959 Exempt Salary Action in D-DR Reactor Operation.

Coordination was provided in making arrangements for the 100-D Area tour of IPD Central Health, Safety and Security Council members following the monthly meeting on December 9.

Revised procedures for suggestion evaluation in D-DR Reactor Operation were under development during the month in line with the change in the Employee Relations Operation evaluation responsibility. Suggestion statistics for the month of December were:

Unanswered at Beginning of Month	44
Received for Evaluation	40
Evaluations Reopened	2
Suggestion Replies	31
Unanswered at Month End	55

B. Personnel Development

There were no rotational pool technical graduates assigned in D-DR Reactor Operation during December.

C. Cost Control Activities

The IPD General Manager's approval was obtained when it became apparent that the revised D-DR Reactor Operation quarterly overtime control limit for October, November, and December would be exceeded (3.16 per cent of available manhours).

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D. Landlord Activities

Landlord alteration work during the month involved providing space in the Building 1719-D Annex to house duplicating service facilities previously located in Building 1717-D, installing the General Electric signature and monogram above the 100-D Area Safety Marquee, modifying HLO offices in Building 1707-D, and providing a railroad spur unloading station south of Building 183-D.

The project proposal for relocation of a dormitory from 1100 Area to 100-D Area was received and approved by the Manager, D-DR Reactor Operation.

A meeting was held with the Manager, Maintenance and Supervisor, Maintenance Planning and Scheduling to obtain concurrence of a planned approach to scheduling and follow-up of janitor work. At month end final details were being developed.

D PROCESSING OPERATION

A. Production

Input production was 114.7 per cent of official forecast. Maximum operating levels were limited when the maximum power level allowed by the Reactor Safeguards Committee was reached.

Time operated efficiency for December was 90.2 % which was 106.1 % of forecast.

B. Operating Experience

1. Operating Continuity

There were three outages during the month. One scram and succeeding rupture were caused by a rupture and one unexplained Panellit scram occurred.

<u>Date</u>	<u>Hours</u>	<u>Cause</u>
12-13-58	0.2	Panellit -- rupture 4067-D,
12-13-58	72.2	Rupture in 4067-D and charge-discharge
12-29-58	<u>0.3</u>	Panellit scram, row 26 - unexplained
Total	72.7	

2. Equipment Experience

a. Vertical Safety Rods

No. 13 VSR has remained out of service the entire month due to an obstruction in the channel.

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Equipment Experience (Con't.)

b. Splines

Splines were used for turnaround control following the outage of 12-13-58. A total of 30 splines were inserted during the outage for removal following start-up. All were removed without difficulty.

During the shutdown, three problem splines were removed by flushing the metal from the tubes and finally clearing the tubes with a push pole

Spline statistics for the month are as follows:

Total splines inserted	34
Total splines removed	58
Balance in Pile	2

During the shutdown, all spline caps were removed and repositioned on nozzles to adjust the spline seals to the proper position and insure that the seals were not distorted by excessive pressure on the cap. At the same time, the tube charges were inspected to be certain upstream dummies were in position. It is anticipated that this action will alleviate the difficulty encountered in inserting splines through the caps and under the metal. Results to date indicate that effort was effective, since incidents where splines could not be inserted through the cap have occurred less frequently than before.

c. Ruptures

4067-D - I & E Enriched, Lot Number KH-033-C, with an exposure of 688 EFT per ton.

As a result of the rupture, 8 other I & E Enriched tubes of this lot number were discharged at near goal concentration to reduce the rupture potential.

C. Improvement Experience

1. Production and Process Tests

a. IP-155-B - "Evaluation of Re-designed Bourdon Tubes for CG-558 Panellit Gauges"

The 19 gauges which were in the board at the end of November continued in service in December without incident.

b. IP-95-A-79-MT - "Irradiation of Lead Dipped Canned I & E Slugs in D Reactor"

Thermocouple stringers were removed from 3 tubes, and 5 tubes were discharged for special pickup on this test.

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D. Radiation Monitoring Experience

1. Radiation Occurrences

One lapse of radiation control occurred during the month. A 55-gallon metal drum was found near the regular burning pit having interior contamination up to 10,000 c/m. The maximum on short pipe sections beside the drum was 65 mrad/hr @ surface. Investigation revealed the tank had been used in the 105-DR Turco decontamination work and transferred to the burning pit by unknown persons.

2. External Exposure Control

The 1958 exposure year ended on December 18 at 8:00 A.M. for 100-D Area. The average accumulated gamma exposure for D Processing Operation Radiation Monitors was 2851 mr per man. Six Monitors were above 2900 mr for the year, the maximum being 2972 mr. The maximum for Processing Operators was 2861 mr.

Special badges were worn by crews during spline removal after the reactor was started up. Twenty-four splines were removed at an average total exposure cost of 35.6 mr/spline. The splines were pulled remotely and the exposure was mostly received in handling equipment. The maximum dose rate received was 700 mr/hr. The previous experience had been 19.5 mr/spline.

E. Events Influencing Costs

No unusual variations in controllable costs are expected for December.

DR PROCESSING OPERATION

A. Production

Production was 98.5% of the official forecast. Time operated efficiency was 72.6% which was 92.4% of forecast. Failure to meet the forecasts was caused by the continuing tube leaking problem and the simultaneous occurrence of four ruptured slugs.

B. Operating Experience

Operating continuity was interrupted by one scram and three unscheduled outages.

<u>Date</u>	<u>Hours</u>	<u>Cause</u>
12-4-58	36.9	Panellit scram caused by failure to jumper panellit when charging PCCF tube 3678.
12-5-58	44.9	Ruptures 4070-DR, 4170-DR, 4271-DR, 4466-DR
12-15-58	37.9	Leaking tube 1684-DE.
12-19-58	34.5	Leaking tubes 2846-DR and 4175-DR, replaced 90 other tubes with low residual wall thicknesses.

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2. Equipment Experience

Ruptures

- 4070 - Charged 9-1-58, lots KE-113-A, KE-58-A, CA-859-A, effective full ton concentration 409, charge could not be saved for inspection, removed with charging machine.
- 4176 - Charged 9-1-58, lot VA-016-A, concentration 342, longitudinal split type, a maximum of 15,000 pounds force required to remove charge. The tube was removed and the channel was left empty.
- 4271 - Charged 9-1-58, lots KE-061-E and CA-128-A, effective full ton concentration 363, charge could not be saved for inspection, removed with charging machine.
- 4466 - Charged 2-8-58, lot KE-012-A, effective full ton concentration 850, longitudinal split variety, removed with charging machine, after first breaking the charge loose with 4,000 pounds force.
- 4076 - Charged 9-20-58, lots KH-011-C, 150 R/hr pigtail indication, discharged with charging machine. No ruptured piece was found when the metal from the tube was inspected by means of the underwater viewer.

These ruptured slugs all occurred on 12-5-58. They apparently were caused by the distortion of the neutron flux to the top center of the reactor during the cold start-up on this date. Eighty-two tubes of solid metal, both regular and enriched, were discharged below goal concentration to eliminate potential ruptured slugs. The discharge list was based on removing charges of regular metal that exceeded a concentration of 200 MWD/ton and charges of E-metal that exceeded 300 MWD/ton, effective full ton concentration. Additional details are reported in document No. HW-58560.

Tube Water Leaks

During periods of operation, the collection of condensate from the gas system averaged 105 gals/day. Three leaking tubes were found and replaced: 1684-DR, 1575-DR, 2266-DR. Ninety other tubes from the high external corrosion central zone were replaced at a rate of 27 minutes per tube.

Building Sewers

Grout was pumped under the floors of the washpad, part of the main corridor and monitor room to fill voids. Work continued on the re-routing of steam condensate lines so that they will discharge outside of the cast iron sewer system.

Process Tube Thermocouple Replacement

Replacement of the original thermocouples was completed.

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Panellit

All gauges have been converted to 10-90 trip settings.

C. Improvement Experience

1. Production and Process Tests

<u>Test No.</u>	<u>Description</u>	<u>No. of Tubes Charged</u>	<u>No. of Tubes Discharged</u>	<u>Total No. of Tubes in Reactor December 31</u>
PITA IP-4-I	Use of I & E-E-Metal at B, D, DR F and H Reactors	44	1	102
PITA IP-6-I	Central Zone loading of I & E into DR Reactor	357	69	1166
PT-IP-16AE	Functional Test of Individual Tube Flowmeters	This test has been in operation since March, 1957. The equipment is now being removed for an inspection to determine the wear on the components.		

2. Projects

AEC-160 - Recirculating Gas Loop

Construction is approximately on schedule.

MJA-11 - Graveled Surface Roof Repairs

The work order was closed out by Project Engineering. However, some major repair work of the roof over the DR Reactor building still must be performed.

3. Other

Crossheader Pressure Differential Monitor

Installation of the system was completed. The system generally worked satisfactorily during all outages this month. However, there are two pressure gauges and the relay to the control room annunciator that are out of service and need repair or replacement.

Gas Moisture Monitor

Instrument Development Operation is running a test on the revised recorders that have been re-installed in the control room. These recorders have not been connected to the dew cells. Instrument Maintenance has been waiting for the reactor to dry out before making the connection.

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Dummy Decontamination Facility

The new 1-ton remotely controlled hoist was installed on the washpad. However, the winch shaft broke shortly after the hoist was put in service.

D. Radiation Monitoring Experience

1. Radiation Occurrences

No lapses of radiation control were experienced during the month.

2. External Exposure Control

A total of 5 employees received whole body dose rates of 3 to 4 r/hr while surveying for and placing "quickie" equipment on tubes containing ruptured pieces. The maximum reading on pigtailed associated with these ruptures was 150 rads/hr. Other dose rates to personnel were 2 r/hr while hanging plastic sheeting and to 1 r/hr while removing the rupture tube.

Personnel were exposed on repeated occasions to dose rates ranging from 30 mr/hr to 1000 mr/hr during drier room entries to drain condensate collected in the turbine export line.

E. Events Influencing Costs

Maintenance costs will be high because of the cost of new tubes and labor costs incurred to replace 93 tubes and remove four ruptured slugs.

D-DR POWER OPERATION

A. Operating Experience

The steam generating load was 99,387 pounds per hour average and 372,000 pounds per hour maximum. The average evaporation rate was 9.24 pounds of steam per pound of coal.

A 100-D and DR Area Electrical Power failure test was conducted at 7:00 P.M. on December 16. The test was conducted by tripping the 230/13.8 K.V. transformer bank circuit breakers in the 151-D substation. The test was completed at 7:32 P.M.

B. Equipment Experience

103-D Building

Seven tons of special graded sand and some Hagan No. 2 coagulant aid were added to Number 1 filter for test purposes on December 16.

The existing Bailey flow meters on the raw water supply were replaced with Republic flow meters on December 26. This was necessary as the total raw water flow exceeded the existing Bailey meter flow range.

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190-D Building

The running assembly from the Number 3 pump unit motor was removed for inspection on December 1. The motor was found to be in good condition except to re-tie eight of the coils to the bull rings. The primary impeller and wear rings were replaced in the pump at this time. The unit was placed in service on December 9.

The primary impeller and wear rings were replaced in the Number 4 pump unit on December 31.

190-DR Building

Number 8 annex process pump unit bypass valve was inspected on December 4 for cavitation and corrosion. A slight indication of cavitation was found.

Number 7 process pump unit was removed from service on December 8 to replace the primary and secondary impellers with a newly designed impeller. A performance and production test was conducted on this unit on December 12. (For reference see H.W. Document No. 58464 - Unclassified.)

Number 6 annex process pump unit was removed from service on December 15 to inspect the impeller and wear rings. Number 5 pump unit was removed from service on December 23 to replace the primary impeller and wear rings.

C. Events Influencing Cost

No unusual costs are anticipated for the month.

D-DR MAINTENANCE OPERATION

A. Equipment Experience

1. Instruments

a. Temperature Monitor System

105-DR - The installation of thermocouple wire was completed during the month when the final 12 bundles were installed during two outage periods.

b. Pressure Monitor System

105-DR - The final 183 gauges for I & E service were installed during the month.

c. Moisture Detection System

105-DR - Instrument Development and DR Instrument Maintenance are working together in an effort to improve the reliability of the Dew Cell segmental recorders. In the remainder of the system

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105-DR (Con't.)

impulse lines are being cleared and dew cell windings repaired.
This phase of the work will be completed by January 16, 1959.

2. Mechanical

190-DR - The following process pump impellers were removed and sent to the White Bluffs machine shop for inspection and repair:

3 - D
4 - D
5 - DR
6 - DR
7 - DR

B. Shift Maintenance Activities

100 D-DR Area

During the month some of our shift personnel approached their yearly exposure limits, and it was necessary to remove them from the master overtime list for exposure work. By doing this we were able to finish out the exposure year with one (1) man above 2900 mr and four (4) other men above 2800 mr.

C. Maintenance Engineering

1. Instrument Engineering

Rear Face Thermocouples, 105-D

An inspection of the rear face thermocouples, occasioned by reports the solder was failing at the hot junction, revealed that a small percentage (less than 5%) were never properly soldered when installed. The extent of improper couples does not warrant a planned program of resoldering but we can expect to have these 100 couples require repair during the next few shutdowns.

Rear Face Thermocouples, 105-DR

This job is completed and performing satisfactorily.

Increase Capacity of 183-D Raw Water Flow Meters

This job is completed and performing satisfactorily.

190-D Cone Valves

Pursuant to the successful testing of a prototype installations, the manual control piping on the level control cone valves on the other three 190-D tanks was completed. This will permit manual operation after removing the automatic pilots for maintenance. Previously the valves were inoperable during maintenance interims.

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DR Crossheader Pressure Differential Gauges

Installation is complete and the system working. However, some carbon steel pivots in the indicators will need replacement with stainless pivots to preclude corrosion. Also several leaking gauge covers will require repair to complete the job.

Dummy Sorter

Wiring changes for the sorter are complete with the exception of two switches which are not yet available.

Panellit Coordinate System

At our request a preliminary mock-up using static switching techniques was made and demonstrated by the Electrical Development Operation. Cost estimates have been requested by both D and DR Processing Operations

Remote Rear Face Radiation Monitoring

Tests made on this equipment have shown that it is not suitable, as received, for operation in rear face environment. Extensive changes will be required to make it sufficiently reliable for our use.

2. Electrical Engineering

Scram Discriminator, 105-DR

A request to provide a scram discriminator for determining the cause of scrams in 105-DR was received. Design Change #231 recently installed at D Reactor will not work due to the lack of a time delay in the 1KY at 105-DR.

Removal of Process Water Low Pressure Contacts

Design Changes to accomplish the removal of the low pressure contacts in the safety circuits of both D and DR Reactors are being prepared. The function of these contacts has been superseded by the Panellit gauges which are individually more sensitive and capable of initiating a scram.

190-D Tank Liquid Level Indicators

Design Change #248, which provides for pressure switch actuation of annunciators in lieu of a float and tape system, has been prepared.

3. Mechanical Engineering

Powered Crossheader Valve Turners

All parts are on order and initial fabrication was started upon receipt of the shafting.

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Hi-Tank Pit Bracing

The reinforcement of far high tanks pits in both D and DR Reactors to accommodate metal lift truck traffic is complete.

DR Downcomers

Effluent vapors have recently denied entry to the near downcomer. We have ordered plastic "sausages" to inflate in the effluent line to form a vapor seal.

Powered Charge Head

Upon completion of successful prototype tests at 100-B, four pneumatic charge heads were ordered for the D-DR charging machines.

Compressed Air Supply

The bulk of work remaining on the new D-DR Reactor air supply system is renovation of existing piping in the D Reactor end of the tunnel.

4. Planning and Scheduling

During the month, the following P.M. work was accomplished:

Class "A"	22
Class "B"	44
Class "C"	178

The relative status of the P.M. work remained substantially the same with the instrument work in the water area and the electrical work on the DR side somewhat behind schedule. Electrical and Instrument crafts have been concentrating their manpower on the fabrication and installation of 2,000 pairs of thermocouple wires in 105-DR, and the Instrument craft, in addition, has reworked and installed 4,000 Panellit gauges in the past two years.

The backlog of work against other crafts was generally reduced, except for welders and pipecoverers.

D. Events Influencing Costs

At the completion of the I & E Panellit gauge work, 422 useable gauges were left over, of which 322 were returned to spare parts for a credit of \$22,540.

During the month it was necessary to use overtime as follows:

Nonexempt	- 906 manhours
Exempt	- 156 manhours

J. H. Brown/RDM
Manager,
D & DR Reactor Operation

JHBrown:JDR:ab

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F REACTOR OPERATION
DECEMBER - 1958

I. ORGANIZATIONS AND FUNCTIONS

No change in assigned responsibilities.

II. PERSONNEL

A. Force Report

	<u>November 30</u>			<u>December 31</u>			<u>Net Change</u>
	<u>E</u>	<u>NE</u>	<u>Total</u>	<u>E</u>	<u>NE</u>	<u>Total</u>	<u>of Total</u>
General	3	2	5	3	2	5	0
Processing	15	38	53	15	38	53	0
Power	7	53	60	7	52	59	-1
Maintenance	<u>13</u>	<u>71</u>	<u>84</u>	<u>13</u>	<u>71</u>	<u>84</u>	<u>0</u>
Total	38	164	202	38	163	201	-1

B. Movement of People

R. H. Nelson, Specialist - Reactor Operations, transferred from F Processing Operation to DR Processing Operation as Supervisor - 100 Operations I.

Nonexempt personnel moves consisted of nine transfers in, including one rehire from military leave, and ten transfers out, including two retirements, 1 deactivate, one leave of absence and one transfer under the R.O.F. program.

There are no Technical Graduates presently assigned to F Reactor Operation.

III. PERSONNEL ACTIVITIES

Five exempt and one nonexempt personnel participated in scheduled I.P.D. training programs.

S. L. Nelson, R. C. Christianson, J. K. Clausen and W. DeGooyer attended the technical information meeting on the Helium Symposium.

C. N. Gross, Manager, conducted a Conference Table Meeting with seven exempt employees participating.

IV. SAFETY AND SECURITY

There were seven medical treatment injuries reported. No disabling injuries and no security violations were reported.

V. NONROUTINE REPORTS ISSUED

The manuscript, "Radiation and Contamination Control at the Hanford Reactors," by S. L. Nelson, for presentation at the 1959 Nuclear Congress.

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HW-58621, "Radiation Occurrence Investigation Report, 105-F," by W. G. Westover.

VI. INVENTIONS AND DISCOVERIES

All persons engaged in work that might reasonably be expected to result in inventions or discoveries advise that, to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during the period covered by this report. 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.

VII. COMPONENT ACTIVITIES

GENERAL

A. Administrative Activities

Co-ordinated activities related to the increased responsibility for administration of the Suggestion Plan as assigned to the Level III Operation due to reduction of manpower in Employee Relations Operation.

B. Cost Control Activities

Operating cost data for CY 1958 and FY 1959 were assembled and comparative operating costs of reactor plants was presented in a F Reactor cost meeting.

C. Landlord Activities

Information regarding available space in the 185-F, 189-F and 1713-F Buildings was supplied to interested parties.

Building Roof Repairs (Project CA-762) - Phase II roof repairs were completed during the month.

D. Suggestion Plan Activities

To be evaluated - start of month	38
Received for evaluation	29
Evaluated and returned	34
Unanswered - end of month	33

F PROCESSING OPERATION

A. Production

F Reactor production was 153.1 per cent of forecast during December. The reactor operated at the ACRS limit throughout the month with a time operated efficiency of 100 per cent. Previous maximums in daily level and production were each exceeded by 15 units and previous maximum monthly net production was exceeded by 4732 units, establishing a new monthly net production record for the old reactors.

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B. Operating Experience

1. Operating Continuity

There were no interruptions to reactor operation during the month.

2. Equipment Experience

a. Water Leaks - Collection rate remained at 30 to 35 gallons per day throughout the month.

b. Gas Leaks - Replacement of several leaking rear boots late in November and miscellaneous repairs in 110-F and 115-F reduced gas usage during the month.

D. Radiation Monitoring Activities

1. Radiation Occurrences

No radiation lapses of control were incurred this month. One lapse of control was carried over from the previous month and involved the discharge of dummy pieces on the discharge elevator as previously reported.

2. External Exposure Control

All F Reactor personnel received less than 3 r gamma exposure during the 1958 badge year, as evidenced by personal meter results.

Favorable operating experience led to less than normal radiation exposure to individuals during the month of December with no employee being exposed to dose rates in excess of 2 r/hour.

3. Contamination Control Experience

Contamination levels inside of water plant equipment were higher than normal with levels of 5000 c/m detected on 181 pump components, 60,000 c/m on 183 filter beds and 1500 c/m on 190-A pump components. Confinement of contamination within controlled areas was readily accomplished.

F POWER OPERATION

A. Operating Activities

1. One pump in 182 Building was placed in service on export raw water system from 6:50 p.m. to 7:05 p.m. on December 16 at the request of D/DR Power Operation during scheduled electrical testing in 100-D Area.
2. Approximately 180 tons of coarse grade Anthrafil was added to all 12 filters to replace normal losses and the fine particle size Anthrafil which had been removed.

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B. Equipment Experience

1. Overhaul of No. 13 raw water pump at 181 Building was started on December 2 and is approximately 40 per cent complete.
2. The stator for No. 5 process water pump motor in 183 Building was rewound and returned to service on December 3. The pump for this unit was found to be in good condition.
3. Inspection and minor repairs on stator windings for Nos. 1A and 3A process water pumps in 190 Building Annex were completed on December 10 and 19, respectively.
4. The discharge line cone valves and bypass valves for Nos. 1A and 3A process water pumps in 190 Building Annex were inspected and adjusted. No evidence of cavitation was detected in bypass valves. The slight erosion on end of valve plug for bypass valves is not considered significant. Adjustment of valve mechanism for No. 3A cone valve corrected the valve leakage problem.

C. Improvement Experience

1. Project CG-558, 190 Building Annex

Modification of No. 1A process water pump rotor assembly and inspection of No. 2 bearing and oil lines for this unit was completed on December 10. A type PW-1417-1 impeller was installed on first stage and type PW-1416-1 impeller was installed on second stage. The wheel rings for both impellers were installed with shrink fit. The carbon seal assembly for inboard side of pump shaft was replaced because of excessive wear.

A repaired first stage impeller type PW-1417-1 with shrink fit wheel rings was installed on No. 3A process water pump. The second stage impeller for this pump was found to be in good condition. Repair work and inspection of No. 2 bearing and oil lines for this unit was completed on December 19.

2. Project CA-696, Coal Car Shake-Outs

All work is completed except electrical wiring and installation of hoisting equipment. January 12 is the estimated shipping date for hoist from factory.

3. Project CA-751 - Steam Line Support Pole Replacement - Phase III

The completion date for this work was December 8.

4. Project Test IP-204.1 - Addition of Alum to West Side Filter Effluent Flume

Test was started on December 17 and suspended temporarily on December 31 to permit study of results by participating groups. Resumption of test may be delayed until period of low quality raw water.

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D. Events Influencing Costs

The following items will increase maintenance costs: (1) repair work on No. 13 raw water pump in 181 Building and on No. 5 process water pump motor in 183 Building, (2) repair work on stator windings for Nos. 1A and 3A process water pump motors in 190 Building Annex, and (3) addition of coarse grade Anthrafil in filters in 183 Building.

Coal consumption costs increased approximately 17.7 per cent over previous month while chemical unit costs will decrease approximately 3.0 per cent.

F MAINTENANCE OPERATION

A. Equipment Experience

1. Instrument

A program to improve the performance of the Helium Leak Detector facilities was undertaken. Efforts were devoted to the repair, modification, calibration and establishing adequate spare parts.

Thirteen reactor rear face thermocouples failed during December. Repairs have been scheduled during the next reactor outage.

2. Electrical

The Fire Alarm System was checked throughout the area and abnormal grounding conditions were corrected.

3. Mechanical

Several revisions were completed to the prototype charge positioning tool.

The two stinger flushing machines designed to provide a pulsating flow for discharging metal during shutdown periods have been completed.

New spray headers have been fabricated for the rear face and the rear wall of the discharge area. The present spray system on "D" elevator will be removed to eliminate the trail hose.

A coupling was installed in the operating shafts of the No. 1 and No. 3 bypass valves at the 190 Annex. These valves can now be removed without the need of an electrician or millwright.

The revision of the dichromate system at the 185 Building was started and is approximately 16 per cent complete.

B. Maintenance Engineering

1. 190-F Process Flowmeter Impulse Lines

Evaluation of a flexible hose for use on the flowmeter connections

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was completed and rejected due to the safety hazards involved. A program will be continued to replace the soft solder couplings with flare fittings.

2. Process Water Pressure Low Trip Safety Circuit Deletion

A formal Design Change No. 246-F was approved and issued to help minimize unnecessary scrams by removing components in the No. 1 Safety Circuit not specifically required by Process Standards.

3. No. 1 Safety Device Bypass Annunciation

Design Change No. 251-F has been completed and approved to provide an alarm when safety circuit systems are bypassed.

4. Revision of Instrument Productive Maintenance Specifications

Revisions to the Instrument P.M. Specifications for the F Reactor Operation systems were completed.

5. Charge Seater - 105-F

The revisions to the charge seater to overcome some mechanical weaknesses were completed.

C. Planning and Scheduling

1. Property Control

An "In Service Spare" equipment allowance list for F Reactor Operation was established and In Service Spare Equipment Authorization Cards for 35 pieces of spare equipment were forwarded to Plant Accounting Operation.

Other activities involving property control involved the transfer of 11 movable items to fixed category, transfer of six movable items to the In Service Spares caption along with four items excessed and one item transferred to others.

2. Productive Maintenance

Approximately 21 per cent of the available manpower was assigned to productive maintenance, including the completion of six Class A overhauls and 244 Class B inspections.

MANAGER, F REACTOR

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H REACTOR OPERATION

December, 1958

I. ORGANIZATION AND FUNCTION

No change.

II. PERSONNEL

A. Force Summary

	<u>November 30</u>			<u>December 31</u>			<u>Net Change</u>
	<u>E</u>	<u>NE</u>	<u>Total</u>	<u>E</u>	<u>NE</u>	<u>Total</u>	<u>of Total</u>
General	3	2	5	3	2	5	0
Processing Oper.	16	39	55	16	39	55	0
Power Operation	9	51	60	9	50	59	-1
Maintenance Oper.	13	61	74	13	62	75	+1
Cent. Maint. Oper.	17	96	113	16	99	115	+2
Total	58	249	307	57	252	309	+2

B. Movement of People

W. J. Ferguson, Supervisor, Central Maintenance Engineering, was transferred to B Processing Operation, B-C Reactor Operation, as Analyst, Reactor Operations, effective December 1, 1958.

M. W. Durkin, painter journeyman, was temporarily promoted to Supervisor, Special Maintenance for the period December 1, 1958 to January 4, 1959.

H. W. Murray, millwright journeyman, was temporarily promoted to Supervisor, Shift Maintenance for the period December 22, 1958 to January 4, 1959. Both promotions were to provide vacation relief.

Nonexempt personnel movements in December included seven transfers in, four transfers out, one deactivation and one reactivation.

III. PERSONNEL ACTIVITIES

D. S. Lewis attended a meeting of the American Standards Association in Detroit, Michigan on December 9, as a member of sub-committee No. 6 of the committee on reactor safety standards.

On December 2, approximately 15 exempt members of the Operation attended an orientation meeting and tour of Fuels Preparation Department Facilities in the 300 Area.

IV. SAFETY AND SECURITY

There were no disabling injuries, radiation incidents or security violations during the month. A total of 15 medical treatment injuries were reported.

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V. NONROUTINE REPORTS

None

VI. INVENTIONS AND DISCOVERIES

All persons engaged in work that might reasonably be expected to result in inventions or discoveries advise that, to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during the period covered by this report. 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.

VII. COMPONENT ACTIVITIES

General

- A. Administrative Activities - H Reactor Operation presented the regular quarterly safety and security meeting for all clerical and secretarial people in 100-H Area.

Developed, evaluated, and secured Reactor Operations approvals for two position guides to establish the positions of Assignment Engineer and Assignment Supervisor in the Reactor Operations. These guides provide increased flexibility in absorbing Technical Graduates and providing developmental opportunities for experienced supervisors.

- B. Personnel Development - Six employees attended December sessions of a total of two IPD Training Program courses. Five employees continued participation in the current FBM-I classes. Ten employees attended one or both of two sessions of the Maintenance Operation Electrical course. One Technical Graduate completed his assignment in the Processing Operation and another began an assignment in the Central Maintenance Operation. Total assigned at month end, one.

Two sessions of the Maintenance Operation electrical training course were presented.

- C. Cost Control Activities - Routine during December.

- D. Landlord Activities - Routine during December.

- E. Suggestions - At start of month 56; received for evaluation during month 24; evaluated and returned, 47; balance at end of month, 33.

H Processing Operation

- A. Production

Maximum possible production was obtained in December as the result of 31 days of operation at the ACRS limit. This run established a complete set of new production records for H Reactor. Production exceeded the forecast by 25.9 per cent.

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B. Operating Experience

1. Operating Continuity

H Reactor operated continuously during the month.

2. Equipment Experience

Except for leaking rear pigtails, all equipment functioned normally.

C. Improvement Experience

Several minor improvements to equipment, each of which contributed to cost performance but do not merit individual mention, were completed this month.

D. Radiation Experience

There were no significant problems involving radiation control.

1. External Exposure

The highest annual exposure received by personnel assigned to 100-H Area was 2983 mr. This was received by a pipefitter.

The average annual gamma exposure of radiation monitoring personnel assigned to 100-H Area was 2630 mr. The high monitor received 2719 mr, the low, 2191 mr.

E. Events Influencing Costs

Overtime requirements for the month consisted of 10.5 hours for processing and 1.0 hour for monitoring. The record operating performance had very beneficial effects on unit costs.

H Power Operation

A. Operating Experience

The average steam generating rate was 53,042 lbs/hr, with evaporation rate of 7.41 pounds of steam per pound of coal.

A surge occurred on the export water system between 7:05 and 7:15 p.m. on December 16, in conjunction with a trip-out test in 100-D Area.

Standard quality process water was produced throughout the month with an average alum feed of 4.1 ppm.

B. Equipment Experience

General - During rain storms in the early part of the month, several roof leaks and/or wall leaks were observed in Buildings 190-H pump room and tank room and 183-H filter floor. As an aftermath of high winds on December 31, the greater part of the roof expansion joint cover in Building 190-H pump and tank rooms was damaged.

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Building 183-H - Realignment of process water pumps Nos. 2, 3, and 4 was completed. The addition of anthrafil was completed on December 2. Approximately 225 tons were required to bring the beds to normal level.

The east raw water cone valve was isolated on December 7, due to excessive water leakage through the packing gland. Since adequate capacity was obtained through the by-pass, valve repairs were delayed until early January.

Building 184-H - Overhaul of No. 3 boiler was completed on December 2.

Building 190-H - The six-inch parabolic assemblies in annex pump unit by-pass valves Nos. 2, 3, and 6 were replaced with four-inch parts on December 16. This completes the installation of four-inch assemblies in all eight by-pass valves.

In conjunction with a high flow Turco purge scheduled for early January, several modifications were made to the solids feed system.

C. Improvement Experience

Project CA-696 - Coal Car Shake-out - No activity on this project during December.

H Maintenance Operation

- A. Instrument Maintenance - Five leaking Panellit gages were replaced during operation. The oxygen analyzer and moisture monitor systems required only a nominal amount of service, as compared to the extensive maintenance previously required.
- B. Electrical Maintenance - The D elevator hoist motor blowers were reactivated to help prolong the life of the motors. The area fire alarm boxes were changed to a three-digit numbering system, replacing the two-digit system that required replacement of code wheels. Stations were renumbered and timed.
- C. Mechanical Maintenance - The KAPL-120 heat exchanger piping fabrication was completed, except for installation during the next outage. The loop piping installed during a previous outage, will be completed then.
- D. Maintenance Engineering
 - 1. Graphite Thermocouple Stringer--2577-H - This stringer has been in service since June 3, 1958. Resistance measurements, taken December 24, were found normal, indicating no apparent damage to any of the 11 iron-constantan thermocouples.
 - 2. Oxygen Analysis Equipment - Procedures are being prepared for operating the reactor gas system at the lowest pressure permissible to maintain the gas composition as required by Process Standards.
 - 3. Inspection of 4500 hp Motors - Building 190-H - No. 2 motor showed no signs of coil abrasions. There were minor corona marks on approximately 25 per cent of the coils. The spacer ring had to be retied at more

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frequent intervals. No. 6 motor also showed no signs of coil abrasion. There were minor corona marks on approximately 15 per cent of the coils. The spacer ring had to be tied, but less frequently than on the two motors previously inspected.

4. Revision of HCR Scram Circuitry - Design Change 233-H - A design change was prepared to eliminate the No. 1 safety circuit relay contacts from the HCR and VSR interlock circuitry to permit withdrawal of an uncooled HCR without the delay of making up the No. 1 safety circuit.
5. Deletion of Process Water Mercoids from Safety Circuit - Design Change 246-H - A design change was prepared to delete the process water mercoids from the No. 2 safety circuit since they are redundant and difficult to maintain. This eliminates the PWP and PWPA relays in the No. 1 safety circuit.
6. Film Removal from Reactor Thermal Loop Components - 105-H - Recommendations and sketches were submitted on proposed piping and necessary equipment for using oxalic acid crystals to clean thermal loop components.

Central Maintenance Operation

A. Engineering

Engineering assistance was provided for a majority of shop work and all of the field work. During tube outage work in various areas, engineers observed and assisted on tool problems. In addition an adaptor to enable the use of a torque wrench with a broach bullet-nose was designed and fabricated and experiments were continued on tools for expediting the cutting of pigtails.

B. Hot Shop

Tube removal tools were supplied to reactors for approximately 160 tubes. In addition, 119 venturis were reworked, gunbarrel flange studs and nuts were decontaminated and reworked for F Reactor, six special broaches for tube inserting were assembled for F Reactor, and ten nozzles were rebored for B Reactor.

C. Instrument-Electronic Shop

Major activities included, fabrication and calibration of leak detector probe assemblies for KW Reactor, and craft assistance supplied to FEO in connection with work being performed on the visicorder, vibration and pressure transducer tests.

D. Machine Shop

Major work included, repairs of five river pump shafts and bearing spider for 100-B Area, metalizing of seven river pump shafts for 100-F Area, fabrication of 70 splitter bodies for tube removal, and reconditioning of three 20-inch gate valves.

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E. Fabrication Shop

Major work included, fabrication of pickup tongs for H, C, D and KE Reactors, installation of an extension to laboratory hood in Building 141-F, fabricated an emergency Beckman carriage for B Reactor, fabrication of ball retrieving equipment for KW Reactor, and fabrication of acoustical baffle boxes for 100-B Area.

F. Paint Shop

The regularly scheduled three-week period for the paint forces was completed in 100-B Area, and work was started for the regularly scheduled period in 100-K Area.

G. Special Maintenance

1. Project Work - Projects currently active include, CG-666, CG-707 and CG-786. Projects assigned but inactive due to design or material requirements, include, CG-706, CG-708, CG-817 and MJA-8.
2. Miscellaneous Activities - KW Reactor thermohm replacement cleanup work was completed and preparatory work for KE Reactor was started. Re-installation of the 1706-KE high frequency generator was started. The installation of 1706-KE pre-heater coils and heat exchanger was completed satisfactorily. Preparatory work for changing 1,350 pig-tails at H Reactor was underway during the last week of the month.

Manager
H Reactor Operation

RTJessen:HCS:met

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KE-KW REACTOR OPERATION
DECEMBER, 1958

I. ORGANIZATION AND FUNCTIONS

There were no changes of assigned responsibilities during the month.

II. PERSONNEL

A. Force Summary

	<u>November 30</u>			<u>December 31</u>			<u>Net Change</u> <u>of</u> <u>Total</u>
	<u>E</u>	<u>NE</u>	<u>Total</u>	<u>E</u>	<u>NE</u>	<u>Total</u>	
General	4	2	6	4	2	6	0
KE Processing Oper.	16	41	57	14	41	55	- 2
KW Processing Oper.	14	41	55	15	40	55	0
Power Oper.	13	73	86	13	72	85	- 1
Maintenance Oper.	24	122	146	23	122	145	- 1
Supp. Crews Oper.	10	57	67	10	56	66	- 1
TOTALS	81	336	417	79	333	412	- 5

B. Movement of People

C. W. Higby, Supervisor I, 100 Operations, KE Processing, was transferred to KW Processing in the same capacity on December 1, 1958.

B. J. McMurray, Reactor Specialist, KW Processing, was transferred to KE Processing on December 8, 1958, and assigned as Acting Supervisor I, 100 Operations.

W. N. Lusebrink, Supervisor I, 100 Operations, KW Processing Operation, was transferred to APED effective December 29, 1958.

E. A. Wegener, Supervisor I, 100 Operations, KW Processing Operation, was placed on temporary assignment as Engineer, Power, to relieve G. W. Wells who, in turn, continued his relief assignment as Supervisor, Maintenance Engineering.

L. D. Loveland, Technical Graduate, assigned to K Maintenance Operation, was terminated on December 31, 1958, to continue his formal education.

Changes for the month included nine transfers in, twelve transfers out, one retirement and one deactivation.

III. PERSONNEL ACTIVITIES

R. J. Bursey replaced J. W. Baker as Manager, Supplemental Crews Operation during the latter's vacation.

T. M. Hall replaced J. T. Baker as Manager, KE Processing Operation during the latter's vacation.

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L. B. Brown conducted four information meetings with K Power Operation personnel on the various GE Benefit Plans.

Twenty-four K Plant personnel attended the IPD General Manager's Information meeting on December 10, 1958.

IV. SAFETY AND SECURITY

Twenty-one medical treatment injuries were experienced for a frequency rate of 3.07.

No security violations were incurred.

The K Plant Safety Council selected the Irradiation Testing Operation as winner of the K Plant traveling safety plaque on the basis of percentage of participation.

V. NON-ROUTINE REPORTS - None

VI. INVENTIONS AND DISCOVERIES

All persons engaged in work that might reasonably be expected to result in inventions or discoveries advise that, to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during the period covered by this report. Such persons further advised, 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.

VII. FUNCTIONAL ACTIVITIES

GENERAL

A. Administrative

A suggestion plan clinic was held for K Plant personnel associated with suggestion evaluation. Purpose of this meeting was to review progress to date and to discuss necessary procedure changes brought about by the re-organization of the Employee Relations Operation and the assumption of additional Suggestion Plan responsibilities by the Reactor Operations.

Suggestion Plan Statistics for the month were as follows:

Suggestions at start of month --	94
Received for evaluation -----	49
Replies submitted -----	44
On hand at end of month -----	99

The exempt salary review was completed and statistics were compiled for the Employee Compensation Operation.

Plans for the forthcoming K Plant Economic Discussions series were formulated during the month.

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B. Personnel Development

A film "Research Reactors - USA" was shown to 90 people in three showings. The film presented a semi-technical review of the major types of research reactors.

Attendance to IPD Training Courses was as follows:

Reactor Processing Fundamentals-I:	R. C. Theil	
Suggestion Plan:	L. E. Brown	J. C. McLaughlin
	T. M. Hall	G. F. Thomas
	J. H. M. Miller	G. W. Wells
	E. A. Wegener	E. E. Weyerts
	R. C. Theil	E. H. Kolts
	F. L. Hughes	A. P. Vinther

C. Cost Activities

An analysis was made of CY 1958 actual production costs. Major over and underruns of budgeted amounts were identified. The material, in chart form, was presented at the Monthly Cost meeting.

Planned Maintenance Costs of the KW Reactor extended outage were broken out by source and distributed to the L-4 Operations as an aid to cost planning for the forthcoming outage at KE Reactor.

A meeting was held with representatives of the Financial Operation to make a final cost review of the last two quarters of FY-59.

Special arrangements by the Plant Utilities Operation with the Bonneville Power Authority and detailed scheduling of reactor outages by the Production Operation in conjunction with the November KW Reactor outage resulted in a saving of approximately \$30,000 to IPD in interruptible electricity costs.

D. Landlord Activities

Arrangements were made to obtain new tables and chairs for the 1704-K lunchroom. The replaced equipment will be used in the 165 KE-KW lunchrooms. The wooden tables and benches in 190 KE-KW lunchrooms are also being replaced with standard type tables and chairs.

The restrooms and lunchroom in 1704-K were repainted as a part of the interior painting program.

Arrangements were made to assign numbers to the three Butler-type buildings recently moved to K Plant. The buildings will be known as 1713 KE, 1713 KW and 1713 KER.

A standby order was issued to provide for ice and snow removal from walkways in the area and at the main gate house.

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Two excavation and core drilling permits were issued.

KE PROCESSING OPERATION

A. Production

Input production was 107.7 per cent of the forecast. The maximum level during the month reached the ACRS limit.

B. Operating Experience

1. Operating Continuity

Reactor outages totaled 118.4 hours for the month. Operating continuity was affected by the following events:

<u>Day</u>	<u>Hours</u>	<u>Remarks</u>
9	60.0	Scheduled outage for metal processing.
28	58.4	I&E regular rupture in tube 3593. Following rupture removal, outage time was used for metal processing and miscellaneous maintenance.

2. Equipment Experience

- a. Instrument and Circuitry - The Component Testing Operation made in-board inspections of 145 panellit gages during the month. A number of the gages were found to have the "C" washers on the range change shaft missing. Forty-six gages were replaced. Twelve Panellit sensing lines were found restricted and were corrected. A high trip check was made on all gages prior to the startup on December 30.

Failure of MRA-1-4 relay in the temperature monitor system on December 26, caused spurious high temperature alarms. The relay was replaced. There were 94 RTD's out of service following the December 30 startup.

The graphite temperature control points were moved to the recorder at the console. The change provides the console operator with additional information for better control of heat cycles. Continuous monitoring of 12 additional graphite temperature thermocouples was made possible by the change.

b. Process Water System

The KE outfall line was inspected by the diver on the December outage. The line was found to be broken in its entire circumference with a maximum offset of six inches. End separation of five inches at the top and eight inches at the bottom was observed. Examination of the inside of the repair sleeve revealed slip marks which indicate the offshore pipe contracted one and one-half inches during shutdown, while the inshore pipe contracted three-quarters inch.

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d. Ruptured Slugs

One slug rupture occurred, an I&E regular in tube 3593, that had attained an exposure of 743. The failure was of the "hole" type and all metal of the lot was discharged.

e. Gas Leaks

During an extensive leak testing program, leaks were found and corrected in the gas tunnels, 115 building and the low pressure storage system. Gas usage totaled 573,495 cu. ft., the highest monthly usage since May.

C. Improvement Experience

1. Production and Process Tests

- a. PT-1P-213-A - Irradiation of Eight Foot UO₂ 7-rod Cluster Element - This PT was irradiated in KER Loop 2 and was discharged by special procedure on December 9.
- b. PT-1P-214-A - Irradiation of Enriched Zircalloy-2 Jacketed 7-rod Cluster Elements in KER Loops - This PT was charged into KER Loop 2 on December 9.
- c. PT-1P-186-A - High Temperature Irradiation of Two-and-Three-Foot Long Cluster Elements in KER Loops - This PT was irradiated in KER Loop 3, and was segmentally discharged on December 28.
- d. PT-1P-221-A - Measurement of Flow Channel Temperatures In Seven Rod Cluster Elements in the KER Loops - This PT was charged into KER Loop 3 on December 30.

D. Radiation Experience

1. Radiation Occurrences

One radiation occurrence was processed during the month. This involved removal of an irradiated perf from the front of a process tube. No significant exposure resulted.

2. External Exposure Control

The maximum dose rate measured on the pigtail of the rupture tube was 1.5 r/hr. The average dose rate for work at the tube location was 150 mr/hr. During the traversing of tube 2034, the maximum dose rate on swabs from the push pole was 20 rad/hr. Dosage rates to the hands of personnel were 6 rad/hr.

3. Contamination Control

Following the charging of a KER tube, contaminated water ran from the front nozzle and down the front face of the unit. The maximum dose

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rate on tube caps was 1.2 rad/hr, including 60 mr/hr. Hosing reduced the contamination level by a factor of three.

KW PROCESSING

A. Production

Input production 84.2 per cent of forecast. Alternate regeneration of driers to remove water from the reactor graphite prevented operation at the ACRS power level limit.

B. Operating Experience

1. Operating Continuity

Reactor outages totaled 141.9 hours. Operating continuity was affected by the following events:

<u>Day</u>	<u>Hours</u>	<u>Remarks</u>
1	24.2	Completion of the November extended outage for gas seal, lead wire, RTD and mattress replacement.
2	3.9	Manual shutdown to repair three defective RTD circuits.
2	1.7	Manual shutdown to repair RTD on tube 3685 which had blown out of the fitting on the rear crossheader.
2	1.4	Manual shutdown to effect temperature monitor power supply repairs.
3	6.7	Reactor shutdown to discharge temporary poison and correct seven defective RTD's.
3	2.2	Manual shutdown for temperature control at turnaround. Temperature monitor power supply failure delayed startup recovery.
8	30.3	Ruptured slug in tube 4063.
10	0.5	Manual shutdown for temperature control at turnaround.
17	30.4	Reactor shutdown to locate water leak following continued collection of water from the driers.
18	4.2	Manual shutdown prior to turnaround due to lack of reactivity control. Startup was delayed to correct rear face cap leaks.
22	32.1	Reactor shutdown for leak testing.
24	3.9	Reactor shutdown to discharge temporary poison.
24	0.4	Beckman dual trip by a faulty Beckman.

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2. Equipment Experience

- a. Instruments and Circuitry - A total of 43 resistance temperature detector circuits failed during operation. Eighteen of these were corrected. Two outages, totaling 5.6 hours, were required to effect repairs in order to continue reactor operation. Eight high trips were experienced during the month, all due to faulty circuitry.

Power was lost to the Number 4 bank of control rods during startup on December 24. A selenium rectifier in the control circuit burned out by over-voltage due to a sheared pin in the controller switch. Rectifier replacement was completed within 1.4 hours to permit the reactor to resume operation.

- b. Water Leak - An undetermined amount of water entered the reactor during the bellows replacement outage in November. Exit drip leg collections at startup totaled 472 gallons. The experience during the month is summarized below:

<u>Date</u>	<u>Remarks</u>
2 to 17	1374 gallons collected.
17	Shutdown for leak testing. Lower sixth of pile hydrostatically tested. Two rear face gasket leaks corrected. Rear nozzles on rows 9 and 10 tightened.
19 to 22	430 gallons collected.
22	Shutdown for water leak. Lower half of pile hydrostatically tested. Corrected 30 minor leaks, primarily in rear nozzle gaskets.
24 to 31	949 gallons collected.

C. Improvement Experience

1. Production and Process Tests

- a. PT-1P-128-CE, Supplement B, "Poison Spline Flexible Control System Tests at 105-K" - Twenty spline cap assemblies and the required upstream dummy charges were installed. Four splines were inserted in the reactor and two were withdrawn during reactor operation. One of those withdrawn, was chopped and deposited into the prototype flushing disposal system. Operation of the system was satisfactory.
- b. PT-1P-86-H, "Heat Transfer Study in KW Biological and Thermal Shields" The startup and non-equilibrium temperatures were taken during the 60 hour period following startup on December 2. These readings completed the test request.

D. Radiation Experience

1. Radiation Occurrences

Two radiation occurrences were processed, neither of which was classified as a Lapse of Radiation Control.

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2. External Radiation Control

Dose rates at the rear face averaged 50 mr/hr approximately six hours after shutdown during the month's outages. This was a three-fold reduction from conditions encountered prior to the Turco decontamination. The maximum dose rate encountered from the nozzle connector of rupture tube 4063 was 10 r/hr. The dose rate to personnel during rupture removal work was 350 mr/hr. A dose rate of 50 mr/hr was measured at the end of the "C" elevator during removal of a poison spline from the reactor after two days of irradiation.

KE-KW POWER OPERATION

A. Operating Experience

1. Electrical Peak Control Efforts

Peak control efforts by use of the generators were required for a total of 185 hours randomly distributed throughout the month during periods of IPD peak operation. The Bonneville Power Authority interruptible demand was limited at 25 megawatts. Control efforts reached a maximum of 5.5 megawatts on December 8.

B. Equipment Experience

1. KW Filters - Sand and Anthrafilt Addition

Addition of five carloads of sand and two and one-half carloads of anthrafilt to the 183-KW filters was completed during the month. This material addition was necessitated by normal deterioration of the beds and to return them to proper depth and composition.

2. Septic Tanks

The septic tank servicing 1717 and 1704 Buildings was inspected by a representative of F.E.C. as part of their investigation of the overall tank overloading problem.

3. KE Brine Pit

Loss of brine from the 165-KE brine pit was noted. Investigation confirmed an underground leak in the system. Plans for corrective action were made.

4. Kilowatt Demand Meter - 165-KW

The kilowatt demand meter in the 165-KW control room showed some tendency toward unreliability. On December 19, a meeting was held with representatives of F. E. C., Electrical Distribution, and K Maintenance Engineering to discuss this and other problems relative to this meter. A program of system improvement was developed and initial improvements were effected. At month end, the meter was operating satisfactorily.

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C. Improvement Experience

1. CG-663 Steam Driven Auxiliaries

Testing of the auxiliary equipment (not including the Fire-eye system) on Number 1 boiler at KW was successfully completed, terminating the KW systems testing. Number 3 boiler at KE remains to be tested.

2. CG-715 Automatic Synchronizers

Orientation and training of the KW personnel in the use of the automatic synchronizing equipment was completed and the system was placed in service.

3. Gravity Acid Feed System

Revamping of the gravity acid feed system by Minor Construction forces at 183-KW was completed. The work included replacement of the line from the head tank to the dilution cells and the installation of new underground polyethylene lines from the dilution tanks to the basin mixing chambers. The new lines were replacements for the old polyvinyl chloride above-ground lines.

Similar work was begun at 183-KE.

KE-KW MAINTENANCE OPERATION

A. Equipment Experience

1. Instruments

Range changes and checks were made to 4022 gages, with 80.4 per cent being completed during outages. Other work was as follows:

- a. The Number 1R Octant Monitor chamber leads were replaced in 105-KW.
- b. Exit Water Temperature Recorder revisions were made to provide an additional range of 70° to 90° C for greater accuracy of power level calculation in 105-KE.
- c. Twenty-four controller boxes were repaired and eight lead wires were pulled down in 105-KE.

2. Electrical

- a. Communications Systems - A rear face to monitor room communications system for use with the leak detector was completed in 105-KW. Increasing difficulties with the regular rear face system were due to deterioration of insulation. All leads showing damage were replaced.
- b. High Lift Pumps - All rheostats in 190-KE were checked and tested for bushing tightness. Electrodes on Number 6 rheostat in 105-KW were tightened. The slip rings and brushes on pump motor Number 1 in 190-KE were cleaned and checked for proper tension. Slip rings

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on Number 6 unit were cleaned. Enlarged brush holders and type 948 brushes were installed.

- c. Monitoring System - 105-KE - Installation of the remote radiation monitoring equipment was completed on the "D" elevator.

3. Mechanical

- a. Air Samplers - 105-KE - Installation of the remote air sampling equipment was completed on the rear face.
- b. Vertical Safety Rods - 105-KW - Twenty-one VSR gas seals were repaired or replaced. Hold down clamps were installed on all gas seals. Four sections of VSR's were moved to the wash pad where they were buffed, polished, straightened and returned to the top of the unit for future installation.
- c. Charging Machines - Lugs were installed on the 105-KE charging machines to reduce possibility of dropped magazines. One charging machine was modified in 105-KW in accordance with Plant Engineering recommendations.
- d. Gas System - 115-KW - Testing and repair work in the Number 1 and 2 driers included the following:
 - 1. Check of condensate flow.
 - 2. Hydrostatic test of pre-heater, cooling and condensing coils.
 - 3. Replacement of the rupture discs.
 - 4. Inspection and repairs of solenoid and air-operated water system valves.
 - 5. Inspection and re-installation of the ejectors.
- e. 1706-KE-KER - The vent and fill piping modifications were completed on KER loop Number 4. This completed the modification work for loops 1, 2, 3 and 4.

B. Engineering and Planning and Scheduling

1. Instrument Engineering

The Electric Autolite Company completed manufacture of all cable required for lead wire replacement. Schedules call for the Lewis Engineering Company to have all bundles completed by the end of January based on present output.

In view of the relatively large number of RTD's required for qualification tests and replacement after the initial installation in 105-KW, an order was placed for an additional 300 for 105-KE.

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2. Electrical Engineering

Ten polypropylene cells were received on plant from the factory. This shipment is the last of those made available to the vendor for repair.

A photo-recorder operation procedure and safety circuit elementary drawings incorporating revisions of Design Changes 155, 240, and 194 in 105-KW were completed.

3. Mechanical Engineering

A design and cost estimate was prepared for a permanent catwalk which will enable side-to-side traversing work on the X-level, without repetitive erection of scaffold..

4. Planning and Scheduling

Class "A" overhauls were completed on 127 items of equipment and class "B" on 304 items. The class "A" overhauls included a turbine, hot water circulating pumps and backwash pump breakers.

C. Events Influencing Costs

1. Overtime Usage

Hours worked in KE-KW Reactor Operation by assigned personnel	196
Hours worked in KE-KW Reactor Operation by other personnel	69
KE-KW Reactor Operation Maintenance requirements	265
Hours worked by assigned personnel for other Operations	312

SUPPLEMENTAL CREWS OPERATION

A. Events Influencing Costs

1. Supplemental Crews' Time Distribution

The non-exempt time distribution was as follows:

<u>Area</u>	<u>Per cent</u>	<u>Area</u>	<u>Per cent</u>
100-B	10	100-F	3
100-C	17	100-H	3
100-D	10	100-KE	12
100-DR	26	100-KW	19

2. Overtime Usage

Non-exempt overtime worked by Supplemental Crews personnel totaled 76 hours.

R. S. Bell
Manager
KE-KW REACTOR OPERATION

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PRODUCTION OPERATION
DECEMBER, 1958

I. ORGANIZATION AND FUNCTIONS

No change.

II. PERSONNEL

A. Force Report

	<u>November 30</u>			<u>December 31</u>			<u>Net</u> <u>Change</u>
	<u>Ex.</u>	<u>N.E.</u>	<u>Total</u>	<u>Ex.</u>	<u>N.E.</u>	<u>Total</u>	
General	2	1	3	2	1	3	0
Prod'n Reports & Statistics	1	2	3	1	2	3	0
Pron'n Forecast'g & Sched'g	5	4	9	5	4	9	0
Prod'n Computing	3	3	6	3	3	6	0
Essential Materials	1	1	2	1	1	2	0
Total	12	11	23	12	11	23	0

III. PERSONNEL ACTIVITIES

R. W. Bown spoke at a weekly meeting of the Pile Physics Operation presenting some of the aspects of Production Scheduling that affect the reactivity status of the reactors.

R. M. Micklich completed an IPD Training Course on "Understanding Human Behavior".

E. Bailey visited several large coal consumers in the East during the week of Dec. 7.

IV. SAFETY AND SECURITY

There were no injuries or security violations. Safety and Security meetings were attended as scheduled.

V. NON-ROUTINE REPORTS

None issued.

VI. INVENTIONS AND DISCOVERIES

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

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VII. FUNCTIONAL ACTIVITIES

A. Production Forecasting, Scheduling and Analysis

1. Production Forecasting

Assumptions for the five-year production forecast to be issued during January were assembled and discussed with interested persons. They were revised as necessary and will form the basis for the forecast.

2. Production Scheduling

a. Discharge Concentrations

Discharge exposures of I & E enriched slugs at C and the K Reactors were reduced an additional 100 MWD/ton. This brings the total reduction below the former goal to 200 MWD/ton. Further reduction of this goal will depend on developments in the High Pu-240 program and in feed material receipts. To date discharge of this material has been based on the former goal with considerable "over-discharging". This method results in slight preference to the higher powered tubes while application of the recommended goal with comparable "under-discharging" to give the same net effect would result in preference to the lowered powered tubes. Preference to the higher powered tubes should provide the greatest reduction in rupture potential.

There were two goal reductions initiated for regular uranium. The first was for I & E material at the K Reactors when discharges had averaged 775 MWD/ton. Under the new plan I & E material will average approximately 700 MWD/ton at current power levels and 620 MWD/ton at power levels 10% higher. To reduce the impact of this reduction on in-reactor product inventory, it is being effected gradually and will be completed during January.

The second goal reduction involving regular uranium is for solid slugs at C Reactor. This reduction amounted to about 10% and was effected immediately because there was little effect on in-reactor product inventory and this type of slug was in good supply.

In general, discharges were accomplished on the basis of the goal plan as amended above. Exceptions are noted below:

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BELOW GOAL DISCHARGING - DECEMBER 1958

<u>Reactor</u>	<u>Tons Disch.</u>	<u>Tons Excess Usage</u>	<u>Mat'l Type</u>	<u>Reason</u>
C	2.8	0.7	Regular	Material discharged from Ball Valves under PT IP-87I.
D	1.4	0.7	Regular	Material discharged to permit charging enrichment in the desired location.
DR	24.8	11.6	Regular	Large-scale process tube replacement.
DR	1.6	0.4	Enriched	Tube replacement.
KW	7.4	2.1	Regular	Discharge of rupture-prone lots CK 013 B and SK 601 B.
	36.4	15.1	Totals for regular uranium.	
	1.6	0.4	Totals for enriched uranium.	

COMPARISON OF DECEMBER DISCHARGE EXPOSURES (MWD/TON)

<u>Month</u>	<u>Regular U</u>		<u>Enriched U</u>	
	<u>Solid</u>	<u>I and E</u>	<u>Solid</u>	<u>I and E</u>
October	506	723	616	786
November	531	736	765	781
December	583	733	735	773

b. Off-Plant Shipments

One cask of isotope production was shipped to ORNL.

3. Operations Analysis

Tube replacement work was kept to a minimum with three tubes being replaced at C Reactor and 93 at DR Reactor.

A review of HW-50300, HAP0 Source and Special Nuclear Material Accountability Reference, was begun with appropriate revisions being made to up-date the manual.

B. Production Computing

Tube-by-tube source data were processed to establish the current production and corrosion status for each tube in all reactors. Routine and emergency reports were issued to implement the scheduling,

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forecasting, and accountability functions of the Production Operation. Charge-discharge and tube replacement information for each reactor operation was provided in accordance with production schedules. Production data were supplied to each File Physicist for reactivity evaluations, and to Process Technology for EDPM processing.

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

A new service for IPD processing people was initiated in December. A complete listing of slug lots charged in reactor tubes is issued to each processing operation once a month. With this tabulation the manager can plan and effect the discharge of proven rupture prone material without waiting for further assistance from Production Computing. In addition to the lot number the tabulation includes the tube number, the rate of production for each tube, and the exposure at some base time. The purpose of the new service is to avoid possible losses of outage time, and to eliminate the occurrence of some overtime situations for PCO.

During the month efforts were directed toward the evaluation of recent recommendations advanced by the Specialist, Reactor Data Analysis, R&EO. He has proposed that Production Computing establish and maintain a central, authoritative punch-card file, termed a Loading Record, which would meet definite standards as to completeness, accuracy, and timeliness. A Loading Record card would describe the charge in each reactor channel in greater detail than is presently done in machine language.

In order to increase the value of tube corrosion calculations for tube replacement scheduling and forecasting, correlations were made between calculated corrosion and observed corrosion as measured by the Probolog instrument. The results showed that for B Reactor the corrosion rate for a given tube outlet water temperature may be considered empirically as a function of tube location. Investigation of corrosion relations are in progress for other reactors.

C. Production Reports and Statistics

1. Daily Reporting

Routine processing of the Daily Production Report and Daily Operations Report in both summary and complete forms was continued.

Comments on a proposed revision of the Daily Operations Report and the associated secret key have been received from appropriate individuals and the preparation of a final draft is in progress.

2. Monthly Reporting

The combined report of Production and Reactor Operations for November was assembled and issued.

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The November production summary was prepared for management.

Special monthly report information was assembled for personnel of the AEC-HOO (Process Engineering and Manufacturing Division) summarizing plant operation and related statistics for November.

3. Special Reporting

Significant time was spent preparing the November report on Production Losses due to Special Irradiations for the AEC-HOO.

Plans were made for issuing the 1958 Annual Report. The IPD contributions to this report are being coordinated by Production Reports and Statistics.

4. Production Statistics

Production statistics work performed during December included the following:

- 1.) A chart book showing reactor outage time, ruptures and scrams was maintained for department management.
- 2.) The Product Cost and Budget Operation was furnished production data, operating efficiencies, outage hours and tube replacement information.
- 3.) The Radiation Protection and Analytical Laboratories Operations, HLO, were given weekly reports showing process water flows and related reactor data.
- 4.) The Plant and Industrial Engineering, Component Testing and Supplemental Crews Operations were supplied information each morning showing which reactors were operating.
- 5.) The Processing Engineering Operation, Fuels Preparation Department, was given power level, water flow and tube replacement data.
- 6.) Calculated time operated efficiencies for specific periods at all reactors as requested by Irradiation Testing Operation.
- 7.) Production data for the period of May through November was given to Radiological Engineering.
- 8.) Reactor outage data were given to F maintenance operation for October, November and December.
- 9.) Miscellaneous Reactor and Production data were given to the Specialist, Measurements, Financial Operation.

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D. Essential Materials

Rail and truck shipments received in December were as follows:

Carload shipments for IPD	- 291
Carload shipments for other Depts.	- 202
Truck shipments for IPD	- <u>140</u>
Total shipments received	- 633

In addition to the routine duties involved in the procurement and delivery of essential materials, the following items were included in the group's activities during December:

1. The regular Helium memorandum dated Dec. 23 and put out to all Federal Consumers of Helium was received, which stated that the supply of this gas for January 1959 would be about the same as that for December 1958.
2. All Departments at HAPO using steam coal were requested to furnish their requirements for FY 1960 so that new contract negotiations could be started as early in 1959 as possible.
3. E. Bailey accompanied J. C. Baudendistal of the Facilities Engineering Operation on a visit to several of the largest coal users in the East to discuss relative methods of steam coal evaluation.
4. One hundred and fifty tons of Liquid Sodium Dichromate were obtained on a spot purchase from the Cascade Fire Equipment Co. of Yakima. The source of this material was Japanese and was delivered at a price considerably below the present domestic market cost.

E. Miscellaneous Services

Security classification matters continued to be handled for the department. An inter-department meeting on photograph classification topics was attended. AEC guidance on the classification requirements for a certain special production program was requested.

Development of the new Pile Operator Selection Procedure was completed, as a joint effort with the Employee Relations and Reactor Operations. Its formal announcement to plant personnel and the union was made during the week of December 8, with an effective date of Feb. 1, 1959. Trials of the associated job knowledge tests progressed to the point where the length and difficulty appeared about right for Utility Operators who are ready for promotion. Arrangements were made for the testing of February upgrade candidates to start in early January.

The reactor training manuals and related written information promised the Stanford Research Institute visitors during their November visit were mailed to them on December 15, per agreement with the AEC-HOO.

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The Processing Operations Procedure for the investigation and reporting of S.S. material inventory discrepancies was revised by the plants to incorporate suggestions by AEC-HOO Security, and copies of the final issue were sent to all interested parties. This Procedure satisfies all accountability and security requirements, with a minimum potential for causing reactor downtime.

A departmental review of Top Secret personnel clearances was conducted, as occasioned by AEC changes in the access definitions for information Categories 1, 2 and 2A.

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Production Operation

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MONTH		REACTOR OPERATIONS STATISTICS - PROCESSING																	
December, 1958																			
		B		C		D		DR		F		H		KE		KW		TOTAL	
INPUT PROD.-PU (% OF FORECAST)		117.7		113.3		114.7		98.5		153.1		125.9		107.7		84.2		110.3	
TIME OPER. EFF. (% OVERALL)		86.6		83.1		90.2		72.6		100.0		100.0		84.1		80.9		87.2	
NO. OF REACTOR OUTAGES & HOURS																			
SCHEDULED		NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.		
UNSCHEDULED - SCRAMS		5	15.5	3	2.2	2	0.5	1	2.0	0	0	0	0	0	0	5	9.3	16	29.5
OTHER		0	22.3	3	52.7	1	20.2	3	79.3	0	0	0	0	1	10.0	5	52.4	13	236.9
TOTAL		5	99.5	6	125.8	3	72.7	4	204.2	0	0	0	0	2	118.4	10	141.9	30	762.5
BREAKDOWN OF REACTOR OTGE HRS.																			
PLANNED																			
CHARGE-DISCHARGE		29.5		45.1		39.8		30.5		0		0		80.3		37.7		262.9 4.4	
TUBE REPLACEMENT		0		4.3		3.6		50.5		0		0		0		0		58.4 0.9	
PROJECT WORK		1.0		0		0		0		0		0		0		0		1.0 0.1	
PRODUCTION TEST		4.0		9.3		2.4		0.5		0		0		20.4		0		36.6 0.6	
MAINTENANCE		27.2		12.2		6.2		41.4		0		0		7.7		42.5		137.2 2.3	
MISCELLANEOUS		0		0		0		0		0		0		0		0		0 0	
SUB - TOTAL		61.7		70.9		52.0		122.9		0		0		108.4		80.2		496.1 8.3	
UNPLANNED																			
CHARGE - DISCHARGE		0		0		18.0		7.9		0		0		0		0		25.9 0.4	
PRODUCTION TEST		0		* 7.4		0		0		0		0		0.7		0		18.1 0.3	
RUPTURE REMOVAL		0		30.8		2.4		37.0		0		0		6.4		3.2		79.8 1.3	
WATER LEAK		12.0		2.2		0		32.0		0		0		0		40.9		87.1 1.5	
MAINTENANCE		10.3		4.0		0		2.4		0		0		2.9		11.2		30.8 0.5	
INSTRUMENTATION		0		0		0		0		0		0		0		0.4		0.4 0.1	
PANELKIT		15.5		0		0.3		2.0		0		0		0		0		17.8 0.3	
MISCELLANEOUS		0		0.5		0		0		0		0		0		6.0		6.5 0.1	
SUB - TOTAL		37.8		54.9		20.7		81.3		0		0		10.0		61.7		266.4 4.5	
TOTAL		99.5		125.8		72.7		204.2		0		0		118.4		141.9		762.5 12.8	
NO. SLUG RUPT. (ALL TYPES)		0		3		1		4		0		0		1		1		10	
NO. NEW TUBES INSTALLED		0		3		0		93		0		0		0		0		96	
TYPE OF WATER LEAK - TUBE		0		1		0		3		0		0		0		0		4	
VAN STONE		0		2		0		0		0		0		0		0		2	

* Includes 7.9 hrs. for the removal of an I&E depleted rupture. (PT-IP-132-AC).

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REACTOR OPERATION STATISTICS – SLUG RUPTURES

[illegible]

BM-500-051 (12-58) AEC-GE RICHLAND, WASH

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MONTH	REACTOR OPERATIONS STATISTICS - POWER										SHEET 1	
	100-B	100-C	100-D	100-OR	100-F	100-H	100-KE	100-KW	TOTAL			
RIVER WATER (BLDG. 181)												
TO RESERVOIR (BLDG. 182)	3040		18526		3156	2890			27612			
TO FILTER PLANT (BLDG. 183)	73300		84919		80779	82100	153200	150800	625098			
TO FILTER PLANT (C&DR)	87800		58329						146129			
TO R & E (KER) & FEO			203				970		1173			
TOTAL	164140		161977		83935	84990	154170	150800	800012			
TOTAL	7327.2		7230.7		3746.9	3794.0	6882.1	6731.7	35712.6			
RESERVOIR WATER (BLDG. 182)												
TO POWER HOUSE (BLDG. 184)	40		72		26	27			165			
TO COND. SYSTEM (BLDG. 190)	3000		1748		3097	2863			10708			
TO COND. SYSTEM (190DR & 183F)			2683		33	0			2716			
TO EXPORT SYSTEM	0		14023		0	0			14023			
TOTAL	135.7		827.0		140.9	129.0			1232.6			
FILTER WATER (BLDG. 183)												
TO POWER HOUSE (BLDG. 184)	190		192		110	147			639			
TO PROCESS (BLDG. 190)	70119	82935	74651	64867	78494	79500	150972	148210	749748			
TO 108	1951	4106	939		1200	1230			9426			
TO 108DR			938						938			
TO FILTER PLANT (BLDG. 183DR)			6752						6752			
TO F & S SYSTEM	103		298		154	118		50	723			
TO R & E (KER) & FEO			153				26		179			
BACKWASH	937	759	996	214	821	1105	2202	2540	9574			
TOTAL	3272.1	3919.4	3790.8	2905.2	3606.0	3664.9	6838.8	6731.7	34728.9			
PROCESS WATER (BLDG. 190)												
TO REACTOR	69719	82535	74251	64467	78094	79000	148100	145100	741266			
TO REACTOR	76000	94500	78700	78700	78094	79000	169900	169500	824394			
POWER HOUSE (K AREA)							32	16	48			
108 (KE - KW)							2326	2694	5020			
TO R & E (KER)							114		114			
BUILDING USAGE							400	400	3300			
TOTAL	400	400	400	400	400	500	6739.4	6616.1	33468.7			
RIVER DATA												
ELEVATION (MSL, FT.)	3130.1	3702.2	3332.4	2895.6	3504.0	3548.9						
(MAX.)	389.9		380.9		367.8	373.0		383.0				
(MIN.)	387.0		378.1		364.6	371.4		380.0				
(AVG.)	387.2		380.1		366.4	372.2		382.0				
TEMPERATURE	47.2		49.0		49.1	48.6		46.1				

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MONTH December, 1958		REACTOR OPERATIONS STATISTICS - POWER										SHEET 2
		100-B	100-C	100-D	100-DR	100-F	100-H	100-KE	100-KW	TOTAL		
<u>WATER TREATMENT DATA</u>												
AT BLDG. 182 BLDG. 183	MM GALS	-		-		140.9	-			140.9		
	MM GALS	3272.1	3919.4	3790.8	2603.8	3606.0	3664.9	6838.8	6731.7	34427.5		
<u>CHEMICAL CONSUMPTION</u>												
CHLORINE (BLDG. 182) (BLDG. 183)	LBS.	-		-		125	-			125		
	LBS	10324	15342	12190	6330	12538	13215	23800	27200	120939		
	AVG PPM	0.4	0.5	0.4	0.3	0.4	0.4	0.4	0.5	0.4		
BAUXITE	LBS	15686	-	-	-	-	-			15686		
	AVG PPM	0.6	-	-	-	-	-			0.6		
ALUM	LBS	55430	75193	137999	89750	110182	124130	180300	198800	971784		
	AVG PPM	2.0	2.3	4.4	4.1	3.7	4.1	3.2	3.5	3.4		
SEPARAN	LBS	0	0	0	0	0	0	280	180	460		
	AVG PPM	-	-	-	-	-	-	.005	.003	.004		
SULPHURIC ACID (AS 100%)	LBS	270914	331117	213176	140823	300000	246364	455800	509200	2467394		
	AVG PPM	9.9	10.1	6.8	6.5	10.0	8.1	8.0	9.1	8.6		
DICHROMATE	LBS	46800	55000	49980	43425	52140	52977	103300	100100	503722		
<u>PURGE MATERIAL CONSUMPTION</u>												
SOLIDS	LBS	0	0	0	0	0	0	0	0	0		

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MONTH		REACTOR OPERATIONS STATISTICS - POWER										SHEET 3	
December, 1958													
ANALYTICAL DATA													
RAW WATER													
PH	PH AVG	100-B	100-C	100-D	100-DR	100-F	100-H	100-KE	100-KW				
TURBIDITY	PPM AVG	8.00	7.90	-	-	8.04	8.06	7.90	7.95				
		2.8	3.8	4.0	4.0	4.7	4.0	4.0	5.0				
FINISHED WATER													
PH	PH AVG	7.00	7.00	7.08	7.09	7.00	7.07	7.08	7.01				
TURBIDITY	PPM AVG	.004	.006	.003	.003	.003	.005	.006	.005				
CL ₂ RESIDUAL	PPM AVG	.05	.05	TRACE	TRACE	.05	.05	.05	.06				
DICHROMATE	PPM AVG	1.81	1.79	1.80	1.80	1.78	1.79	1.80	1.80				
STEAM DATA													
GENERATED (MAX)	LBS/HR	100-B	100-D	100-F	100-H	B-D-F-H TOTAL	KE	KW	KE-KW TOTAL				
(NOR)	LBS/HR	164000	372000	80000	72000	688000	65000	67000	132000				
(AVG)	LBS/HR	96600	95000	60000	53042	304642	--	--	--				
TOTAL	LBS/HR	97000	99387	59233	53042	308662	37427	34129	71556				
TO PLANT	M LBS	72595	73944	44069	39463	230071	27846	25392	53238				
COAL RECEIVED	M LBS	61560	62704	33979	33465	191708	25061	22853	47914				
CONSUMED	TONS	4291	5054	4001	3141	16487	--	--	--				
IN STORAGE	TONS	4172	4001	2975	2663	13811	--	--	--				
GEN. STEAM/LB. OF COAL	TONS	35796	46370	31832	30598	144596	--	--	--				
		6.70	9.24	7.41	7.41	8.33	--	--	--				
OIL RECEIVED	GALLONS								0	504991			
CONSUMED	GALLONS								227724	481093			
IN STORAGE	GALLONS								876540	2262078			
GEN. STEAM/GAL. OF OIL									109.9	111.5	110.7		
ELECTRICAL DATA													
TOTAL GENERATED KW HRS.									1624000	1870400	3494400		

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REACTOR OPERATIONS STATISTICS - RADIATION MONITORING

December 19 58

	B	C	D	DR	F	H	KE	KW	IPD Total
Special Work Permits Issued	18	23	3	4	19	119	15	7	208
Routine and Special Surveys	413	443	470	465	300	210	300	249	2850
Air Samples Taken	39	75	35	99	16	22	62	70	418
Hand Contamination Cases	0	0	0	0	0	0	0	0	0
Skin Contamination Cases	4	0	0	5	0	0	0	0	9
Contaminated Injuries	0	0	0	0	0	0	0	0	0
Vehicles Contaminated	3	0	0	0	0	0	0	0	3
No. of Cases of Personal Clothing Contamination	2	2	0	9	0	0	0	0	13
No. of Cases Contamination Spread Outside of Radiation Zones	3	4	6	2	0	0	0	3	18
No. of Employees for whom Dose Rates ≥ 6 Rads/hr. Were Established	0	0	0	1	0	0	0	0	1
Lapses of Control (Reactor Operation)	2	1	1	0	1	1	0	2	8
No. of Hours Training Others	8	12	3	12	0	0	0	0	35
Attendance at Mtgs for Training Others	23	37	50	45	0	0	0	0	155
REACTOR EFFLUENT DATA									
No. of Effluent Calculations	23	93	93	105	29	92	27	26	
Ave. Beta Dose Rate (mrads/hr.)	11.1	10.5	10.9	7.0	13.6	14.4	18.7	16.6	
Ave. Gamma Dose Rate (mrads/hr.)	13.7	9.3	18.7	13.0	26.8	26.9	32.8	36.3	
Ave. Total Dose Rate (mrads/hr.)	24.8	19.8	29.6	20.0	40.4	41.2	51.5	52.8	
Ave. Integrated Dose in 24 hrs.	662.7	475.2	710.4	480.0	972.6	989.4	1236.0	1267.2	
Max. Integrated Dose in 24 Hrs in 19	915.0	1930.0	1242.4	1394.0	2061.0	3290.0	1701.6	3305.0	

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FACILITIES ENGINEERING OPERATION
MONTHLY RECORD REPORT

DECEMBER, 1958

I. ORGANIZATION AND PERSONNEL

A. Responsibility

There were no changes of assigned responsibilities during the month.

B. Personnel Statistics

	November 30, 1958	December 31, 1958	Net Change
Employees on Permanent Roll	200	203	+3
Technical Graduates (Rotational)	3	4	+1
Technical Trainees	2	2	0

	<u>FEO</u>	<u>Technical Graduates Rotational</u>
Transferred into Operation	5	1
Transferred out of Operation	1	0
Payroll Removals	1	0

C. Personnel Changes

J. W. Helm transferred from Plant and Industrial Engineering to Hanford Laboratories December 1, 1958.

R. C. Ventling, Stenographer, was placed on the roll with Equipment Development December 15, 1958.

G. A. Daw, Secretary, terminated from Equipment Development December 12, 1958.

J. W. Hedges transferred from Project Engineering to Equipment Development December 1, 1958.

M. J. Sirola, Engineering Designer II, transferred from Construction Engineering Operation to Plant and Industrial Engineering December 1, 1958.

J. C. Crist, Engineering Designer II, was placed on the roll with Plant and Industrial Engineering December 1, 1958.

J. Bazemore, Design Draftsman, was placed on the roll with Plant and Industrial Engineering December 16, 1958.

D. W. Harmon, Design Draftsman, was placed on the roll with Plant and Industrial Engineering December 1, 1958.

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J. W. Dodds, Equipment Development, deceased December 21, 1958.

B. H. Richards, General Clerk B, transferred from Financial Operation to Plant and Industrial Engineering December 8, 1958.

D. Personnel Development

<u>Title of Course</u>	<u>Personnel Attending</u>
Reactor Processing Fundamentals	2
Process Orientation	5
Principles and Methods of Supervision	3
Labor Relations	3
Management Orientation	1
You and Labor Law	5

E. Safety and Security Experience

Three medical treatment injuries were reported.

No security violations were reported.

II. MONTHLY REPORT OF INVENTIONS OR DISCOVERIES

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

<u>Name</u>	<u>Title</u>
J. W. McLaughlin	Slip Joint Pigtail - H-1-11196, and Pigtail Adapter - H-1-11197. Wye Fitting for Slip Joint Pigtail, Sketch on 9-2-58. Drawings H-1-111495 through H-1-111498. Breech Lock Ball Valve Rear Face Nozzle, Sketch dated 7-7-58. Redesigning of 1/4" Control Spool on Old Area Charging Machine - Drawing BFF-9198. 105-KB and KW Rear Face Slip Joint Pigtail and Adapter, Sketch dated 6-1-58.
C. D. Emmons	Vertical Rod Drive Mechanism, November 17, 1958.

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III. ACHIEVEMENT

A. Process Design

1. Research and Development

a. Category I - Existing Reactor Support

System demand curves for the 100-C Area 190 Building tanks to the reactor crossover line have been completed.

An evaluation of flow velocity in the piping systems between the 190 and 105 Buildings in each area was made and the location of maximum stresses caused by high velocities determined.

Preliminary tests at 105-F of a pneumatic discharge chute vibrator designed to alleviate the slug hang-up problem have proven satisfactory.

The report from Washington State College covering Phase I of the model downcomer studies has been issued. Phase II contract negotiations are currently under way.

b. Category II - New Reactor Studies

Two CG-654 prototype connectors were tested to failure. The cause of failure is being evaluated.

The tube rupture test pressure vessel fabrication is 75 percent complete. The graphite has been ordered. All layer plans and details are in the check print stage.

A quick study was made, for cost evaluation purposes, of a graphite moderated, boiling water cooled power reactor.

2. Design Projects

a. CG-558 - Reactor Plant Modifications

A process pump first stage impeller of new design was received from DeLaval and performance tested. The test indicated a need for trimming the diameter a small amount.

Detailed design drawings and specifications for the piping, building, foundations, and electrical and water services for the pump test facility have been issued for comment. Drawings of the motor and pump installation, instrumentation and electrical connections have been started. Requisitions for all major equipment have been issued and bids on most reviewed. A cost estimate just completed indicates \$240,000 for material, installation, and overhead plus \$40,000 for Design including Title I, II, and III and Management services.

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b. CG-704 - 100-K Outfall Study

An inspection of the 100-KE outfall line by a diver revealed that the previously observed break is now completely separated with a six inch maximum offset and an end separation of five inches at the top and eight inches at the bottom with an indication that the separation is enlarging because of thermal expansion and contraction of the line. The break in the KW line does not appear to be enlarging.

c. CG-775 - 100-K Area Water Plant Expansion

Fabrication of models of the 190-K high lift pump suction piping at Oregon State College is essentially complete.

A contract for the performance of hydraulic model tests of the 181-K river pump house modifications was awarded to Washington State College.

d. CG-791 - Reactor Exhaust Air Decontamination

Detail design of the rear face fog spray system is now approximately 47 percent complete. Scope and detail design of the filter building, ductwork, etc., are 80 percent and 16 percent complete respectively. System tie-in and ventilation modifications are 30 percent scoped and four percent detailed.

e. CAI-816 - New Production Reactor

Scope work is in progress on all components of the reactor and on the architectural and structural portions of the building. The status of reactor plant design is estimated as 5.7 percent complete.

Reactor Plant Project Representatives meetings were initiated. Minutes 1, 2, and 3 were reviewed by the Design Council. Re-examination of the extent of thermal mixing needed for the process water plus intensive design studies have reorientated the reactor piping back to the original arrangement but with smaller sized inlet and outlet main mixing headers in the Heat Dissipation System.

The conclusion to issue the Design Basis in the following four parts has been reached:

1. General
2. Functional requirements of the plant control and instrumentation systems.
3. Functional requirements of the containment system.
4. Functional requirements of the nuclear control and safety system.

The first part has been issued for comment to the project representatives.

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3. Visitors

Dr. C. E. Behlke, Dr. R. M. Shoemaker, and Mr. H. D. Pritchett of Oregon State College visited HAP0 on December 4 to discuss construction drawings of the 190-K primary pump suction wells model and to visit the prototype facility.

R. L. Stetson, Manager of Research Reactor Sales, American Standard Atomic Energy Division, visited early in the month to discuss assistance they might provide to us in the physics design of the new production reactor.

Mr. John Gronan and Mr. P. J. McCoy of Burns and Roe, Inc., visited December 15-17 to discuss details of NPR plant location and site preparation.

4. Trips

E. R. Rudock attended the ASME Annual Meeting in New York City, and visited a number of vendors to discuss engineering problems associated with restoration of the K graphite stack during the period December 1-10.

Four suppliers of graphite were visited by D. Marinos from December 6-16 to apprise them of the latest criteria in regard to graphite demands anticipated for the NPR. They were also told of the development program and its effect on required production rates and bid negotiations. A third subject of possible vendor machining was also discussed.

C. E. Bonham visited the Canadian General Electric Company Limited at Peterborough, Ontario, on December 10-11, to discuss the problems of the NPR process tube assembly.

J. R. Carrell attended the ANS convention and the ANS-7 Reactor Components Standards Committee meeting in Detroit, Michigan, on December 8-9. He also visited the Canadian General Electric Company Limited at Peterborough, Ontario, to discuss unclassified problems common to the NPR and NPD-2 designs.

H. S. Davis visited Burns and Roe, Inc., at Hempstead, New York, and Atomic Power Development Associates, Inc., in Detroit, Michigan, on December 4-8, to discuss 105-N building layout and confinement features.

L. G. Henke visited Burns and Roe, Inc., at Hempstead, New York, December 4-5, to discuss NPR primary coolant piping.

G. T. Haugland visited the J. L. Flink Laboratories at Brooklyn, New York, to discuss test procedures and data related to contract DDR-50, and attended the ASME annual meeting in New York, during the period November 26 to December 8.

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C. A. Pursel attended the ANS meeting in Detroit, Michigan, and visited the University of Minnesota at Minneapolis to discuss reactor design data. Also, during the week of December 11, he visited ANL at Chicago, Illinois, to discuss reactor containment design.

During the week of December 11, C. A. Mansius visited ANP at Cincinnati, Ohio, for a job interview.

5. Significant Reports Issued

- HW-57009 - "Graphite Moderator Criteria," D. Marinos, December 6, 1958.
- HW-58189 - "An Interim Engineering Report - New Production Reactor," Staff of Process Design Operation, November 24, 1958.
- HW-58295 - "Process Design Operation Monthly Design Test Status Report - November, 1958," W. J. Morris, November 26, 1958.
- HW-58415 - "NPR Lattice Physics Calculations for a Seven-Element Cluster Fuel Geometry," C. A. Mansius, December 8, 1958.
- HW-58434 - "Trip Report - Radio Halogen Removal with Activated Charcoal at Arco," E. L. Etheridge, W. C. Schmidt, December 12, 1958.
- HW-58462 - "Reactor Plant Project Representatives Meeting No. 1 - December 3, 1958," J. R. Carrell, December 9, 1958.
- HW-58464 - "Production Test IP-222-A, Performance Test of CG-558 190 Building Pump with FW-1419 First Stage Impeller - FW-1417 Second Stage Impeller," M. H. Schack, December 9, 1958.
- HW-58499 - "Performance Curves for 181-K River Pumps with 31-7/32" Diameter Impellers," N. F. Fifer, December 11, 1958.
- HW-58577 - "Estimated Graphite Temperatures - NPR with Graphite Cooling Tubes," F. J. Mollerus, Jr., December 17, 1958.
- HW-58622 - "Performance Test of 190 Building Pump with FW-1419 First Stage Impeller and FW-1417 Second Stage Impeller." M. H. Schack, N. F. Fifer, December 22, 1958.
- HW-58624 - "Reactor Plant Project Representatives Meeting No. 3 - December 23, 1958," J. R. Carrell, December 23, 1958.

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HW-58565 - "Reactor Plant Project Representatives Meeting No. 2
December 16, 1958," J. R. Carrell, December 18, 1958.

Letter, H. W. Heacock to S. L. Nelson, "Hydraulic Model Studies of
the 100-F Downcomer and Effluent System," December 15, 1958.

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B. Equipment Development

In the charge-discharge-while-operating program, 26 uranium columns have been discharged and recharged at C Reactor while operating; one on 11-21-58, 10 on 12-9-58, 9 on 12-10-58, and 6 on 12-11-58. Scrams, followed by scram recoveries, were encountered following completion of the cycles on the first and 26th charges; in both cases charging was complete and the tube inlet ball valve was closed but safety protection had not been transferred from the charge-discharge control center to the Panellit system. A design change removed the possibility of subsequent scrams from the first cause and high speed pressure recordings of tube inlet pressure have been made to gather data on the cause for the second so that corrective and preventive actions can be taken. Significant observations made during the testing include: (a) no major reactor control problems were encountered, (b) power level was not reduced, (c) operations were remotely controlled (for the most part), (d) cycle time was less than ten minutes per tube, and (e) in one 24-hour period the discharge-charge rate matched the discharge-charge rate required in a full reactor, so equipped. In addition to discharging and charging 26 uranium columns during operation, 45 aluminum columns were discharged and charged, 35 during operation and 10 during outages.

The New Production Reactor Zircaloy process tube section, flared by Leonard Precision Products Company, failed during testing following 207 thermal cycles; cause for failure has been determined as self-relief of the high pressures in the fittings holding the surfaces together; the assembly was cleaned, reassembled with 1,800 foot-pounds of torque, and thermal cycling started a second time; leakage occurred after 41 cycles; additional test sections are being ordered with 410 stainless steel and hardened 4130 carbon steel replacing the existing 1040 carbon steel fittings. In nozzle end closures, continued trouble was experienced with the Marmon Conoseal; use of bell-ring seal and flexitallic configurations continued to show promise. A. O. Smith Corporation flash-welded successfully several test sections of New Production Reactor Zircaloy tubing and evaluation of the welding is in progress. Preliminary testing of various configurations for cooling of cast-iron thermal shields shows cast-in-place pipe to have a heat transfer coefficient one-third higher than pipe embedded in lead. Installation of the New Production Reactor Prototype Concept Evaluation Loop progressed to 20 per cent completion.

In the development of improved ball materials for the Ball IX System, 50-pound prototypic lots of ceramic (alumina) balls, poisoned with gadolinium and boron, have been ordered from Electric Auto-Lite Company and Coors Porcelain Company. Advantages of ceramic balls over steel or stainless steel balls include higher temperature resistance, lower cost, reduced recovery problems, and improved neutron economy should balls "hang up" in an operating reactor. Preliminary samples from Electric Auto-Lite have been submitted to the Hanford Laboratories Operation for analyses for chemical composition and neutron absorption cross-section. At the request of Research and Engineering, prototypic quantities of ceramics are being requisitioned for evaluation of the effects of various concentrations of boron, gadolinium and hafnium on neutron absorption cross-section. Extension of the poisoned ceramic program to poison slugs and control rods is being studied.

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In the poison spline program, three splines were inserted in KW Reactor on December 31, 1958, while operating at equilibrium, and one spline was removed using the water eductor system. Operating data with these splines include (a) a poisoning effect of approximately 3.5 inhours, (b) temperature effects of 2.5°C, 4.7°C, and 7.1°C, and (c) Panellit pressure effects of 14-17 psi. KW Reactor has been outfitted with 20 spline caps, a chopper, a water eductor system for spent spline disposal and a storage tank under the C Elevator. Initial use of the hose reel system supplying water to the eductor and returning waste to the storage tank showed that the rewinding springs were not strong enough when the lines were filled with water and the elevator raised 70 feet (a condition that had not and could not be duplicated in cold tests in the laboratory). Stronger springs have been ordered and a second reel will be fabricated; in the meantime, the system was made operable by removing the supply water hose from the reel and attaching it as a trail hose under the elevator.

In the program to measure in-core flux, the prototype traveling wire flux monitor approached 60 percent completion in the Technical Shops. This prototype fabrication, costing approximately \$9,000, has been made from Savannah River drawings that have been corrected for known problems and Hanford adaptations. Required 34 mil, low vanadium, music wire and 3/16" stainless steel tubing have been received. Laboratory tests have determined the best insertion speed for the wire and an optimum tubing bend radius. Contacts have been made with KW Reactor where the first installation will be tested in Tube 3856. Drawings have been completed for a gamma chamber type in-core flux monitor and prototype chambers have been requisitioned and fabrication of an instrument readout chassis and power supply started.

In the program to develop equipment to determine response time of Panellit gages "in-panel," two rows of Panellit gages at D Reactor were tested with prototypic equipment. Of 88 gages, 30 were found to be slower than desired. Typical gages will be removed from the reactor and bench-tested to confirm the accuracy of the testing technique. Besides determining response time in-panel, positive trip checking will be accomplished, both in approximately twice the time to perform trip checking alone.

A static switching system mockup was assembled and tested to determine its utility in indicating the first Panellit gage which trips a reactor. Test results show that such a system will perform the function of transmitting Panellit information to a coordinate or digital readout of the first gage to trip.

Initial reactor testing of tubular aluminum cadmium poison pieces shows no operational problems in their use. Additional 305 Pile tests have been scheduled to determine the minimum cadmium content necessary since early tests showed that far less cadmium is required than was originally specified and since the cadmium cost is high.

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Visitors

The following off-site personnel visited Instrument Development:

Bill Hammond, Chief Engineer for Claud S. Gordon Company, J. C. Faul of Pyro Electric, and G. J. Martini of Pacific Scientific, to discuss mineral insulated cable and thermocouples, on 11-20-58.

W. A. Derr, Manager - Power and Control Engineering, Westinghouse, to discuss nuclear instrumentation, on 11-21-58

Dr. Kenneth Newman of Turco Products, Los Angeles, California, visited Materials Development on December 1, 1958; his visit provided consultation on problems of decontamination.

Trips

R. K. Smith visited the A. O. Smith Company in Milwaukee, Wisconsin, on 12/1-4/58, to observe procedures for flash welding and testing of zirconium tubing.

C. A. Munro, on 11/30-12/9/58, visited G. E. Manufacturing Services, Schenectady, N. Y., The National Power Show, New York City, Teleflex Corporation, North Wales, Pa., and the Joy Manufacturing Company in Michigan City, Indiana, to obtain information relative to an Improved Charging System.

J. H. Fastabend visited the Canadian General Electric Company, Limited, at Peterborough, Ontario, to discuss unclassified engineering details of Zircaloy tube fittings, on 12/9-12/58.

M. R. Wood, on 12/13-21/58, visited Victoreen Instrument Company and Reuter-Stoakes in Cleveland, Ohio, to perform acceptance testing of equipment for Project CG-707, and consulted with Bendix Research Laboratory in Detroit, Michigan, on their reactor nuclear instrumentation and facilities to solve CGI-806 problems.

J. W. Green, on 12/13-21/58, visited Victoreen Instrument Company in Cleveland, Ohio, to witness acceptance testing of equipment for Project CG-707, and Battelle Memorial Institute, Columbus, Ohio, to consult on in-core flux and fuel rupture monitoring.

Significant Reports Issued

Undocumented - "Status Report - NPR Fitting Development Activity,"
J. H. Fastabend, December 23, 1958.

HW-58206 - "Flow Characteristics, NPR Header-to-Nozzle Connector
#17, Supplement A to Design Test 1026," J. H. Fastabend, November 17, 1958.

HW-58257 - "Final Report - Design Test 1028 - HCR Isotope Slug
Discharge for the NPR," J. W. Dodds, November 24, 1958.

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- HW-58517 - "Trip Report - A. O. Smith Company, Milwaukee, Wisconsin - Dec. 2 & 3, 1958 - Flash Welding Zircaloy-2, NPR Tubing," R. K. Smith and C. D. Brons, December 15, 1958.
- HW-55539 - "Final Report - Design Test #1016 and Supplement A - Air Accelerated VSR for Project CG-709," C. D. Emmons, December 12, 1958.

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C. Plant and Industrial Engineering

1. Drafting Operation

Summary of Drafting Operation services provided is:

Revised or New Drawings, Graphs and As-Builts	134
Drawings and BFFs Added, Refiled or Retired	394
Blueprint File Customers Serviced	73
Catalogs Added to File or Refiled	55
Catalog Customers Serviced	31

2. Industrial Engineering

Assistance to NPR Planning

Assistance was provided Expansion Operation personnel for re-viewing a tentative layout drawing of the N Reactor 105 Building. The review was started and two meetings were conducted with Expansion Operation personnel. The IEO discussed techniques of planning layouts and material handling systems which consider men, equipment and materials.

Metal Handling 300-100 and All Reactors

Work has been initiated to integrate the design and procurement of fuel element transport pallets with existing and planned Processing Operations work area metal handling systems. Preliminary analysis of FPD metal shipping facilities was completed. Motion pictures of the recently installed material handling system in 105-D have been taken and are being analyzed. Preliminary design that will incorporate a combination 300-100 metal transport pallet with the 100 Area tuck charge box has been initiated. Preliminary design for work area "C" elevator conveyor system at 105-F has been completed. These activities are being integrated with FPD, Process Engineering Operation and with IPD Equipment Development Operation.

Protective Clothing

A report to the Manager, F Reactor Operation, was made on November 24, 1958, stating the economic feasibility and increased safety of zippered protective clothing. A sample of 100 suits with aluminum zippers and 100 with bronze zippers will be tried in 100-F Area, in cooperation with P. B. Evans, Laundry Supervisor.

Box Enclosure

A demonstration in the use of Bostitch staplers was arranged in W-10 Building and attended on December 4 by representatives from 100-B-C, D-DR, and KE-KW Reactor Operations. Several types of staplers were demonstrated. It is estimated that some savings will be made

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Box Enclosure (continued)

in tape and labor costs with increased safety by the use of proper staplers in the 105 Buildings. It was the consensus that staplers are faster, cheaper and safer for contamination control than tape.

3. Reactor, Plant Engineering

Reactor Gas Moisture Monitor - 100-B, C, D, DR, F and H

The repair work which was to be done on this system has been completed and concurrence to close out MJA #2 has been obtained. Further work necessary to obtain desired system performance will be done on a test basis at 105-F reactor. After these tests have been completed necessary additional work can be determined.

Victoreen Remote Personnel Exposure Monitor

The bench testing of this monitor was completed and a report issued. The equipment as tested is not suitable for installation as a remote monitor in the discharge area.

Ventilation Rebalance - 105-DR

Field work on the 105-DR ventilation rebalance was essentially completed during this period. A special draft-test was made for the Processing Operation to demonstrate the difference in work-area flow patterns between a raised or lowered front-face curtain. A review of the system is now in progress to assist the Processing Supervisors in maintaining proper pressure gradients throughout the building.

Rear Face Decontamination - 105-B

Engineering criteria on the handling, dissolution, heating and conveying of the Turco solution was presented to B Reactor Operation. Installation follow-up and engineering consultation are being provided in the field. Work continued on the preparation of a Production Test Authorization and Procedure for Rear Face Decontamination at 105-B. Requisitions were prepared for all special materials required for the decontamination and delivered to "B" Processing Operation.

Ball 3X Improvement

Present efforts are being expended in testing system action of current removal facilities and in developing an improved pick-up nozzle. One test model successfully fed itself through 10 feet of balls in the test channel with no interruptions. This unit utilizes a 3/4 inch diameter "shoe" mounted below the 1 1/2 inch pick-up tube to create a 5/8 inch annulus through which the balls are captured. A shop fabricated nozzle is on order which will include modifications to minimize air turbulence at the capture annulus.

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Increased Capacity for 105-B, D, F, Electrical Distribution System

Four basic circuit designs were studied, and estimates were obtained from Construction Engineering Operation on three of these designs, to establish a cost analysis for determining the best per dollar investment. A rough draft of the scope report has been written, routed for comment, and justification information requested by the customer.

4. Water Plant and Utilities Engineering

105-DR Downcomer

On November 26, 1958, the DR far downcomer was again inspected for condition of breather pipes and copper tubing. The corner breather pipe in the top group of pipes was badly corroded at the bottom and the bottom end had actually moved about two inches. Four of the copper tubing pressure lines were broken near the point of entry. Recommendations for repair are being formulated.

Engineering in Support of Power Forecasting

A study was initiated to consider a request from BPA for firm power contracts on a two-year basis. Monthly power estimates for IPD covering fiscal years 1959, 1960 and 1961 were prepared for Utilities Operation's, R&UO, use in negotiation of the future contract. These estimates do not significantly differ from values in the five-year forecast (HW-57705). The two-year power contract may seriously limit adjustment either up or down in power commitments and will require more rigid advance planning and scheduling of load increases and decreases occasioned by IPD projects. These contracts are necessary to insure power availability and may represent firm commitments on the part of HAPO.

4500 HP Drives - 190 Buildings

The investigation of the apparent change in life expectancy of the exciter brushes on these units has been completed. The results of this study indicate that the brush supplied as a replacement is not suitable for this application. The installation of brush catalogue #58D4497, grade T-583 was recommended, which is designed for use in this type of service.

Four of the subject units were inspected this month. Looseness of the textolite spacer rings and the minor effects of corona discharge appear to be common to these units. In addition to recommending additional ties on the spacer ring and the application of varnish to the areas showing evidence of corona discharge, efforts to have the rest of these motors inspected is being encouraged. At the request of the power operations engineer, an inspection of unit #2-B gear was made and indicates that there is some progressive pitting. Although this pitting does not appear to be severe or destructive in nature, we have recommended the addition of an extreme pressure additive to the lubricating oil.

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Reduction of Chemical Cost in 100 Areas

An appropriation of funds (AR 59-1P-19) has been approved to construct a 1½ inch overhead acid line from 183-C head tank to 183-B building. Final design and drawings are nearly complete.

Two aluminum oxide-sulfuric acid feeders have been installed in 183-B building and placed in operation. These two units were installed for test purposes to determine problems in operation and have been accepted by Power Operation as satisfactory. Preliminary runs indicate acceptable operating characteristics.

Coal Utilization Standards

A comprehensive study of methods used to evaluate coals has been completed. This study included personal discussions with personnel of four large utility users. A method for use at HAPO has been firmed up and transmitted to Production Operation for use in FY-60 coal negotiations. The study indicates that our proposal to use total available heat as a payment basis is in keeping with good industrial practices. A technical report on this procedure is being prepared.

Downcomer Studies - 100-F Area

Transducers were installed in the lid of the F downcomer to measure variations in both water surge pressure and vapor space pressures. One has been inoperative from the start, but results from the other indicate considerably higher (6" H₂O) pressure surges in the vapor space than had been suspected.

5. Standards Engineering

Spare Parts

Stock Adjustment Requests processed	25
Maximum Authorized dollar value of new items added by SAR's	\$ 4,781
Maximum Authorized dollar value of spare parts requested by letter to Project Engineering	400
Maximum Authorized dollar value of spare parts requested for Projects by SAR's	537
Number of Engineered spare parts items reviewed	28
Number of Drawings revised	3
Actual Dollar value of items deleted from spare parts stock	11,294
Maximum Authorized dollar value of items deleted from spare parts stock	15,516

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Engineering Standards

The OPG concerning "Pressure Vessels and Pressure Piping" proposed by SEO was approved by the HAPO General Manager, November 26, 1958, and has been published. Work is now in progress on developing a proposed IPD OPG on the same subject.

In conjunction with Hanford Labs personnel, the Explosimeter application for Helium leak detection has been tested both in the laboratory and in field application and has been found reliable, sensitive to Helium system leaks of any consequence, and a very rapid method of locating Helium leaks. This instrument was used to leak check the Army Gas Loop presently being installed at DR with excellent results.

Craft Training

Work is progressing satisfactorily on service manual and training course covering Sub-Critical Monitoring system to be installed in all areas.

Other training projects in progress are as follows:

- (1) Ball 3X System Modifications, 105-C.
- (2) Reactor Tools Manual - Description and Procedures.
- (3) Preparation of Heat Treating information to be presented to the Machinists in Central Maintenance.

6. Trips

W. W. Walker visited Reynolds Aluminum Company, Phoenix, Arizona, during the month to consult with vendor on production order of 1,000 process tubes.

J. C. Baudendistel made a trip from December 7 to 12, 1958 to discuss coal evaluation with personnel of the following firms: Commonwealth Edison, Chicago, Illinois; Wisconsin Electric Power, Milwaukee, Wisconsin; Detroit Edison, Detroit, Michigan; and Ohio Edison, Akron, Ohio.

7. Significant Reports

HW-58512 (Secret), Budget Study Reason Sheet - Reactor Effluent Quenching, 105-H, JP Corley, 12/12/58.

(Uncl.) Productive Maintenance, dated 12/15/58, EW Baker and TM Clement.

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D. Project Engineering

1. Projects

<u>Number of Jobs</u>	<u>Activity</u>	<u>Financial Responsibility</u>
9	Engineering Studies, Scoping, and Project Proposal Preparation	\$ 155,650
9	Projects in design phase	933,710
14	Projects in construction phase	4,743,600
5	Projects in close-out phase or accrued work on closed projects	40,070,011
3	Field management of non-project work and MJA's	648,000
<u>40</u>		<u>\$46,550,971</u>

AEC-160 - Recirculating Gas-Cooled Test Loop

Leak testing of the loop piping and fabrication of the in-pile tube shielding was completed. In-pile removal facilities have been completed and satisfactorily tested. The gas lubricated compressors have completed testing on the helium gas and a 50 hour run is in progress on nitrogen.

CG-558 - Reactor Plant Modifications for Increased Production

Design of the pump test facility is approximately 90 per cent complete. Procurement of materials is underway.

Performance tests were run on a FW-1419 impeller installed on the first stage and a 1417-1 impeller on the second stage of one of the process water pumps at the request of DeLaval on December 11, 1958. Results of the test were given to DeLaval for their evaluation. The DeLaval proposal for correction of 190 process pumps, as outlined in their letter of November 12, was accepted with minor modifications which were outlined to them by letter dated December 12, 1958. Reply or comment has not been received to date regarding their acceptance of the modifications.

CG-674 - Water Plant Component Test Loop - Building 1706-HE

Repair work is proceeding on the loop at Alco Products. The damaged heater was returned by Alco to the original supplier, Wiegand Company. Further repair is pending return of this heater.

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CA-696 - Coal Car Shakeouts, 100-B, D, F, H and 200-W Area

Although this job is scheduled to be 92 per cent complete at this time, it is now only 50 per cent finished. The lump sum contractor, Lewis Hopkins Company of Pasco, has been delayed due to a strike at one of his supplier's plants. The hoist being furnished by Harnischfeger Corporation of Milwaukee, has been delayed by a strike which was not settled until December 4, 1958. The material has now been shipped, however, and will arrive on plant site approximately January 5, 1959.

CG-707 - Improvements to Reactor Nuclear Instrumentation - 100 Areas

During the week ending December 19, the project engineer and representatives from Instrument Development and Design, were at the Victoreen, Incorporated Plant at Cleveland, Ohio to test and approve the prototype which had been built to represent the electronic system for each of the 100 Areas. This project is scheduled to be 34 per cent complete and we have reported it actually at 35 per cent.

The installation of conduit is complete in all areas at 105-C. This conduit is required to conduct the wires from a test hole location to the control room. Pulling of wires in the conduit in the "cold" area is complete at 105-F, H, and KW.

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

Project completion date extension of one year was recommended in a letter to J. S. McMahon from W. Seeburger dated December 16, 1958. The extension is due to "K" Area graphite distortion. Future activity on the project is dependent upon corrective measures now under study.

CG-740 - Replacement of Central Viewers, 105-B, D, F Buildings

During an outage at 105-B on December 22 and 23, the rear face viewer was virtually installed and beneficial use was obtained on December 23. Work remaining to be accomplished consists of lead wool caulking, as well as, finish painting and completion of a platform in the viewing room.

CG-741 - Renovation of Ball 3X System - 105-C

During the week ending December 19, Construction Operations' forces removed the existing ball trough from the Ball 3X room. This was a very important step in the progress of this project for the demolition work remaining now consists of removing 27 ball valves. Although the removal of these remaining ball valves must wait until an appropriate "C" Area outage, the work can progress as soon as the reactor goes down without the expensive trough clean up time which has been delaying the project so much in the past.

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This project is scheduled to be 21 per cent complete and is reported as actually being 21 per cent complete.

CG-793 - Filtered Water Crosstie Line, 183-B and 183-C Buildings

This job, which is scheduled to be 60 per cent complete is now reported as 70 per cent. All pipe has been laid, tested and backfilling is now in process.

Hydro-test was placed on this pipe line and accepted on December 16, 1958. Backfilling operations began on December 17. The principal work remaining to be accomplished is a tie-in of a 24" lateral to an existing 36" process water line at "B" Area and will be made during the next scheduled outage of sufficient duration.

2. Project Proposals

Project Proposals Awaiting AEC Approval

CGI-815 Increased Water Capacity, B-C, D-DR, F, and H
CGI-824 Remotely Operated Cap Removers, KE and KW Reactor Discharge Areas

Project Proposals Submitted

AEC-160 Recirculating Gas Loop
Rev. 5
CGI-823 Improved Electrical Wiring, Buildings 1760-H and 1761-H

Requests Received for Project Preparation, Revisions, and Changes

AEC-160 Recirculating Gas Loop
Rev. 5
A-75564 Request received for justification preparation on conversion of KIER loop facilities.
A-75828 Continuous Air Monitoring, All Reactors

Project Proposals Approved

CG-704 Design, 100-K Area Outfall Structure Replacement
Rev. 2
CG-823 Improved Electrical Wiring, Buildings 1760-H and 1761-H
Rev. 1

3. Trips

M. G. Patrick visited the General Electric Company at Schenectady and Alco Products at Cincinnati on December 12 through December 19, 1958. The purpose of his visit was engineering liaison on development of special gas compressors and check progress on repair of high pressure water test loop damaged in shipment.

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Mr. H. A. Zweifel visited the Victoreen Instrument Company's plant at Cleveland, Ohio, during the week of December 15 through December 18. The purpose of this trip was to review and approve a prototype electronic system for Project CG-707.

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E. EXPANSION OPERATION

1. Activities

Construction Planning

Discussions were held with personnel of Burns & Roe and the AEC with regard to over-all CAI-816 schedules. Good general agreement was reached for establishing design requirements. Expenditure and obligation patterns were prepared on the basis of the revised schedule thinking. Information on expenditures and obligations was transmitted orally to the AEC.

Maintenance Planning

A review was made of maintenance experience with the 181-K pumps and the 165-K boilers.

Class A overhauls of the 181-K river pumps requires fifty-six working hours on a day shift basis or seventy-five working hours on an around-the-clock basis. Class A's for this equipment are scheduled for every three years. This may be possible of extension to every five years. Based on this actual experience, it is concluded that NPR must be so provided with equipment that overhauls can be accomplished independent of outages.

The 165-K boilers are presently inspected once each year. The inspections take about six to twelve days each. Class A overhauls are scheduled once every three years and require twenty-one days. The boilers presently average about thirty-five days out of service per year. This period may be reducible to fifteen or twenty days.

Zirconium Planning

All prospective vendors that have been requested to submit proposals for fabricating the pilot order of NPR tubes have shown considerable interest. Fabrication of the heavy wall KER tubes has been completed with four of six tubes being acceptable. Improper care during annealing probably was the contributing cause to the rejections.

Technical information concerning the fabrication of the tubing has been submitted to Process Design by Research and Engineering and a formal specification is now being prepared. Discussions are also being held on the on-site preparation work required prior to installation to determine how best and by whom this may be performed. This appears to be a major and expensive problem.

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Since each prospective vendor is engaged in some development work at his own expense to assure he can fulfill any proposal he should submit by February 2, 1959, it is important that funds be available at this date.

Graphite Planning

The study to program the procurement and fabrication of the graphite moderator is continuing. CEO is making a detailed study of their requirements concerning machining facilities. The major graphite producers were visited to discuss and review their capabilities to deliver graphite and to perform machining within the schedule necessitated by the contraction testing program. It was found that to meet the pile stacking date of September 1961 it will be necessary to place orders approximately January 1960 unless we are willing to engage in an expensive crash program. Although each vendor appears to have the know-how to furnish machined graphite the short schedule dictates on-site machining except for rough surfacing and boring.

Expansion Design Council

The Expansion Design Council approved scope drawings for the NPR telephone exchange, the NPR connection to the 230 KV loop and the provision of a diesel-electric emergency back-up drive for the river water pumps.

Reactor Plant Project Representatives

The first meeting of the Reactor Plant Project Representatives was held on December 3, 1958. Discussion of the NPR Design Bases document continued during December. At the Project Representatives meeting of December 16, 1958, it was decided that the pilot orders for zirconium tubing would specify a length of 57 feet plus anything additional that might be required for on-site end sampling.

The basic dimensions of the reactor block were established during the month.

Heat Conversion Plant Project Representatives

The Project CAI-816, New Production Reactor Heat Conversion Plant Project Representatives recommended the following scope items for Design Council consideration:

- a. That imported electrical energy be supplied by a single tap line from the HAPD 230 KV distribution system as shown on SK-1-26666.
- b. That the telephone service be connected to the 100-K exchange and consist of one hundred new line and nine trunk lines as shown on SK-1-26665.

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- c. That fire protection funds in the amount estimated as needed to construct and man a T.C. facility be made available to the IPD Employee Relations Operation to help finance the construction and manning of a permanent station which would give protection to the NPR construction site.

Discussion of the back-up steam system continued during the month.

Control Planning

During the month of December controls on receiving, checking out, and expediting on G.E. classified and unclassified drawings, documents and specifications were established and the file room was set up.

All arrangements have been completed to have all Burns and Roe drawings, specifications and documents received by us and a register has been established for their control.

2. Visitors

J. Gronan, Burns and Roe, visited the plant from December 15 through December 18, 1958, and discussed project schedules, plant layout, administration building design and the river pumping plant layout.

3. Trips

W. D. Richmond visited Burns and Roe in New York November 26 and 27, 1958, for the purpose of discussing NPR project schedules.

E. W. Wilson attended the Annual Meeting of the ASME, the concurrent Twenty-third National Exposition of Power and Mechanical Engineering and visited Burns and Roe Company in New York City, New York from November 30 through December 5, 1958.

C. E. Love, along with D. Marinos of Process Design, took a trip December 6 to December 17, 1958, to National Carbon Company, New York City, Speer Carbon Company, Great Lakes Carbon Corporation, and Graphite Specialities Company, all in Niagara Falls, New York; Great Lake Carbon Corporation plant at Morgantown, North Carolina and Crescent Carbon Company, Los Angeles, for the purpose of discussing and reviewing their capabilities of delivery of various graphite components within the NPR schedules.

J. S. M. C. M. M. M.
by J. L. Hovorka
MANAGER
FACILITIES ENGINEERING

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EMPLOYEE RELATIONS OPERATION
DECEMBER 1958

PERSONNEL DEVELOPMENT & PLACEMENT

Efforts continue toward locating an experienced Nuclear Instrument Development Engineer and two qualified candidates have responded through contacts with the Engineering Register. Three experienced BS/MS candidates were interviewed during the month, resulting in one offer and acceptance with another offer being anticipated from these interviews to a former HAPO engineer.

There were three interviews of PhD candidates during the month, resulting in no employment offers. There are no offers outstanding at month end.

Transfer activities continued at a high level during December with three transfers out of the Department; one to the Aircraft Nuclear Propulsion Department - Cincinnati, one to the Atomic Power Equipment Department at the Vallecitos Atomic Laboratories, and the other to the Hanford Laboratories Operation. There were two transfers into the Department; one permanent assignment from the Technical Graduate Program and one from the Construction Engineering Operation, both engineers. There were seven transfers within the Department.

There were two exempt losses; one resignation for personal reasons and the other a loss due to death.

Seventeen additions to payroll and nineteen removals from payroll were made. Sixteen requisitions were filled with eighteen remaining open at month end.

MAIL AND DUPLICATING

Industrial Engineering Study No. 58-66, requested in order to assist in evaluating the future needs of 100-F and 100-B Areas for various types of duplicating service, was completed this month. The study results will be used in determining whether duplicating facilities should be established in these two locations during CY-1959.

Arrangements were completed which will permit the transfer of the 100-D duplicating facility from 1717-D to the 1719-D annex. The necessary work orders were issued, and Minor Construction forces have begun the necessary renovations. The new location will more adequately house the existing duplicating facility and new equipment soon to be installed.

A survey was begun of the cost method used to assess charges for duplicating work performed within IPD. General Accounting Operation, with assistance from the Office Service Operation, will periodically repeat the survey to assure that an equitable proration of such charges is being made.

COMMUNICATION

Mass communication activities included the publication of eight Management NEWS Bulletins, one Round Table Guide, three Memos from the General Manager, OPG A 11 and Advices 1.2.8, 1.3.2, 1.3.7, 1.6.1 and 6.2.12; plus 189 column inches in the GE NEWS. Two Management Information Meetings were held.

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UNION RELATIONS

Eighteen of the 27 grievances received during the report period were again on the subjects of jurisdiction and overtime. One grievance was received from a non-unit employee and was satisfactorily settled at Step I.

On December 17, the Labor Management Relations course was presented to fifteen IPD exempt employees.

The HOO-AEC Labor Standards Board approved eight jobs for assignment to plant forces which are estimated to cost \$60,081. Since the procedure for obtaining LSB approval was initiated in IPD, 112 jobs have been approved, representing a total cost of \$3,792,085.50.

EMPLOYEE COMPENSATION OPERATION

A new appraisal guide and appraisal form were issued, and salary review plans for 1959 were officially launched.

All eligible IPD employees were contacted for possible sign-up or revocation in the Savings and Security Program as of December 12. Per cent participation as of December 15 is 96.2.

Thirty-three suggestion awards have been approved for payment this month. In CY-1958, IPD has awarded \$21,522.

HEALTH & SAFETY

Safety representatives from all departments are meeting on a regular monthly schedule with Stores representatives to discuss the current inventory of safety equipment, re-ordering and new purchasing procedures. It appears that many items are no longer in use; also that substitute materials are frequently inadequate and unsafe. The purpose of the discussion is to enable Stores to keep in stock safety items needed and to confer with safety representatives before substituting or re-ordering any safety items.

Considerable safety interest is being displayed by all components operating in 189-D building. This is very desirable in view of the wide-spread activities being conducted.

IPD's safety performance, if continued favorably, will assure each member of an award by January 18, 1959.

100-K Areas have completed four consecutive years without a disabling injury.

Interview with Area Management indicate individual desire to handle injury data and appraisal activities. The chart submitted by safety "Accident Prevention" appears desirable and will be accepted by Level 3 Management.

Because of modified standard changes in maximum hearing levels, there are new studies and preventive planning scheduled for the next few months. Where applied to date, the acceptance of recommendations is gratifying.

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FIRE PROTECTION

Responded to no fires in December.

Complete Training course for new members and refresher course for old members of the Rescue Crews was completed on December 26, 1958, making a total of 232 hours of instruction for CY-1958.

E. J. Fitzmaurice

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FINANCIAL OPERATION
MONTHLY RECORD REPORT
DECEMBER, 1958

General Accounting

The AEC, through Contract Accounting, requested comments on their current definition of "Spare Equipment Held In Storage." We recommended that the definition be broadened to consist of spare equipment which is deemed desirable to be held in storage because of cost, control, utilization and warehousing considerations.

Financial closing was made on Projects CA-788 Fire Protection Facilities 1760 and 1761-H Buildings, and CA-751 Replacement of Steam Line Support Poles - 100 Areas-Phase III.

The quarterly custodial inventory of Precious Metals and Special Materials was taken as of December 31, 1958.

Five employees of IPD traveled to Canada during the month.

Product Cost and Budgets

Discussions were held with Contract Accounting and the AEC budget division on implications of the revised financial plan received in December.

A comprehensive review of organization and job content (particularly of non-exempt positions) was made in connection with planning for CY 1959 improvement in performance of clerical functions.

Current and historical maintenance cost information was prepared for T. M. Clement, Facilities Engineering Operation to be used in an article he is preparing for publication. Assistance was also given P. C. Cabell, of FEO on more detailed maintenance cost information.

The preparation of the monthly power materials and statistics report having become routine was transferred from the Power Analyst to the Records and Reports group.

Personnel Accounting

W-2 Forms reporting employees 1958 earnings were delivered on January 9.

Payroll checks were delivered on December 24 and December 31 to Operation's Representatives because of the Holidays falling on Thursdays.

Suggestion Awards totaling \$21,532 were paid during 1958. Of this sum, \$6,596 was chargeable to prior year's funds.

Auditing

A report of the audit of the records and procedures pertaining to the accounting for special irradiation services for off-site customers was issued.

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An audit of the procedures for the control of grain alcohol was made during the month and findings were reported in an audit memorandum.

The cash fund maintained by Personnel Accounting for travel and salary advances was counted on December, 1958, and transactions since the last count were reviewed.

Procedures

An examination was made of the month-end reporting procedures for essential materials. Inventory and consumption information flow was studied between field personnel, Production Operation, and Financial Operation.

Services were provided Employee Compensation Operation in the revision, reproduction, and distribution of the new exempt appraisal forms for the Department.

A revision was prepared of the Department's advice on forms control.

General

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

W.P. MacNaughton
Manager - Finance
IRRADIATION PROCESSING DEPARTMENT

DP MacNaughton:apa

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END

**DATE
FILMED**

8/21/92