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MONTHLY RECORD REPORT

72022

IRRADIATION PROCESSING DEPARTMENT

MARCH, 1959

By Authority of SC-PR-2

RM Iten 6-25-92

By T.L. Phillips 3-3-92

DG Krueger 8-3-92

Compiled By
IPD Personnel

April 21, 1959

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HW-59840

TABLE OF CONTENTS

General Summary	A-1 through A-6
<u>Research and Engineering Operation</u>	B-1 through B-41
Process and Reactor Development Operation	B-3 through B-17
Process Technology Operation	B-18 through B-22
Operational Physics Operation	B-19 through B-29
Irradiation Testing Operation	B-30 through B-38
Component Testing Operation.	B-39 through B-41
<u>Production and Reactor Operation</u>	Cb-1 through Ch-5
B-C Reactors Operation	Cb-1 through Cb-9
D-DR Reactors Operation	Cc-1 through Cc-15
F Reactor Operation	Cd-1 through Cd-8
H Reactor Operation	Ce-1 through Ce-6
KE-KW Reactor Operation	Cf-1 through Cf-10
Production Operation	Cg-1 through Cg-6
Reactor Operations Statistics	Ch-1 through Ch-5
<u>Facilities Engineering Operation</u>	D-1 through D-26
<u>Employee Relations Operation</u>	E-1 through E-3
<u>Financial Operation</u>	F-1 through F-2

IRRADIATION PROCESSING DEPARTMENT
MONTHLY RECORD REPORT
MARCH, 1959

SUMMARY

RESEARCH AND ENGINEERING OPERATION

Examination of the self-supported fuel elements discharged from B Reactor in February showed no evidence of corrosion. Ten columns of fuel elements with "bumper" type projections for use in ribbed tubes were charged into the KW Reactor.

Tests in KER Loops Nos. 2 and 3 were discharged because of increased activity which indicated fuel failures. However, initial examination of the Zircaloy-2 jacketed cluster type elements from Loop No. 2 and aluminum jacketed elements from Loop No. 3 showed no such evidence.

A study of the adequacy of the K Reactor cooling system was completed and a safety criteria for Hanford reactors was also established. A contract was also negotiated with the Lockheed Aircraft Corporation for a study of the susceptibility of Hanford reactors to earthquakes, to locate points of obvious weakness and suggest means of improvement.

A detailed study of the effect of the wearing away of process tube ribs on the in-pile corrosion rate was completed.

At the end of the report period all reactor power levels were based on fuel element failure control.

Addition of alum with the diatomaceous earth to the KW pressure filters resulted in a decrease in turbidity of the filtered water and longer filter runs.

The first of a series of tests of a nuclear mock-up of the fuel element for the DR Gas Loop in the Hanford Test Pile was completed.

PRODUCTION AND REACTOR OPERATIONS

Reactor input production was 10.9 percent above forecast; 13.1 percent above at the six old reactors and 7.8 percent above at the K Reactors. This was the second best month ever experienced with production 1.5 percent below last month's record.

A new maximum power level (combined total for all reactors) was achieved exceeding the previous maximum by 80 megawatts. New maximum levels were established at all reactors, except F, with increases ranging from 10 to 60 megawatts.

Overall time operated efficiency was 81.7 percent (81 percent forecast); 81.3 percent at the six old reactors and 83.0 at the K Reactors. The H Reactor achieved a 100 percent efficiency and established a new production record for one of the six old reactors.

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The six ruptures removed from the reactors were all I & E regular metal. Four were "O" size which are the first of this type to rupture at the old reactors. Two of the ruptures were at DR and the others were at B, D, KE and KW.

Significant items of equipment experience were:

1. Eighty-five process tubes were installed; 49 in 100-F, 31 in 100-D, three in 100-C and two in 100-KE.
2. Eleven water leaks were corrected; seven tube leaks and four van Stone leaks.
3. Approximately 12 feet of flexible VSR number 27 at F Reactor remained in the channel when rods were withdrawn for start-up March 7.
4. The first zircaloy tube was removed without incident at C Reactor.
5. Loss of raw water back-up, due to loss of leaks in the line, caused an outage at C Reactor.
6. At 115-D Building, the CO₂ flowmeter was ruptured due to overpressure. Flying metal pieces damaged the helium meter which was located near by.

A disabling injury occurred when an electrician journeyman fell from a work bench injuring his back. Three technical overexposures to radiation were experienced. There were no security violations.

Processing and Power statistics for individual reactor areas are tabulated on Pages Ch-1 through Ch-5 of this report.

FACILITIES ENGINEERING OPERATION

Pre-scope design study was initiated on the emergency back-up facility modifications recommended for consideration by the K water plant study group.

Selection of a testing agency was made and contract negotiations initiated for the proposed halogen collector equipment evaluation program under the existing reactor confinement project.

Necessary design and development program redirection was made following the decision that the N Reactor primary loop piping would be carbon steel except for heat exchangers, pumps, and associated piping.

Final decision was made on N Reactor primary pump drive power requirements. A draft of the primary heat exchanger specifications was issued for comment by the Architect-Engineer.

Although over-all N Reactor design progress is approximately on schedule, it has been noted that the current rate of accomplishment will have to be increased significantly to maintain this position. Steps have been initiated in this direction.

The NPR Design Council and Project Representatives groups met regularly during the month. Ten scope items were approved by the Council.

Evaluation of vendors' proposals for furnishing zirconium alloy process tubes in pilot order quantities continued.

Studies of the effect of NPR on HAPO manpower assignments and new hires were completed.

Planning for organization and staffing the General Electric field components was completed.

Flushing and pressure testing of the Prototype Concept Evaluation Loop in 189-D Building is under way.

A rolled zirconium tubing joint supplied by the Canadian General Electric Company, Limited, has been thermal-cycled successfully more than 1,800 times from 275 to 525° F at 1,325 psi.

Samples of a solid-sintered-boron-carbide-alumina material of potential value in the poison spline program have been received at Hanford.

Meetings were attended in Washington D. C., on March 17 and 18 by W. J. Dowis with E. J. Bloch, W. E. Johnson, and some members of the Joint Committee on Atomic Energy and staff to discuss the New Production Reactor Program.

Removal of baffles from the first stage of the DeLaval 190 pumps has been discontinued until the cause and cure of the resultant flow fluctuations have been determined.

Byron-Jackson has promised shipment of four replacement impellers for Project CG-600 by mid-May.

General agreement has been reached with other HAPO departments for the basis of a "Tool Steel Identification Standard."

A scope study for procurement and installation of a scale model of the Columbia River was completed.

One 4500 HP stator was sent to the General Electric Service Shop for modifications and consultations were held with Schenectady representatives in order to develop maintenance information.

Two hundred SWP garments with zippered closures have been received and are being tested in 105-F.

EMPLOYEE RELATIONS

Experienced BS/MS and PhD recruitment continued at a high level during March. Eleven experienced BS/MS candidates were interviewed with five offers extended. Eight PhD candidates were also interviewed with three offers extended.

The manpower requirement study initiated in February will be discontinued with the issuance of the Part I report. This report presented a tabulation of additions required in selected non-exempt personnel classification.

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The first round of the 1959 "Understanding Human Behavior" Course was completed in March.

Pre-employment selection criteria for coal handlers, miscellaneous operators, etc., in Power Operation was prepared for consideration and possible adaptation in other HAPO departments.

Mass communication activities included the publication of eight "Management News Bulletins," one Memo from the General Manager, one Round Table Guide, two IPD Employee Headliners, and one letter to supervisors and managers from the General Manager. GE News coverage included 11 items about IPD activities totaling 165 column inches. Six OPG's and nine Advices were issued during March.

The Van Reenan arbitration case was withdrawn by the HAMTC, but notice was received of a desire to arbitrate an Instrument grievance involving overtime distribution.

The HOO-AEC Labor Standards Board approved five jobs for assignment to plant forces bringing the total to 132 jobs approved since the procedure was initiated in IPD.

An analysis of salary statistics and their comparison to similar statistics for the Company was made. Data were prepared as a basis for salary review action and the schedule and control criteria for an over-all exempt salary review were established.

Appraisal ratings and their distribution with relation to salary zones has been analyzed. Satisfactory progress has been made on the over-all salary review with completion due about the middle of April.

There was one disabling injury sustained March 16, 1959, by an electrician journeyman who fell three feet injuring two vertebrae and a kidney. This injury occurred in 100-H Area.

A serious accident in D Area also happened March 16 when a helium meter exploded causing property damage of \$1,500. No serious personal injuries resulted from this accident.

Approval of test fabrication in 212-P (North Area) was granted on March 29, 1959. Building pressure tests are to be conducted for criteria determination.

Approval to use compressed gas adaptors on a helium-water-pumped nitrogen system was granted for exclusive use in the recirculating gas cooled test loop in 105-DR.

A comprehensive safety inspection of B Area was conducted in March--F Area will be inspected in April.

IPD's Fire Department responded to two alarms during March: (1) March 17 - Hanford Area - High winds extended controlled burning to grass and dead trees, making extinguishment necessary. Approximately one acre was burned - loss was \$10. (2) March 18 - 100-B Area - Improper disposal of smoking material ignited trash in a Load Lugger - loss was \$160.

IPD's Fire Protection Operation will transfer to Construction Engineering and Utilities Operation, Plant Auxiliaries, April 1, 1959

FINANCIAL OPERATION

The Plant Acquisition and Construction, Equipment, and Operating Expenses budgets for FY 1961 and Revision of FY 1960 were completed.

Physical inventory of fixed plant and equipment commenced in 100-B Area and 100-D Area on March 23.

Tuition refund checks totalling \$810 were prepared and mailed to 36 IPD employees who completed fall semester courses at the University of Washington Center for Graduate Study.

Cancellations of periodical subscriptions have resulted from the list circulated to Level 3 Managers in February.

Negotiations for the transfer of the IBM Transceiver equipment from Personnel Accounting to Production Operation have been completed.

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IRRADIATION PROCESSING DEPARTMENT

MONTHLY REPORT OF INVENTIONS OR DISCOVERIES

MARCH, 1959

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>
E. C. Arbuckle	A pneumatic tool to assist in the manual lifting, transfer and positioning of uranium fuel elements
B. C. Benedictson	
H. A. Kramer	Control of vapor "steaming" from the surface of a body of water at elevated temperatures in a temperature zone from ambient to near boiling point

General Manager
IRRADIATION PROCESSING DEPARTMENT

RESEARCH AND ENGINEERING OPERATION

MARCH 1959

VISITORS AND BUSINESS TRIPS

J. W. Burton and J. White of Roberts Manufacturing Co., Darby, Pa., visited HAPO to observe operational methods of water treatment, 3/4/59.

W. F. Dietrich of Burns & Roe Co., New York, N.Y., visited HAPO to discuss water treatment and decontamination, 3/9/59.

Dr. D. J. Pflaum of the AEC, Div. of Classification, Washington, D.C., and Dr. R. D. Bennett of Vallecitos Laboratory, San Jose, Calif., visited the KER Facility at HAPO on 3/23/59 and 3/24/59, respectively.

R. C. Howard of the General Atomics Division of General Dynamics, San Diego, Calif., visited HAPO to deliver nuclear mock-up assembly, 3/24/59.

O. H. Greager attended the ASA Sectional Committee N6 Meeting at Youngstown, Ohio, and also visited the Shippingport Reactor at Shippingport, Pa., 2/28-3/4/59.

R. W. Benoliel visited General Electric Research Laboratory, Schenectady, N.Y., and National Carbon Co., Cleveland, O., for technical discussions on graphite research and development and production, 2/27-3/8/59.

F. E. Dearing and J. E. Hanson visited the Bettis Plant, Westinghouse Electric Corp., Pittsburgh, Pa. to observe loading of the KAPL-120-8 fuel elements and to exchange information as to the final details of the KAPL-120-8 testing program, 2/28-3/5/59.

W. H. Clark visited General Electric Co., Vallecitos Laboratory, Pleasanton, Calif., for an employment interview, 3/1-3/59.

R. E. Hall visited the Savannah River Laboratory, Augusta, Ga., Mallinckrodt Chemical Works, St. Louis, Mo. and Feed Materials Processing Center at Fernald, Ohio, to discuss uranium fabrication problems, 3/7-13/59.

W. K. Alexander attended a Sheath Meeting at Savannah River Plant, Augusta, Ga. and discussed the fuel development program at Nuclear Metals, Inc., Concord, Mass., 3/14-21/59.

A. G. Blasewitz visited General Electric Co., APED, San Jose, California for an employment interview, 3/15-18/59.

R. Nilson visited the University of Washington, Seattle, Wn. for PhD recruiting, 3/18-21/59.

W. C. McGee presented a paper at the Symposium of Central Ohio Assn. for Computing Machinery, Columbus, Ohio and discussed computing matters with GE Evendale Computation Group, Cincinnati, Ohio, 3/20/59.

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ORGANIZATION AND PERSONNEL

	<u>Permanent</u>		<u>Rotational</u>	
	<u>Feb.</u>	<u>Mar.</u>	<u>Feb.</u>	<u>Mar.</u>
Management & Administration	5	5	-	-
Process & Reactor Development	43	43	3	4
Process Technology	35	33	2	3
Operational Physics	19	19	3	4
Irradiation Testing	21	23	1	1
Component Testing	18	17	0	0
Coolant Testing	26	25	0	0
	<u>167</u>	<u>165</u>	<u>9</u>	<u>12</u>

Process Technology: Genevieve L. Anderson, Secretary, transferred to F Reactor Operation, IPD, 3/2/59. D. L. Moore, Engineer II, terminated 3/13/59.

Irradiation Testing: R. S. Hagan, Engineering Assistant, transferred from Component Testing, 3/16/59. R. M. Cadd, Engineering Assistant, transferred from H Reactor Operation, IPD, 3/30/59.

Component Testing: R. S. Hagan, Engineering Assistant, transferred to Irradiation Testing, 3/16/59.

Coolant Testing: W. D. Bainard, Engineer II, returned to Facilities Engineering, IPD, 3/1/59. Martha U. Sodorff, Secretary, terminated 3/6/59. Louise H. Dreher, Secretary, transferred from B & C Reactor Operation, IPD, 3/9/59.

PROCESS AND REACTOR DEVELOPMENT OPERATIONReactor FuelsPresent Reactor Fuels TechnologyProjection Fuel Element Testing

PT IP-183-A-98-FP, "Evaluation of Projection Fuel Elements for Use in K Process Tubes", R. E. Hall, HW-56525-C.

Ten columns of fuel elements with "bumper-type" projections, accompanied by ten columns of KIIIIN type controls (1.460" x 0.385" natural uranium I & E Fuel elements) were charged into KW Reactor during the outage of 3-25-59. This test is designed to determine the feasibility of using projection elements in ribbed process tubes as a means of eliminating hot-spot ruptures. It presumes that hot-spot ruptures may be eliminated if an annular flow passage greater than approximately 15 mils can be provided. These test elements guarantee an annulus of 30 mils.

Success of this test will be evidenced in the absence of hot-spot flow patterns on the test material and no evidence of other problems associated with the presence of the projections, e.g., sticking, if this success is obtained a demonstration loading and preliminary preparations for large scale usage may be in order.

PT IP-84-A, "Evaluation of Slugs Having Projections for Use in Ribless Process Tubes", R. E. Hall, HW-50991-A.

Two columns of self supported I & E elements were discharged at 200, and 425 MWD/T from B Reactor during the outage of 2-27-59. Visual examination revealed one piece from the lower exposure column which had a minor flow pattern between two ribs on the downstream end of the piece.

Since the column was so low in exposure, it was difficult to evaluate the pattern; however, it was decided that it was not a hot-spot, but probably was a point at which the film had not as yet been deposited. This is somewhat born out in that after cleaning it was no longer discernible nor was any evidence of corrosion.

Uranium Heat TreatmentDelay Quenched Uranium Rod Stock

PT IP-179-A-97-FP, "Evaluation of the Effect of a Modified Beta Heat Treatment Cycle on Dimensional Stability of Uranium Fuel Elements", R. E. Hall, HW-56429-C.

The first eight columns of rod heat treated, delay quenched, I & E fuel elements was discharged from 105-C and is currently being examined. These columns had occurred at approximately 600 MWD/T. The remainder of the test will probably reach goal exposure prior to the next C Reactor outage.

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HW-59840

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Chloride Heat Treated Blank Cores

PT IP-220-A-4-FP, "Evaluation of the Dimensional Instability of Core-Blank Heat Treated Uranium", R. E. Hall, HW-59222.

Six columns of fuel elements heat treated in chloride salt in core blank form at Fernald alternated with control material were charged into 105-DR for irradiation to normal variable goal.

Nickel Plated Fuel

PT IP-207-A-3-FP, "Evaluation of Effluent Contamination Problems Associated with Nickel-Coated Fuel Elements", R. E. Hall, R. B. Hall, HW-58179-A.

Preliminary results of the sampling of the effluent water from the six columns charged in 105-C indicate very little if any, difference in activity after approximately 30% of goal irradiation. Panellit pressures for two of the columns were variable after the last C startup, which might be indicative of plate flaking. Hourly readings were established and the offending columns will be discharged if further indications are obtained in an effort to prevent a Panellit scram.

Depleted Uranium Demonstration

PT IP-231-A, "Irradiation of Depleted Uranium to High Exposure", R. E. Hall, HW-59230.

Production test coverage was obtained to transfer eight columns of depleted uranium from PT IP-132-AC to PT IP-231-A in order that PT IP-132-AC could be terminated. These eight columns are scheduled to be irradiated for one year to attempt to evaluate the effectiveness of tails preparation process changes on the failure rate observed in that material previously.

Advanced Reactor Fuels

NPR Fuel Development

The first full size NPR prototypic tube-tube co-extrusions were made on March 13. These extrusions were made at American Brass Company on their 2400 ton press. Two outer tubes were made and although complete evaluations of dimensions and quality have not been received, it appears from visual inspection that the material is of good quality. The inner tube was produced without difficulty although the OD/ID ratio is large in comparison to normal commercial tube extrusions.

Fabrication of the KER size enriched material is being delayed somewhat. NMI is several weeks behind schedule getting out their feasibility study which they are required to complete before they can start work on any enriched metal. They are now planning to start melting and alloying the U-2w/o Z2 material about April 1.

Fernald is also experiencing considerable delay in fabrication of the enriched unalloyed billets which they are preparing for extrusion by NMI.

Cladding of I & E Geometry/NMI Contract

During the month zircaloy clad I & E extrusions were made by the three following techniques: a) conventional floating mandrels, b) oversized conventional floating mandrel with subsequent hot work to I & E dimensions, and c) filled billet with subsequent removal of core. A scheduled extrusion with a stationary, tipped mandrel was not accomplished because of an unsatisfactory ram mandrel combination. The three types extrusions which were done will be evaluated and some additional extrusions made by the most satisfactory method.

It now appears that I & E size zircaloy clad extrusions can be made without undue difficulty. Such extrusions would be end closed by methods being developed on the NPR program.

Fuel Design Studies

The Reactor Planning IBM Physics program is now complete and is in debug phase.

The tubular element - heat split, temperature profile, etc., program has been reduced to FORTRAN language and will be translated and debugged as soon as the main Physics program has been cleaned up.

A tentative flow chart for a fuel design program embodying a combination of the Reactor Planning Physics program, the heat split program, a pressure drop-flow rate - ΔT program, and a heat transfer coefficient calculation program has been drawn up and will be expended as rapidly as time will permit.

Irradiation Test Experience in 1706-KER

Two high temperature recirculating KER loops were discharged March 24 because of suspected failures. KER Loop 2, containing four enriched Zircaloy-2 jacketed seven-rod cluster elements, two natural UO_2 Zircaloy-2 jacketed seven-rod cluster elements, and one enriched three-foot three-rod Zircaloy-2 jacketed cluster elements under PT IP-214-A was discharged at about 1600 MWD/T after above-normal activity was indicated by the delayed neutron monitor and by surveys of coolant samples. Incomplete examination of the fuel elements has not shown a point of failure. After the reactor was shut down, a failure was indicated in KER Loop 3, containing twenty-five aluminum jacketed depleted uranium fuel elements and one doe alloy thermocouple element under PT IP-229-A at about 200 MWD/T, by a marked flow reduction and excessive activity from the loop components. Again, a cursory examination of the fuel elements has not shown the location of failure.

Uranium Volume Increase

Radiometallurgy examination of 16 rods of 1.6% enriched uranium with co-extruded Zr-2 cladding has shown that all have experienced macro and micro cracking covering about two thirds of the diameter in the center. The cracking was accompanied by a 1.5% diameter increase. Examination of 14 rods of similar, unenriched material shows only one instance of diameter increase. The latter has not yet been cross-sectioned to identify cracking.

The status of Production Tests active and/or authorized are summarized in Table I.

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TABLE I
PRODUCTION TESTS - FUEL DEVELOPMENT

Test Number	Type Metal	Tubes	Reactor	Goal Exposure	Current Exposure	Remarks
IP-56-A	Low Hydrogen Dingot U Elements	127	D, DR, F	Variable		Semi-production scale testing of low hydrogen dingot uranium fuel, solid and I & E
IP-81-A	BWTL Regular	232	D	Variable 500		Provide for quantity charging of BWTL elements. (Solid)
IP-84-A	Projection I & E Nat. Elements	13	B	400 & 600 800 MWD/T		Preliminary evaluation of self- supported fuel elements. (I&E)
IP-93-A	Cast uranium I&E Natural	12	C	500 & 700 MWD/T	450 MWD/T	Preliminary evaluation of fuel elements fabricated with Cast uranium cores to evaluate dimensional instability.
IP-95-A	Lead Dip, 1.445"	7	D	800 MWD/T		Provides for corrosion moni- toring of I & E elements in D Reactor.
IP-168-A	1.460" O.D. Natural I & E	4	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	450 MWD/T	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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HW-59840

TABLE I (cont'd)

Test Number	Type Metal	Tubes	Reactor	Goal Exposure MWD/T	Current Exposure MWD/T	Remarks
IP-179-A	OIIN geometry, 45 sec. delay quenched nat. uranium.	8	C	900 MWD/T	750	Provides for testing to optimize heat treatment of I & E fuel elements. 8 columns discharged at ~600 MWD/T.
IP-183-A	OIIN with bumper supports	20	KW	400, 600, 800 MWD/T	~ 50	Provide for testing of bumper con- cept of projection elements in ribbed tubes.
IP-205-A	Zr-2 Jacketed Rod-and-Tube elements.	1	KE	2500	1500 MWD/T	Charged Nov. 18, 1958, in KER Loop 4.
IP-207-A	Nickel Platted CIIN Fuel Elements.	6	C	400,800	200	To evaluate the effluent contami- nation problems associated with Nickel Platted Fuel Elements.
IP-210-A	CIIE normal sorted as to Bond integrity.	30	C	Normal	300	Evaluation of relationship between Bond integrity and Hot- Spots.
IP-214-A	Zircaloy Jacketed 1.6% Enriched 7-Rod Cluster elements & a 3-foot, 3-rod, Zr-2 Jacketed, 1.6% enriched integral and closed cluster element.	1	KE	3500	1600	Charged in KER Loop 2 Dec. 9, 1958. Discharged March 24, 1959 because of neutron monitor activity. Failure not confirmed.
IP-226-A	Zr-2 jacketed, 1.6% Enriched 7-rod cluster elements.	1	KE	4500	1100 MWD/T	Charged in KER Loop 1 on Jan. 15, 1959.

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TABLE I (cont'd)

<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-229-A	Dip canned al. jacketed depleted uranium solid elements; one doe thermocouple element.	1	KE	500 MWD/T	160 MWD/T	Test was charged Feb. 4, 1959 to evaluate high temperature uranium - Al-Si bond stability and discharged March 24, 1959 because of suspected failure. Failure not confirmed.
IP-231-A	Depleted (0.2%) Uranium I&E	8	C	One year	4 months	Test charged 11-24-58 for irradiation to high exposure to evaluate integrity.

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Reactor Physics

Present Reactor Physics Technology

Graphite Contraction

In order to properly interpret contraction data in Hanford irradiated graphite samples, a better idea of the detailed neutron flux spectrum must be obtained than is presently available. To satisfy this need, theoretical calculations have been started. The first step of these calculations has been completed. The carbon-moderated slowing down spectrum has been obtained by numerically integrating the following expression on the IBM-709.

$$\psi(E) \Sigma_s(E) = \frac{k}{E} \int_E^{20 \text{ Mev}} [1 + P_{AA}(E/E_s)] N(E_s) dE_s,$$

$\psi(E)$ is the slowing down flux

$\Sigma_s(E)$ is the scattering cross section for graphite

E is the energy in Mev

$P_{AA}(E/E_s)$ is the deviation of the Placzek function from its asymptotic value.

ξ is the logarithmic decrement for graphite

$N(E_s)$ is the fission spectrum

The spectrum is closely $1/E$ up to $\sim .1$ Mev, but then lies above the $1/E$ curve. Furthermore, the spectrum shows variations from the discontinuities in the Placzek function and derivatives. At very high energies, the spectrum lies below the $1/E$ curve, as would be expected.

To this spectrum must be added the properly normalized virgin neutron spectrum.

Advanced Reactor Physics

Thermal Neutron Absorption Cross-Section of Zircaloy-2

The microscopic cross section of a typical sample of Zircaloy-2 process tube was measured in the 305 pile. The value obtained was .206 barns, which compares to .180 barns for pure zirconium. The ratio of Σ_{Zr-2} to $\Sigma_{2s al}$ is .6479 assuming $\rho_{Zr-2} = 6.4 \text{ gm-cm}^{-3}$ and $\rho_{al} = 2.699 \text{ gm-cm}^{-3}$.

NPR Heat Generation Data

Preliminary calculations indicate that the maximum heat split for the NPR during shutdown will be 83.6%, 13% and 3.4% for fuel, graphite and process tube, respectively. The time variation of the split has been obtained for three representative NPR fuel elements for times of 100 - 100,000 seconds after shutdown.

Control Rod Studies**DECLASSIFIED**

Work is continuing on perfecting a general purpose control rod program. The present edition has been expanded to allow absorption of fast neutrons by the rod, the only requirement being that one know the extrapolation length for fast neutrons in an infinite medium of the same composition as the rod.

Difficulties have been encountered with the formulation as written in the document AERE-R-R-818. It seems that the solution is almost impossible to obtain by ordinary convergency methods due to the very erratic behavior of an infinite series of Bessel functions contained in the formula. At the present time centered control rods can be calculated with good results, the only problem being eccentric rods.

NPR Rupture Detection

The ETR project CA-681 revision proposal was accepted by the AEC and HLO. Design and equipment specifications for the ETR rupture test facilities addition are nearly 90% complete. A development proposal was received from Battelle Memorial Institute BMI, regarding the development of a proposed Silver Halide collector. This proposal proposes the development and evaluation of prototype silver halide collectors for reactor rupture detection systems.

NPR Design Criteria Review

The following design bases or system design criteria were reviewed and commented on during this report period.

- HW-57044 RD 2, "105 N Design Criteria Functional Requirements of the Primary Loop Control and Instrumentation Systems," March 5, 1959.
- HW-57029 RD, "105 N Design Criteria, Pile Motion, Seismoscope and Optical Systems," March 17, 1959.
- HW-57020 RD, "105-N Design Criteria, Power Calculator, Boiling Point, and Bulk Coolant - Bulk Temperature Measurement Systems," March 11, 1959.
- HW-57013 RD, "105-N Design Criteria, Horizontal Rod System," March 16, 1959.
- HW-57041 RD, "100-N Design Bases - Part V Functional Requirements of the Plant Auxiliary Control and Instrumentation Systems," March 23, 1959.

NPR Loop Stability Studies

The equations for the kinetics and heat transfer within the reactor have been programmed and are ready to be checked out on the analog computer next week. First runs will be directed toward evaluating relative stability. Later more runs may be made to determine the transient response to particular input functions.

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The previous estimates of the flux profiles are being used to give estimates of the flux currents into the thermal and biological shields. The previous data have been modified slightly to obtain values consistent with the design flattening efficiency.

Reactor EngineeringPresent Reactor Engineering TechnologyZircaloy-2 Process Tubes

Two orders for C Reactor ribless Zircaloy-2 tubes have been submitted to HOO for final approval. Each order is for 50 tubes at a price of \$1,029 each, and the orders are being placed with Harvey Aluminum Company and with Bridgeport Brass Company. In addition, a contract has been prepared and submitted for approvals for 75 BDF Zircaloy-2 ribbed tubes.

In-Pile Process Tube Corrosion

A detailed study has been made of the effect of the wearing away of the reactor process tube ribs upon the process tube corrosion rate. The effect of this reduced rib height upon the fraction of the total flow in the annulus between the ribs and the annulus above the ribs around the rest of the fuel rod was determined. This was combined with the assumption that 25 percent of the annulus heat is dissipated between the ribs to give a value for the ratio of the between-the-rib bulk outlet temperature over the average annulus bulk outlet water temperature (R_{BTR}).

To date, values of R_{BTR} equal to 1.25 - 1.30 have been calculated for C Reactor annuli. Thus, assuming an 80°C average temperature increase across the charge the temperature leaving the bottom annulus would exceed the average annulus temperature by 20 to 25°C. This would amount to a corrosion rate in the between-the-ribs annulus near the downstream end of the fuel charge of nearly four times that predicted with uniform annulus temperatures. This means that at high tube outlet temperatures, tube corrosion rates will be in the order of 2 mils per operating month.

Earthquake Studies

A contract has been established with Lockheed, Holmes, Narver Companies for \$50,000 to make a study of the earthquake susceptibility of the reactor plants and to locate points of obvious weakness and suggest means of improvement.

K-Reactor Cooling Adequacy Study

A study was completed of the adequacy of the K Reactor cooling system with respect to the conditions of:

- 1) Loss of BPA power.
- 2) Loss of 4.16 KV power
- 3) Loss of both BPA and 4.16 KV power.
- 4) The sudden mechanical loss of a process pump.
- 5) Rupture in a process pipe line
- 6) Rupture in or failure of the high-pressure cross-tie between the two reactors.

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HW-59840

A safety criteria was established for the Hanford reactors. These criteria were then used in conjunction with the six general types of system incidents to explore the region of increases in the K Reactor power level with still further increases in the safety of the system. In addition to the planned CG-775 K water plant modification the following capital installations have been recommended for budget study:

- 1) Addition of a steam turbine driven pump in each area.
- 2) 4.16 KV electric cross-tie between KE and KW 165 Buildings.
- 3) Increases in Hydraulic cross-tie capacity.

Advanced Reactor Technology

Zircaloy-2 Process Tubes - NPR

An interim evaluation of the tube proposals submitted by the interested vendors was prepared by General Electric and submitted to HOO on March 24. Negotiations were held with representatives of Harvey Aluminum, Allegheny Ludlum Steel Corporation, Tube Reducing Corporation, and Budd Manufacturing Company. After much discussion all vendors agreed to the terms and conditions of GE and AEC concerning the proposed contracts.

NPR Graphite

Irradiation of TSGBF and CSF in GEH-9-8 in the L-42 position in the MTR which was charged February 2, will be continued to May 18. This is one more cycle than originally scheduled. The additional cycle is available because the KAPL-37 device to be charged into that position will not be ready on the previously scheduled April 27 date.

The L-48 modified shim rod assembly to be charged into the MTR as GEH-19-1 is nearly complete. The irradiation thimble contains three samples of a new graphite made of a Continental coke similar to the old Kendall coke used for the graphite for the B, D, F reactors and one sample of CSF graphite as a reference material. The device is scheduled to be charged April 27. The Minneapolis-Honeywell plant from which the instruments to control the temperature of the samples in the modified shim rod are being purchased is on strike. The instruments are at the plant ready to be shipped. A government priority is being obtained in an effort to move the instruments from the struck plant.

The ETR operating schedule dated March 19 indicates that there will be only a two week period of low power operation between now and June 19. This is due to the scheduled installation of several test loops in the reactor. Steps are presently being taken to improve the "C" priority on the graphite test irradiations. Currently no other user has higher than a "C" priority. Also to compensate in part for the reduced irradiation time, a request is being made for increasing the number of test installations from two (E-5 and N-14) to four (including the other two corner filler positions, E-14 and N-5). Plans are also being made to conduct high temperature irradiations of candidate NPR graphites in small capsules in test holes in the ETR reflector. The temperature of these irradiations will not be accurately known but direct comparisons will be made between the extent of contraction of candidate materials and reference graphites such as KC or CSF.

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HW-59840

During the week of March 2, visits with HLO personnel were made to some of the plants and laboratories of the three major carbon companies. Discussions indicated that study of graphite manufacturing process variables (over and above the variation of starting cokes included in the present cooperative test program between the manufacturers and Hanford) might aid Hanford in specifying the graphite for the NPR on January 1, 1960. Samples of several different graphites made by processes including steps which it is believed may impart desirable characteristics have been shipped to Hanford by Speer Carbon. Presumably National and Great Lakes will also submit samples. Variables include graphitization of raw coke, exceedingly fine particle size in the mix, non-symmetrical extrusion and molding.

Reactor Planning

Document HW-59414, Production Only Optimization Study, R. O. Gumprecht, et.al., March 13, 1959 has been issued. This document indicates incentives associated with new reactor design.

A computational program for the calculation of reactor physics parameters has been readied for the 709. The program will find the feed enrichment required to operate a reactor at stated equilibrium conditions. The lattice may have as many as 16 different materials in 16 different regions. As of this time, the adequacy of the program has not been determined.

A computational program for the calculation of reactor physics transients has been readied for the 709. From an input of equilibrium conditions, the program will develop changes in K with up to 3 independent changes in operating conditions for as many as five points per independent parameter. At this time, the adequacy of the program has not been determined.

NPR Project Representatives

The following material was approved by the R&E Heat Conversion Representative during the month:

- 1) SK-1-31300 - Administration Building floor plan.
- 2) SK-1-31302 - Administration Building elevation and section.
- 3) Design criteria - 1704 Building.
- 4) Design Bases Part III Functional Requirements of the Containment System.

The following scope documents were approved for Research and Engineering during the month:

HW-57012, Pile Gas System Design Criteria

HW-57045, Design Bases, Part III, Functional Requirements of the Confinement System.

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HW-59840

Radiological Engineering

Radiation Control Experience

The following table summarizes the first 12 weeks 1959 radiation exposure experience for the critical IPD classifications:

<u>Classification</u>	<u>Total Dose</u>	<u>No. of Men</u>	<u>Average Dose/Man</u>	<u>Extrapolated Year End Average</u>	<u>No. of men Over 3r Extrapolated Exposure</u>
Radiation Monitors	4158 mr	85	489 mr	2120 mr	11
Processing Operators	97212 mr	259	375 mr	1625 mr	13
Pipefitters	51740 mr	94	550 mr	2384 mr	28
Millwrights	33041 mr	80	413 mr	1790 mr	11

Three technical overexposures were recorded during the month. One involved a Supplemental Crews Sub-Section employee receiving an exposure of 375 mr in a five day period as shown by his film badge. The estimated exposure was 255 mr. Another involved a K Maintenance Sub-Section employee who lost his badge in a storage basin. A review of his estimated exposure for the period covered by the badge revealed 320 mr received in a six day period. The third was a localized overexposure to a Component Testing Sub-Section employee. He received a dose which could have been as much as 5.8 rads to the skin of his foot as the result of picking up a radioactive particle on the sole of his shoe.

Eighteen Reports of Lapse of Radiation Control were issued during the month. In addition to the technical overexposures reported above there were three cases of spread of contamination to the skin or personal clothing of employees and five cases in which employees received uncontrolled exposure to radiation. The latter cases occurred as a result of: 1) a ball valve breaking off at the charge face of a reactor, permitting irradiated dummies and poison pieces to spill out onto the charge elevator; 2) sampling for a rupture without establishing the dose rate; 3) overlooking a high dose rate due to a beam in setting the dose rate in a ball 3X room; 4) removing the barricade around a highly radioactive spline cutter; and 5) opening a ball valve while personnel were on the discharge elevator, permitting a charge of perfs to spill onto the elevator floor.

Other lapses involved: 1) gross contamination in the bed of a pickup truck; 2) a piece of highly radioactive thermocouple wire on an experimental level; 3) contamination of the ground due to improper handling of a burial cart; 4) a loaded dummy cart left outside a radiation zone; 5) a high dose rate at the edge of a radiation zone due to highly radioactive material stored too close to the edge; 6) no timekeeping provided for a job involving dose rates up to 10 r/hr. One technical overexposure which occurred last month is included in this month's lapse of control experience.

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HW-59840

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 Totals</u>
Processing	1	4	1	1	1	0	1	3	
Maintenance	0	0	0	1	0	1	1	1	
Supplemental Crews	0	0	0	1	0	0	0	0	
Research & Engineering	0	0	0	0	0	0	0	0	
Facilities Engineering	0	0	0	0	0	0	0	0	
Central Maintenance	0	0	0	0	0	0	0	0	
Reactor Areas	0	1	0	0	0	0	1	0	
Assigned Totals	1	5	1	3	1	1	3	3	18
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

These data are reported through the cooperation of the Radiation Protection Operation, HLO.

Columbia River and Sanitray Waters

100-F Area

	<u>Raw</u>				<u>Sanitary</u>			
	<u>Dec.</u>	<u>Jan.</u>	<u>Feb.</u>	<u>12 month average</u>	<u>Dec.</u>	<u>Jan.</u>	<u>Feb.</u>	<u>12 month average</u>
%MPE _{GI}	8.8	7.7	6.2	5.7	2.0	2.7	1.3	1.3
%HAPO Limit					20	27	13	13

Pasco

	<u>Raw</u>				<u>Sanitary</u>			
	<u>Dec.</u>	<u>Jan.</u>	<u>Feb.</u>	<u>12 month Average</u>	<u>Dec.</u>	<u>Jan.</u>	<u>Feb.</u>	<u>12 month Average</u>
%MPE _{GI}	1.9	3.2	1.3	1.6	0.4	0.4	0.4	0.4
%HAPO Limit	38	64	26	32	8	8	8	8

Kennewick

	<u>Sanitary</u>			
	<u>Dec.</u>	<u>Jan.</u>	<u>Feb.</u>	<u>12 month average</u>
%MPE _{GI}	0.2	0.4	0.2	0.4
%HAPO Limit	4	8	4	8

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HW-59840

Average Reactor Effluent Activity Output

	<u>March 1959</u>	<u>February 1959</u>	<u>March 1958</u>
107-B	31,000 $\mu\text{c}/\text{sec}$	27,000 $\mu\text{c}/\text{sec}$	20,000 $\mu\text{c}/\text{sec}$
107-C	47,000 "	29,000 "	39,000 "
107-KW	66,000 "	58,000 "	28,000 "
107-KE	58,000 "	50,000 "	28,000 "
107-D	36,000 "	26,000 "	29,000 "
107-DR	21,000 "	18,000 "	22,000 "
107-H	27,000 "	26,000 "	22,000 "
107-F	26,000 "	30,000 "	22,000 "

Radiological Training

Training of radiation monitors in presenting radiation protection information to appropriate IPD personnel continued. The total reported attendance at meetings conducted by the radiation monitors during March was 411. Attendance by area was as follows:

$\frac{100-B}{90}$	$\frac{100-D}{181}$	$\frac{100-F}{22}$	$\frac{100-H}{45}$	$\frac{100-K}{73}$
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A meeting on the subject "Protective Clothing and Contamination Control" was presented to 35 Facilities Engineering personnel. A radiation training bulletin was issued concerning the new "Routine and Repetitive Survey Record" forms.

Protective Clothing

The Engineering Standards Council is preparing a procurement guide for radiological protective equipment which should assist in improving the quality and uniformity of equipment purchased. Radiological Engineering will represent IPD in providing assistance in the preparation of this guide.

Remote Area Monitoring

The Victoreen remote monitoring equipment arrived on site March 18, 1959. The following observation concerning the acceptance tests of the equipment are listed:

- 1) Calibration appears to be within specifications in most cases. There will be more than 40 satisfactory sensing elements and station units out of 55 in the shipment.
- 2) Temperature tests to date indicate the equipment will meet this specification.
- 3) Humidity tests are not complete, however, with highest humidity condition obtainable in the test facility, i.e., 90% at 170°F, the sensing element and connector function satisfactorily.

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HW-59840

- 4) Drift of the sensing elements appears to be negligible, however, the longest drift test made to date is 48 hours.
- 5) Power supplies are stable and the calibration shift with variation of the supply voltage fall within the specification limits.
- 6) Station units and power supplies do not meet the original specification for humidity resistance. However, this specification was waived. It may be possible to enclose the entire unit in a polyvinyl plastic case which may allow the use of the equipment in conditions of high humidity.

Through Pile Decontamination

Under the authorization of PT-203-AE, two tests were conducted at 105-C to gain some information on the persistence of benefits from process tube decontamination with Turco 4306-B. A series of water samples were obtained from one tube which had been decontaminated. At the end of a month and a half, the concentrations of arsenic-76 and phosphorous-32 were about half and neptunium-239 about 20% of normal effluent concentrations. On the other hand sodium-24, copper-64 and zinc-65 concentrations were about normal. The arsenic-76 and copper-64 contribute most of the gamma dose rate early in an outage and zinc-65 contributes most of the long-lived activity. The other test involved exposure of three rings in the rear of the process tube to determine the build-up of radioisotopes. These rings were made of aluminum, stainless steel and carbon steel so that the effects on different materials could be observed. When the sets of rings were removed after exposure for about one month the gamma dose rate was 6 mr/hr from those in the decontaminated tube and 14 mr/hr from those in the control tube. Determination of the relative activities of the various radioisotopes is incomplete, but the table below shows the relative activities of those listed per cent of the activity on the control samples.

	<u>Al</u>	<u>SS</u>	<u>CS</u>
Cu ⁶⁴	120	150	100
As ⁷⁶	44	34	50
Np ²³⁹	15	22	53

Columbia River Water Analysis

<u>Date</u>	<u>Time</u>	<u>Location</u>	<u>Temp.</u> (°C)	<u>Turbidity</u> (ppm)	<u>As</u> (ppb)	<u>P</u> (ppb)	<u>Zn</u> (ppb)
2/11	12:00 noon	Grand Coulee Dam	2.9	1.3	<0.5	9	22
2/11	2:00 p.m.	Chief Joseph Dam	2.8	1.8	3	<50	4
2/11	3:15 p.m.	Near Azwell	3.0	0.9	<0.5	3	8
2/11	4:40 p.m.	Rocky Reach	3.3	1.9	2	27	4
2/12	8:30 a.m.	Rock Island Dam	2.6	1.9	<0.5	5	4
2/12	10:45 a.m.	Priest Rapids Dam	2.7	1.8	0.6	32	16

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HW-59840

PROCESS TECHNOLOGY OPERATION

REACTOR POWER LEVEL LIMITATIONS

The limits to all reactor power levels at the end of the report period were based on fuel element failure control.

WATER TREATMENT

Plant Tests

Redesign of the bauxite feeders in 183-B is needed because in use to date, approximately one-seventh of the time has been required for clean-out.

The experimental sand, filter-coal filter at 183-D is operating well.

Recording Microphotometer

This instrument, located at 183-B, is indicating alum and Separan demand trends.

Alum to Diatomaceous Earth Filter

Since alum has been added along with diatomaceous earth to the pressure filters of 183-KW, turbidity in sanitary water has materially decreased and filter runs have been appreciably lengthened.

Plant Assistance Work

Recommendations were made concerning miscellaneous problems involving water plants.

PROCESS STANDARDS

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

One revised Standard was issued for the D, F, and H Reactor manuals during the month. This was:

Process Standard F-011 - "Process Materials"

The revision lists the I & E slugs and water mixing spools that are acceptable for use at reactors using B-D-F size process tubes. In contrast to solid slugs, I & E slugs are not freely interchangeable between the older reactors and the C or K Reactors; therefore, end cap data were provided to assist in I & E slug identification. Inadvertent use of I & E slugs intended for either C or K Reactors could result in production loss through limiting tube temperatures.

HW-46000 K, Process Standards - Reactor

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

Process Standard A-022 - "Tube Outlet Temperature Limits - Top-of-Annulus Corrosion"

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HW-59840

DEL

Specifications on I & E charges no longer used in the K Reactors were removed, and limits for enriched I & E charges using mixing slugs were added. Also, tube temperature limits are no longer restricted to temperatures 5°C or more below rear header crossheader saturation temperature. Removal of this restriction was possible because laboratory data demonstrated that the K temperature monitor will accurately monitor temperatures above the rear header crossheader saturation temperature.

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

A critical review of the hazards involved indicated that the seismoscope-flux monitor Ball 3X coincidence trip could be safely by-passed during initial steps of a cold start-up. This eliminates the possibility that an unnecessary ball drop could occur on false trip of the seismoscope. By-passing is feasible because residual heat generation at low levels will allow time for manual action if a real need for a ball drop arises.

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

Process Standard C-100 - "Number of Inoperable Rods and Ball 3X Hoppers During Shutdown"

Recently, K Reactors' Ball 3X systems were split into "inner" and "outer" groups of hoppers. Appropriate changes, reflecting the Ball 3X system modification, were made in the Standards.

Process Standard F-011 - "Process Material"

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

PROCESS CHANGE AUTHORIZATIONS

Eleven Process Change Authorizations were issued during the month to permit temporary relaxation of Process Standards - Reactor, HW-46000; two were issued to permit temporary deviation from Process Standards - Water Plant, HW-27155 Rev 1, and three were issued to permit temporary relaxation of Process Equipment Standards, HW-41000. These were:

PCA #9-10 - "Ball 3X and #1 Safety Circuit Process Water Pressure Trips - B Reactor"

Because re-orificing and changing from solid to I & E slugs has reduced the hydraulic resistance of the reactor, it has been increasingly difficult to raise the cold water pressure high enough to ensure automatic re-setting of the LP trip, for start-up. The PCA permitted reduction of the LP trip-setting from 100 to 130 psi below cold operating pressure. This is believed to be the last of several changes necessary to keep pace with changing hydraulic resistance.

PCA #9-11 - "Rear Pigtail Failures - B, D, DR, F, and H Reactors"

The PCA extended the provisions of PCA #8-119. The expiring PCA specified conditions under which operation could be continued if the rear pigtail failed on a tube containing fissionable slugs.

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HW-59840

REL

PCA #9-12 - "Oiled Panellit Gauge Sensing Lines - B Reactor"

The PCA extended PCA #8-106. The expiring PCA imposed restrictive TAI limits on tubes having Panellit gauges over-damped from use of 340 Sayboldt Universal Seconds oil in the sensing lines.

PCA #9-13 - "Process Water Sectionalizing Valve - F Reactor"

It was necessary for Power Operation to change from a 4-3 to 3-4 pump configuration at the 190-F Annex to permit pump repair. Because of an existing riser pressure unbalance, it was desired to make this pump change with the flow balance valve open (a condition normally permitted only with 2-4 pump configuration) to avoid aggravating the unbalance and risking a scram during the pump change. The PCA permitted the flow balance valves to be open for two hours for the pump change.

PCA #9-14 - "Allowable Forces - Tube and Stuck Slug Removal - C Reactor"

The PCA was issued to permit C Reactor to use Process Guide #5, HW-56000, in lieu of consultation with Research and Engineering personnel concerning permissible pushing forces on stuck charges.

PCA #9-15 - "Allowable Forces - Tube and Stuck Slug Removal - DR Reactor"

The PCA was issued to permit DR Reactor to use Process Guide #5, HW-56000, in lieu of consultation with Research and Engineering personnel concerning permissible pushing forces on stuck charges.

PCA #9-16 - "Rate of Tube Power Increase -KW Reactor"

The rate of equilibrium tube power increase is limited by Standards to a specific increment per week above the previous high. After a recent tube power increase at KW Reactor, control difficulties resulted in local tube powers above that expected from the scheduled increase. Since a power reduction to maintain all tubes within tube power limits would have probably caused a shutdown due to heat cycling, the PCA permitted maintenance of the existing tube power level.

PCA #9-17 - "Ball 3X Testing - KE Reactor"

The PCA extended the provisions of PCA #8-97 until the extended outage scheduled for April 12. The expiring PCA permitted delay of Ball 3X system testing until the extent of the graphite separation problem had been evaluated. It is now known that ball removal is a problem in the fringe zones only. The PCA also specified an acceptable alternate method of testing fringe zone hoppers that did not require dropping balls into the channels.

PCA #9-18 - "Process Water Sectionalizing Valve - B Reactor"

It was necessary to change from 4-3 to 3-4 pump configuration at 190-B to permit pump repair. Because of an existing riser pressure unbalance, it was desired to make this pump change with the flow balance valve open (a condition normally permitted only with 2-4 pump configuration) to avoid aggravating the unbalance, risking a scram during the pump change. The PCA permitted the flow balance valves to be open for two hours for the pump change.

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HW-59840

PCA #9-19 - "Flux Monitors - D Reactor"

Two flux monitor amplifier readings were slightly lower than the five major divisions required by Standards. The readings could not be increased without moving the chambers; a procedure which risks an outage from spurious flux monitor trips. Hence, the PCA permitted amplifier readings as low as four major divisions. There was no significant decrease in reactor safety because the amplifiers are linear and reliable in this range.

PCA #9-20 - "Panellit System - K Reactors"

A review of K Reactors' Panellit circuitry revealed that the coordinate lighting circuit contained a seal-in relay that would inadvertently by-pass a complete horizontal row of gauges if an intentionally by-passed gauge tripped. The PCA required removal of the offending circuit on the first minimum outage.

PCA #9-21 - "Panellit Pressure System - D-DR Reactors"

Recent review of the Panellit continuity-trip-check circuit at D and DR Reactors revealed that this circuit would inadvertently by-pass the Panellit gauge adjacent and between the by-passed gauge and the row relay, if the intentionally by-passed gauge tripped. The PCA required removal of the offending circuit on the first minimum outage.

PCA #9-22 - "Automatic Scram Feature of the Temperature Monitor - KW Reactor"

The Standards require that K temperature monitors be in the #1 Safety Circuit during a cold start-up. During the operating period since new RTD's and rear face wiring were installed in the KW temperature monitor system, several spurious trips have occurred due to minor electrical faults in the new installation. To provide time to correct the problems without sustaining unnecessary scrams, the PCA permitted by-passing the temperature monitor at KW Reactor during cold start-ups.

PCA #9-23 - "Graphite Temperature Limit - DR Reactor"

As a result of violent heat cycling, local graphite temperatures at DR Reactor rose above the limit requiring reactor shutdown. To preclude an immediate unscheduled outage, the PCA permitted operation above limits for two hours. operation beyond this was contingent upon maintaining graphite temperatures within limits.

PCA #9-24 - "C Elevator Photocell Interlock - D-DR Reactors"

A photocell is required on the charging elevators to prevent elevator movement that could damage tube fittings and cause coolant loss if objects were protruding over the railing into the tube pattern. Because of elevator flexing and other factors, current electric eye system design does not provide complete protection. The PCA specified interim elevator interlock measures while improved methods of obtaining protection are being developed.

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HW-59840

PCA #9-25 - "Charging of K-III M-388 Jacketed Fuel Elements - KW Reactor"

The PCA permitted charging K-III slugs jacketed in M-388 alloy at the KW Reactor. Except for the jacketing material, these slugs are identical to slugs currently permitted by Process Standards. Charging conditions were specified.

PROCESS ASSISTANCE

Auditing

One engineer audited conformance to Process Standards on all Process Operations' shifts.

Graphics

Graphics services prepared 64 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>
3/7/59	1674DR	CL-027-C	8" I&E Natural	828	Hole
3/13/59	3391D	CL-035-C	8" I&E Natural	793	Hole
3/17/59	0970DR	CL-812-D	8" I&E Natural	713	Unknown
3/24/59	1262KW	SK-032-D(1)	8" I&E Natural	711	Unknown
3/24/59	3487KE	KK-063-C	8" I&E Natural	713	Side-Other
3/31/59	2765B	SL-064-D(2)	8" I&E Natural		Hole

- (1) Reprocessed material. The parent lot could not be determined.
(2) Reprocessed material; parent lot CL-831-D.

Legend:

Side-Other - failure probably caused by corrosion on water penetration of the can wall or other unknown mechanism

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

Unknown - failure lost among other metal

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HW-59840 DEL

OPERATIONAL PHYSICS OPERATION

PILE PHYSICS ASSISTANCE

ECT values at each reactor were above average during the month. The operating periods were generally longer than normally experienced; however, because of ruptures, PCCF malfunctions, and water leaks, start-up efficiency losses would be slightly greater than February's record low.

The flux cycling problem, which was unusually acute in February at nearly all reactors, lessened in March as a result of lower residual exposures and improved control techniques. However, it was too early to predict the full effectiveness of improved control procedures at high residual exposure. Increased experience with the poison spline system indicated that these may aid cycle control during extended operating periods at the K reactors.

A study of the operational physics feasibility and justification for discharging the entire flattened zone of a reactor at one time, thus holding the central zone exposure uniform, was initiated. Availability of spike enrichment and splines might make such a procedure operationally feasible provided operation is relatively scram-free and rupture-free. The principal efficiency justification would be to eliminate the tube power difference between adjacent high-exposure and low-exposure columns (of the order of five per cent).

TABLE I

SUMMARY OF OPERATING DATA OF PHYSICS INTEREST
FOR THE MONTH OF MARCH, 1959

Pile	B	C	D	DR	F	H	KE	KW
ECT in March (1)	1470	1660	1470	1550	1470	1610	2435	2490
12 Mo. Avg. ECT	1440	1610	1450	1495	1445	1590	2410	2430
Equil. Scram Time(2)	20-23	25-30	15-20	24-47	15-30	25-30	17-25	15-20
No. of Scrams and Recoveries (3)	2/2 3/0	0/0 0/0	1/1 2/1	0/0 3/1	0/0 2/0	0/0 0/0	4/3 0/0	0/0 0/0
No. of Non-Scram Outages (4)	3/0	2/1	1/0	2/0	2/0	0/0	3/1	1/0
Report Period--From To	2/24 3/25	2/24 3/24	2/21 3/24	2/23 3/23	2/24 3/25	2/23 3/22	2/25 3/26	2/26 3/21

- (1) 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.
- (2) This is defined as the maximum time available in minutes between scram and the first indication of start-up.
- (3) 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.
- (4) The first number shows the number of ordinary outages (including those initiated by scrams followed by unsuccessful recovery attempts), and the second shows the number of additional outages to discharge temporary poison.

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HW-59840

B Reactor - W. R. Smit

Early in the report period a ball valve was broken during operation by elevator movement. The back flow from the rear face washed nearly a full column of poison onto the front elevator. The bulk power raise resulting from the sudden reactivity gain was slightly less than ten per cent. The reactor was manually scrammed when the control room was notified of the incident. A number of high exposure tubes in the immediate area were discharged to reduce the possibility of a rupture due to high tube powers around the empty tube. Twenty days of continuous operation, at ever increasing power levels, followed this outage. This operating period was the first in over six months with no appreciable flux shifting and graphite temperature cycling. Apparently a lower residual exposure and closer control prevented the problem from developing. Through this operating period the long term gains were absorbed first by the addition of helium and then by an increased amount of control rods. The operating period was interrupted by a scram from inadvertent reduction of flow on a wrong ball valve the first time equilibrium PCCF work was attempted; recovery was unsuccessful.

The reactor recovered from one scram shortly after start-up but failed to recover from a subsequent shutdown from non-equilibrium to disconnect the PCCF charge machine from a ball valve; a 26-hour minimum outage resulted.

A preliminary study of some tube power factor maps for the last two years indicated that there was no apparent change in the size of the "flat" zone between mid-1957 and early 1959 despite an increase in the measured ECT, and that the enrichment did not make any apparent change in the flattened zone size or the buckling in the fringe. In other words, increased ECT have resulted from more uniform column outputs within the flat zone. The results of this study are being used to optimize and standardize the enrichment pattern.

C Reactor - R. D. Carter

The reactor was shut down on 3-4 to investigate a water leak. Although the water collection rate was only reduced by half, no apparent reactivity effect was noted during the report period, indicating that the leaks were probably outside the high power portion of the core. On March 21, a broken raw water supply line caused a shutdown. Non-equilibrium losses were greater than normal when the reactor was allowed to start up and operate at a reduced tube power while the breaks were being fixed.

Because of limited operating experience since the Pu-240 program was terminated and the absence of suitable start-up conditions to measure the graphite reactivity coefficient, recent start-up prediction errors have averaged approximately 75 inhours high. Firm plans have been made to perform reactivity tests soon to obtain the necessary data.

D Reactor - A. D. Vaughn

A new high level for D pile was attained during the month with a 25 per cent helium atmosphere and with 29 splines for flattening. During the rupture outage of 3-13 the "zone temperature monitor" was repaired and two Operational Physics tests, PT-IP-105-C, "Graphite Coefficient Test," and PT-IP-188-C, "Test of Start-up Procedures with Sub-Critical Monitoring," were performed.

DECLASSIFIEDD Reactor (Continued)

Forty-one splines were used for the subsequent start-up, which was the largest number used to that time for a single start-up. The reactor successfully recovered from two scrams, one shortly after a start-up and the other from near equilibrium conditions.

Trouble has been encountered due to spline chopper jamming during start-ups. The jam usually leaves extremely radioactive pieces of spline in the chopper so that repair is impossible until the radioactivity has decayed about 20 minutes. Since this is most apt to occur shortly after turnaround when continuous reactivity removal is necessary to compensate for xenon build-up, the temporary failure of the spline removal system must be compensated by a combination of flushing PCCF, raising power, and increasing the CO₂ concentration.

Results of the graphite coefficient test showed that the minimum down time with no discharge was 40 hours compared to 36 hours predicted. A new value for the graphite coefficient is now being used which has been developed from data taken during the last six start-ups. The former coefficient value yielded accurate predictions for long outages, but was inaccurate for minimum outages. Further correlations are planned to include the results of the graphite coefficient test.

Although D pile is better equipped with start-up instrumentation normally because of its prototypes, some of the start-up instrumentation requires attention as follows: Beckman sensitivities became inadequate for meeting start-up instrumentation requirements, the triple PC falls to an unsatisfactorily low counting rate during switching from the cold to the hot chamber, and the Flexowriter continued to function improperly despite daily repair efforts. These instrumentation problems have been discussed with Operations.

DR Reactor - D. I. Monnie

Tube power limits restricted levels for the report period. On 3-2 a severe front-to-rear and top-to-bottom heat cycle commenced which resulted in excessive tube power and graphite temperatures. A rupture occurred in tube 1674 on 3-7. This tube was over goal exposure and had exceeded the individual tube power limit during the preceding cycling.

There were no significant heat cycling tendencies after 3-2. A relatively low residual exposure was at least partially responsible. An increasing tendency to cycle was anticipated as exposure increased.

The zone temperature monitor has been in service subsequent to the outage of 3-7. Four graphite stringer replacements appear to be operating satisfactorily; these may ease previous control problems since some of the replaced thermocouples which were being used for control were inconsistent and resulted in improper attempts at heat control with the rods and PCCF.

A graphite coefficient test on 3-8 indicated a minimum down time of about 35.5 hours with no charge-discharge. A new graphite coefficient equation was developed from the results of the test, and the xenon calculations were revised to correct for the increased amount of xenon poisoning in the I & E load.

DECLASSIFIEDF Reactor - R. A. Chitwood

Although a new high level was achieved during the month, the operating continuity was interrupted by two extended outages for water leaks which didn't significantly affect equilibrium operation.

The low residual exposure during the report period required a minimum of flattening in the PCCF and permitted only about 250 inhours in horizontal rods, a minimum for effective control.

A PC sensitivity check indicated a slightly poorer sensitivity (~150 watts) than former tests; however, the data were clouded some by simultaneous PCCF work.

A recent flux traverse indicated a near cosine distribution displaced slightly upstream. Experience with a low residual exposure indicated that below an exposure of 30 MWD/tube it may be desirable to recharge PCCF tubes with natural uranium to maintain sufficient reactivity in horizontal rods for effective control.

Because of the recent large number of outages considerable information regarding the reactivity status was obtained, increasing the reliability of critical predictions.

H Reactor - G. R. Gallagher

Maximum pile level was restricted to a specific total power. There were no scrams or outages this month - operation was continuous since 2-26. Graphite cycling was slight; however, long term gains were causing increased temperature movement.

A test involving changing gas composition to correlate reactivity versus per cent helium was in progress at the end of the report period. Recent reactivity coefficient refinements increased prediction accuracy.

KE Reactor - F. C. Franklin

Graphite temperature cycling was not a serious problem this month because the average metal exposure was lower than normal. However, the exposure is rising, and a corresponding increase in the cycling problem is anticipated.

Three I & E natural uranium slug ruptures occurred during the report period.

Eleven poison spline caps were installed on 3-1-59; however, no splines were used because the spline removal system was not completed, and no circumstance arose justifying their use prior to installation of an efficient means for removal.

KW Reactor - C. E. Bowers

For the second consecutive month KW enjoyed a long and fairly smooth operating run, continuous from 2-26 to 3-24. The highest ECT in March was 2490 - -60 tubes higher than the 12-month average. Also for the second straight month a graphite temperature cycle brought on by long term gains plagued operation

DECLASSIFIEDKW Reactor (Continued)

near the end of the operating period. As in February, the cycle was brought under control, this time with little cut in level.

Pile residual exposure increased from approximately 300 MWD/T on 2-26 to 500 MWD/T by shutdown on 3-24. Accompanying this increase was a large gain in reactivity which was compensated by inserting splines and increasing helium concentration to decrease the graphite temperature.

Twenty splines were inserted for start-up control on 2-26; these were removed during operation. As long term reactivity gains became significant, 20 splines were inserted (one or two per day) as equilibrium control. It is estimated that a minimum of 1300 MWD's of production can be directly credited to the spline system during the run (1000 on start-up, and at least 300 during equilibrium).

The full reactor conversion to the K-III fuel element which was initiated during the 3-24 outage is expected to result in a reactivity loss of 100 inhours.

PROCESS PHYSICS STUDIESStart-Up Instrument Tests - PT IP-188-C

The first series of start-up tests to evaluate sub-critical monitor performance and to determine appropriate cold start-up procedures with this instrumentation was carried out at D pile on 3-18-59. Five "runs" were made in which the approach-to-critical rod withdrawal rates were varied between 15 and 60 in/minute.

The "apparent" period due to background increase during rod withdrawal in the sub-critical reactor closely followed predicted values. However, procedures developed for use with sub-critical monitoring must take into account the inherent lags in signal response. Further testing and considerable analytical work will be required in establishing operating standards for use with this equipment which is scheduled for project installation at all reactors during the latter half of CY-1959.

Observations were also made during the same start-up of the prototype rate-of-rise instrument performance. Bases for operational use can probably be evaluated in large part best by measurement of response to applied signals in the shop, with normalization of this information to one or two start-up experiments under production test conditions.

GRAPHITE COEFFICIENT TESTING - PT IP-105-C

This test under which minimum outage time is determined by sub-critical monitoring was carried out at both the D and DR reactors during the month. Both reactors shut down with pile reactivity residuals corresponding to about 550 MWD/T, and both cases were favorable in that discharge was not commenced prior to minimum downtime. These tests will be run at other reactors as counting equipment and schedules can be arranged in order to obtain sufficient data for evaluating the graphite temperature coefficient of reactivity over a reasonable exposure spread.

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HW-59840

Pu-240 PROGRAM SEGREGATION - PT IP-132-C

The AEC has requested that the depleted uranium slugs irradiated under this program be segregated into three batches:

- (1) Those containing plutonium of 0-13% Pu-240 content.
- (2) Those containing plutonium of 13-15% Pu-240 content.
- (3) Those containing plutonium of >15% Pu-240 content.

This distribution has been calculated for each tube, and work sheets have been prepared giving the numbers of slugs from each column to go into each batch; the appropriate slugs within a column for a given batch will be determined by relative "weasel" radioactivity readings of that column.

OPERATIONAL REACTIVITY STUDIES

Long term reactivity transients in the hot pile were calculated with a 709 program set up by Design Analysis. A range of hot and cold cases will be calculated in order to obtain a good "feel" for the trends of hot and cold reactivity with exposure and slug type. Initial indications were that hot gains in I & E slugs are nearly equivalent to those in solid slugs over normal exposure ranges.

The final draft of an unclassified paper for the AEC contractors' SS Materials Management meeting was prepared after the necessary approvals had been obtained. This paper outlines the approximations and computer methods used at Hanford for taking into account neutron energy spectrum and second order build-up effects.

A preliminary report on the multi-region diffusion theory calculations which are expected to lead to revised reactivity weighting methods is in initial rough draft form.

SUPPLEMENTARY CONTROL STUDIES

Nineteen splines inserted in the KW pile during the last operating period aided both flattening efficiency and control of long term gains. Except for some trouble with spline chopper jamming, spline start-up experience at D and KW was encouraging during March.

A contract for the design and fabrication of seven winch-and-cable assemblies of the poison column displacement system developed by Mechanical Development has been awarded. The currently estimated delivery date of July 1, 1959, is approximately three months behind preliminary estimates.

POTENTIAL GAINS IN OPERATING EFFICIENCY

The monthly report on this subject for February, HW-59587, shows unusually good performance for all piles except C, but points out a number of circumstances regarding exposure and outage status which would not be expected to combine to give such favorable numbers in future months.

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HW-59840

SHIELDING STUDIES

Investigation was made into the applicability of Process Standard A-070, "Thermal and Biological Shield Cooling Water," under present conditions. Conclusions reached and transmitted were that (1) current temperature rise limits for individual K pile shield cooling tubes are satisfactory, (2) temperature vs flow tests should be carried out in K reactor shield tubes to verify that it is permissible to operate without flow on individual tubes (under specified fringe power conditions) as is judged to be acceptable at the older reactors, and (3) that in some cases a more efficient system should be developed for making flow checks on individual shield cooling tubes. Preliminary arrangements have been made with the K Processing Engineers on item (2).

Increased helium usage associated with higher operating levels has tended to reduce maximum biological shield temperatures except at H pile. Steps are being taken there to back off slightly on top-fringe enrichment and to increase the number of far-side fringe poison columns. No additional fringe poison loading is contemplated at the other reactors in the near future.

Initial runs have been made of a 709 program for determining heat generation and radiation attenuation through the NPR reflector and side shields. A number of cases will be calculated in support of Reactor Physics and Design Analysis studies which must be resolved soon for setting shield dimensions.

REACTOR FUNDAMENTALS TRAINING

The weekly classes for the 32 operating specialists, 16 in each class on alternate Tuesday evenings, continued during the month with an average attendance of 12 out of 16. Two eight-hour fundamentals classes for non-operating engineering personnel were completed during the month.

Over fifty sets of training material dealing with Chapters I and II of the IPD Physics Primer were forwarded in answer to requests of operating personnel during the month, an encouraging sign of increasing shift training activities.

The final draft of Chapter V on control of reactivity and flux distribution will be complete following final graphics work.

NPR ACTIVITIES

The numbers of horizontal rods and ball 3X channels were increased during the month as a result of Operational Physics bases studies.

Operational Physics has suggested that the cross coolant system have the flow reversed in alternate tubes in order to preclude side-to-side reactivity distortions from a one-direction system.

Other comments forwarded for NPR consideration included the request for control room readout and adequate instrumentation for shield coolant flow determination, comments on operating temperature and flux monitoring indications, and the proposal and encouragement of the concept of automatic control provisions. The latter is conceived as a "natural" evolution of operating experience with a set-back control system combined with properly located in-core flux monitors, very possibly without the necessity for simultaneous reactivity transient calculation and feedback.

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HW-59840

IRRADIATION TESTING OPERATION

KAPL-120 LOOP

The empty in-pile tube was on process water cooling during this period. The following is the status of the Loop modifications:

1. The heat exchanger piping and instrumentation is approximately 95 per cent complete.
2. The lagging is approximately 70 per cent complete.
3. The dual ion exchange column installation is complete.
4. The delayed neutron monitor piping is approximately 90 per cent complete.
5. The instrument panel installation is estimated to be 70 per cent complete.

The following activities are in preparation for charging three Westinghouse fuel assemblies (KAPL-120-8) and starting recirculation in April:

1. Production Test number IP-248-D (HW-59768) which authorizes the operation of the KAPL-120 Loop, as modified, is being circulated for approval. Supplement A of this Production Test (HW-59769) which authorizes the irradiation of the KAPL-120-8 fuel trains has been written.
2. The power supply to pumps is being modified to improve the reliability of a continuous coolant flow.
3. The Maintenance Operation is in the process of making a systematic check of the instrumentation.
4. A mock-up charge and discharge of the dummy fuel elements was completed. Further out of pile charge-discharge tests were made at 185-F. These tests were made to simulate the in-pile conditions which may be expected at discharge -- two years hence.
5. A plan for performance testing the Loop components during recirculation without fuel has been written.
6. The operating plan for start up on recirculation with the experimental fuel trains has been formulated. Set points for alarm and scram signals have been established.

A mutually agreeable test plan for the KAPL-120-8 run was established during meetings held at Bettis on February 23 and 24.

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HW-59840

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DR GAS COOLED LOOP

The construction activity on the DR Gas Cooled Loop continues on schedule, with construction about 92 per cent complete. Three compressors were received in March and the fourth compressor is ready for shipment.

A representative of the Maritime Reactors Branch-AEC visited Hanford to discuss the progress of construction activity on the Loop facility.

Two Engineering Assistants were added to Irradiation Testing Operation's roll to complete the operating staff of the DR Loop.

A representative from General Atomic visited Hanford to deliver a nuclear mock-up of the fuel element proposed for the first test. The first in a series of tests utilizing the mock-up in the Hanford Test Pile has been completed. These tests will serve to establish the enrichment density for the fuel element to be tested in the Gas Loop.

QUICKIE FACILITY CALIBRATION (E TEST HOLE F REACTOR)

The conventional thermal neutron flux in pocket number one of this facility was determined from gold foil irradiations to be 3.0×10^{13} n/cm²/sec at an adjacent tube power of 660 KW with an estimated accuracy of 20 per cent. Work is continuing to improve the accuracy and to define the intermediate and fast flux spectrum in the facility.

HAPO FUEL ELEMENT IRRADIATIONS

The irradiation of one three-foot-long swaged UO₂ fuel element in test hole 3865 KE (HAPO-215) continues. As of March 18 the fuel element had reached 31 per cent of the goal exposure. A panellit gage with a 10-90 psi range has been installed to reduce the possibility of a reactor scram due to pressure fluctuations during start up.

OTHER IRRADIATION TESTS AND SERVICES

1. A total of twelve sets of activation analysis samples were irradiated in the Poison Column Control Facilities at D and DR piles. These samples are identified as follows:
 - a. Eight sets of HAPO-184 samples in support of a Washington Designated Program assigned to HLO.
 - b. Four 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. One set of thorium tensile specimens (HAPO-213) was discharged from a fringe zone process tube at DR pile. This irradiation was performed in support of an HLO study of mechanical and physical properties of thorium which may provide a better understanding of irradiation damage in uranium.
3. A total of four samples were irradiated or are undergoing irradiation in the Quickie Facility (E test hole) in F pile. These samples are identified as follows:

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HW-59840 Del

- a. One sample of UO_3 (HAPO-227) to provide a Np^{239} tracer in support of an HLO chemical separations study.
 - b. One yttrium oxide pellet (U of W 104) to provide a high energy beta source for the treatment, by radiation-surgery, of certain types of cancer. These sources were prepared for use by the University of Washington's Department of Surgery.
 - c. One sample of effluent water residue (HAPO-172) in support of an HLO study of the radioisotopes in effluent water.
 - d. One sample of UO_2 (HAPO-229) in support of an HLO study of the effect of neutron irradiation and fission events on the structure of thin foils of UO_2 . The post-irradiation examination is being done with an electron microscope.
4. One graphite casing was discharged and two sample casings charged in the Magazine facilities (2 B test holes) at KE and KW reactors. These irradiations are in support of an HLO study of irradiation damage to graphite.
 5. One piece of UO_2 (HAPO-215) was recharged into a fringe zone process tube at DR area. This irradiation is in support of an HLO evaluation of the properties of UO_2 as a fuel element for high temperature operation.
 6. One cobalt source (HAPO-217) was recharged into the General Purpose facility (4 B test hole) at KW reactor. When the irradiation is completed, this cobalt piece will provide a high intensity gamma source for the Chemical Research Operation, HLO.
 7. The irradiation of a thermocouple capsule to determine to what extent the electrical output of thermocouples is affected by the gaseous atmospheres which surrounds the thermocouple bead continues in the 2 A test hole at KW reactor (HAPO-199).
 8. A production test supplement is being routed for approval which authorized the controlled temperature exposure of graphite samples in the 50-300 C temperature range (HAPO-124). The test is tentatively scheduled for charging during April.
 9. Twenty baskets began exposure and nineteen baskets completed exposure in the KE gamma facilities. The bulk of these irradiations are being sponsored by the Non-Metallic Materials Development Operation, HLO.

TEST FACILITIES

The piping and interlock modifications to the Pneumatic Facility are 90 per cent complete. The hot cell is approximately 80 per cent complete. The facility and hot cell will be ready for shakedown during the KE extended outage. Regular irradiation of HAPO-184 samples in this facility is anticipated following the extended outage.

The New Snout Facility has been fabricated and is now undergoing mock-up tests in the Irradiation Testing Operation's Test Mock-up in F area. The facility will be installed in the 4 C test hole during the April outage of KW reactor.

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VERTICAL BOWING MEASUREMENTS

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

<u>Area</u>	<u>Tube</u>	<u>Date</u>	<u>To A Depth Of</u>	<u>Results</u>
105-F	4090	3-6-59	9'4"	No previous data
105-DR	4675	3-8-59	28'	up .05" at 9'4" since 10-31-58 down .09 at 19' since 10-31-58
105-DR	4456	3-8-59	28'	up .04" at 10' since 5-11-56 down .44" at 17' since 5-11-56
105-DR	4492	3-8-59	28'	up .08" at 10' since 5-11-56 down .28" at 17' since 5-11-56

BORESCOPING ASSISTANCE

The following examinations were made with the borescope in an effort to assist the Maintenance Operations with problem tubes and channels:

- a. VSR #37, 105-F - Large pieces of liner block were lodged across the channel at 40 feet down from the top. The graphite was broken and the rod could then be inserted properly.
- b. VSR #27, 105-F - The rod tip was broken off at a knuckle joint. The bore-scope was used to assist Maintenance in attaching a removal rod to the rod tip. The rod tip was successfully removed.
- c. VSR #32, 105-D - Gaps in the liner blocks were noted at 25 feet and 32 feet down. Small droplets of what appeared to be melted aluminum were noted from 16 to 33 feet. The channel was unobstructed.
- d. VSR #13, 105-D - A gap in a liner block was noted at 16 feet down. The channel was obstructed at 38 feet down with a piece of liner block.
- e. Tubes 4168 and 1085 KW - The tubes were checked for chatter marks. No evidence of chattering was observed.
- f. Channel 3772, 105-DR - The rear entry block was broken and block separations were noted at 10 and 14 feet in from the rear. Except for an accumulation of graphite powder in the bottom, the channel appeared to be in good condition.
- g. Channel 3666, 105-C - A drill was stuck in the channel. The blocks are broken all along the channel. Extensive efforts to remove the drill were unsuccessful.

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COOLANT TESTING OPERATION

During March, 1959, activities of the Coolant Testing Operation included operation of the 1706-KE in-pile and out-of-pile equipment, operation of the 1706-KER in-pile loops, and preparation for KER loop work during the KE extended outage scheduled for April.

A summary record of operation of each piece of equipment follows, including significant items of performance, changes, and improvements.

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

The six central zone single pass tubes that were charged on January 14, 1959 with I & E fuel elements canned in X-8001 aluminum alloy, including a mixing slug, continued operation under the same operating conditions reported last month, namely:

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
4863	7.0 pH process water
4963 & 5063	6.5 pH process water

During the March 1 outage, the dummies were discharged from tube 2943 and the tube recharged with numbered production metal. The regular metal was discharged from tube 3043 and the tube recharged with dummies.

During the March 14 outage, cooling water flow was inadvertently valved off tube 2943 for several hours. The tube was then discharged and recharged with dummies. The dummies were discharged from 3043 and the tube recharged with regular production metal.

The 1706-KE mock-up tubes were operated during the month for the following tests:

Tube No. 5 - Corrosion evaluation of two types of nickle plated slugs, electroplate and chemical plate and corrosion evaluation of four types of X-8001 aluminum cans, including tests on cast blanks. The test conditions are process water, 50 gpm at 120C.

Tube No. 7 - Galvanic corrosion evaluation of two types of nickle plated slugs, electroplate and chemical plate. The test conditions are process water, 40 gpm at 60C.

Tube No. 11 - This test is to evaluate four different types of coupon holders for in-pile use. The test conditions are process water, 35 gpm at 130C.

ELMO LOOPS

ELMO 1 - The loop was shut down during the month.

ELMO 2 - The loop was disassembled and disposed of during the month in order to make room for other test equipment.

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HW-59840 DEL

ELMO 5 - The loop was operated during the month at 290C and pH 10.0 for corrosion tests on samples of carbon steel, zircaloy-2, stainless steel, and Hasteloy-C. Samples of 304 Stainless Steel and Stellite, which had previously been exposed to the Turco process, were discharged and showed no appreciable change in corrosion rate on being tested in ELMO-5, following the Turco process.

Zircaloy-2 coupons, exposed to the same sets of conditions, are showing slightly accelerated corrosion rates.

A caustic embrittlement test of stressed A-212 carbon steel continued during the month with no indication of caustic embrittlement appearing.

ELMO-6 - was started up on March 2, following last month's Turco decontamination run. The loop is being run at 300C and pH 4.5 for corrosion tests on zircaloy-2 and stellite coupons which had previously been exposed to the Turco process combined with high hydrogen concentrations. The Zircaloy-2 coupons are showing corrosion rates much higher than normal. Stellite coupons are also showing corrosion rates slightly higher than normal.

A test is also being run on magnetite exposed to 300C water, pH 4.5 to check weight loss and particle size change.

ELMO 7 - The loop continued operation during the month, with the following tests:

- (a) North Burst Box - 1.9 gpm flow, thermal cycle between 350-475F. Test is on Canadian rolled joint nozzle-tube connection.
- (b) Manifold No. 6 - 527F maximum flow. Test is on nickel plated slugs.
- (c) Manifold Nos. 4 & 5 - thermal cycle between 300-500F. The test is on composite PRTR seals and NPR flared nozzle-tube seal.
- (f) KER test section - 527F. The test is on thermocouple cores and sheath corrosion.
- (g) Manifold No. 3 - 5 gpm, 527F. The test is on NPR Flexitallic and bell ring cap seals.
- (h) PRTR Vertical Tube - Full loop flow, 527F. The test is on a 19-rod zircaloy clad element.

ELMO-8 - will be installed by the Contractor (CG-671) about April, 1959.

ELMO-10 - This loop remained shut down during the month awaiting arrival of a new pump.

DOWTHERM UNIT - The unit was shut down after the failure of the drive motor on the main pump. A replacement motor has been received but the unit will remain down because of a power shortage. (Transformer at 165-KE burned out.)

CEP-1 (Corrosion Experiment Prototype)

This loop has been shut down during the month awaiting parts. Parts were cannibalized from this loop to use on the KER Rupture Experiment.

ORGANIC COOLANT PROGRAM

ORA-1 - The loop was shut down on March 5, due to failure of the recirculation pump. Pump repair has been completed and loop startup is awaiting completion of minor piping revisions.

ORA-3 - The loop has been shut down during the month. The next test will be to check leakage of MIPB with American Standard dryseal threads.

KER RUPTURE EXPERIMENT - The equipment was shut down during the first part of the month, awaiting procurement of parts and subsequent repair of the recirculation pump. On March 26, the second test run was initiated in which 300C water was circulated over a 60 gram sample of irradiated uranium until the loop was contaminated to 2.2 r per hour at the heater section. As soon as gamma scans on the contaminated coupons are completed and the coupons recharged, the Turco 4501 process will be used to decontaminate the loop.

INDUCTION HEATING APPARATUS - The induction heating apparatus is undergoing minor repairs before final testing.

107 BASIN SEALANT TEST - The proposal to alleviate the excessive leakage from the concrete 107 basins by sealing with Bentonite clay is being tested in 1706 filter No. 2. This is being done by lining the filter with concrete blocks, spacing them with 1/16, 1/8, and 1/4 inch cracks. The wider cracks are covered with strips of plastic with a cord attached so that they may be removed to expose the wider cracks for subsequent tests. Hot water with Bentonite added is then added to the filter and the sealing effect evaluated for the various crack widths.

KER FACILITY

LOOP 1 - The loop continued low temperature recirculation operation until March 26, when the loop was put on single pass operation due to failure of a canned motor pump. The cause of the large increase in pressure drop through the in-pile tube, and the resulting low flows, was not determined. Examination of the front and rear nozzles revealed no apparent flow restriction, indicating that the flow restriction is in the tube charge, which includes seven 1.670 enriched 7-rod clusters, a 7-element thermocouple train and coupon holders.

Loop 1 was discharged March 29, 1959, and recharged with dummies when a faulty fuse separated, causing an instrument power failure and reactor scram.

LOOP 2 - The loop continued operation at 205C and pH 10.0 until March 13, when a faulty fuse connection in the 105 Ball 3X room caused loop flow instruments to go full-scale, resulting in a reactor scram.

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HW-59840 DEL

As loop temperature was being raised following reactor startup, an abnormal increase in activity was observed on the delayed neutron rupture detection instrument. Loop temperature was lowered immediately, with a resulting decrease in activity to normal levels. Loop temperature was held at a minimum value (100C outlet temperature) until March 24. At this time, strong rupture indications were observed in a KE reactor normal production tube. During the time that the rupture was being confirmed, a test was run on Loop 2, in which loop temperature was raised to normal to check for further rupture indications. The rupture monitor again showed positive indications and at the same time loop water activity increased from a normal value of 100 mrad per hour to a maximum observed value of 4200 mrad per hour on one-pint sample bottles. The slugs were discharged into a special tray and lowered into the basin during the reactor outage. No rupture was immediately apparent on observation of the slugs during discharge. The charge consisted of four 7-rod Zircaloy-2 clad enriched cluster, and two 7-rod, 18-inch UO₂, Zircaloy-2 clad 7-rod clusters.

LOOP 3 - The loop continued operation at 235C and pH 4.5 until the March 24 reactor outage. Early in the outage a large increase in ΔP , accompanied by very high loop water activities was observed. A check of an evaporated loop water sample with a "poppy" alpha counter showed water activity in excess of 5000 d/m. The loop was discharged during the outage with a force of 2100 pounds required to start movement of the charge. No ruptures were observed during tube discharge. However, the slugs were coated with a thick, reddish film which flaked off readily during handling.

LOOP 4 - The loop continued operation at 22C and pH 4.5 until March 17, when substantial increases in tube ΔT caused reduction of loop operating temperature to 190C tube outlet temperature. The charge consists of two rod-and-tube elements, and one 18-inch, 7-rod Zircaloy-2 clad UO₂ cluster element.

1706 KE-KER PERFORMANCE AND IMPROVEMENTS

A total of 54.0 hours of KE Reactor outage time was charged to Coolant Testing Operation during the month. The following is a breakdown of time charged:

March 13, 1959 Outage - Production Test IP-214-A (Loop 2)-----17.3
This was charged as reactor lost production time from the scram caused by the faulty fuse connection in the Loop 2 flow instrumentation.

March 24, 1959 Outage - Production Test IP-214-A (Loop 2)----- 3.5
This was time used for special tray discharge of Loop 2.

Production Test IP-229-A (Loop 3)----- 2.7
This was time used for discharge of Loop 3.

March 29, 1959 Outage - Production Test IP-226-A (Loop 1)-----30.5
The entire outage was charged as lost reactor production time. 2.0 hours of this time were used in discharging Loop 1. A faulty fuse in Loop 1 flow instrumentation was the cause of this outage.

IMPROVED KER IN-REACTOR TUBES

Non-destructive tests have been completed on the four new KER tubes. The results are:

- 2 Sound tubes with 170 mil minimum wall
- 1 Sound tube with 166 mil minimum wall
- 1 Reject (two sound 170 mil minimum wall, 15-foot mock-up tubes were cut from this tube.)

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HW-59840

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COMPONENT TESTING OPERATION

IRRADIATED MATERIAL EXAMINATION

The examinations of the fuel elements from the following twenty-six tubes were completed in the Metal Examination Facility during March.

<u>PT No.</u>	<u>Tube No.</u>	<u>PT No.</u>	<u>Tube No.</u>
39A	2857-B	179A	1488-C
	2160-C		2781-C
	3961-B		2790-C
	3162-B		2688-C
	3978-B		2076-C
	3161-B		1678-C
84A	1880-B		2387-C
	1881-B		1481-C
	0672-B	*198A	2943-KE
168A	0973-C		

- * Sixteen irradiated solid aluminum dummies were photographed for film pattern analysis and thirty-six were weighed for corrosion information above water with a maximum exposure of 500 mr/hr.

Algae Growth

In the past, a considerable quantity of algae has formed on the basin walls of the Facility. During a recent shutdown, the walls were scrubbed with a solution containing Roccal, an iodine solution, and soap. This has inhibited algae growth to such an extent that it is planned to spray all of the equipment and walls with this solution during the next shutdown of any basin.

Warp-Hot-Spot-Rib Relationship

A compilation has been made to determine whether a warp-hot-spot-rib relationship exists on forty tubes of irradiated slugs and 239 recently discharged slugs from C-Reactor. Both groups of fuel elements showed that a greater number of slugs warped with the convex side between the ribs (bowed downward), the majority of the hot spots located opposite the ribs and the hot spot usually located on the convex side of the slug. Industrial Statistics, Research and Synthesis Operation personnel are analyzing this data to determine if and with what assurance the warp-hot-spot-rib relationship can be established.

Internal Wall Thickness Development

Two charges of irradiated slugs were measured using the developmental Probolog to determine the residual can wall thickness. The results showed a larger variation than would normally be anticipated as a result of irradiation; hence, a program is now underway to measure a number of slugs prior to charging and again after irradiation. Twenty-two charges, or 764 slugs, have been given a pre-exposure check which resulted in a variance of 5 mils in the average wall thickness. Some of these charges will be Probologged after irradiation in an attempt to detect any changes resulting from the irradiation.

PROCESS TUBE CORROSION MONITORING PROGRAM

In-pile measurements of 274 process tubes were made during the month using the Probolog. 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>
H	12	10	59425
F	123	11	59561
D	52	12	59683
F	30	13	59697
B	47	14	59751

Six tubes from C-Reactor and three tubes from KE-Reactor will be reported at a later date.

Visual and metallurgical examinations were completed on three tubes from B-Reactor, four tubes from C-Reactor and two tubes from H-Reactor. Also an attempt was made to examine four tubes from DR-Reactor; however, too many sections were missing from each tube to obtain any significant results.

Tube leakers examined were 1292-B, 1996-B, 1074-C and 3957-C. The leaks in the two tubes from B-Reactor were caused by external corrosion adjacent to the rear gunbarrel. Two pin holes were found in tube 1074-C located three feet upstream from the rear Vanstone flange. The holes were caused by a galvanic attack set up in the tube by the brass fittings that were used on a thermocouple train previously used in the tube.

In tube 3957-C, a small pin hole leak was found in a damaged area, caused by a ruptured sling located 17 feet upstream from the rear Vanstone flange.

The third tube from B was a Vanstone flange leaker; the fourth from C was a new tube with no significant anomalies; insufficient sections of one of the tubes from H were received for examination and the second tube from H will be reported in detail in our Interim Report.

PANELLIT PROGRAMS

Inspections were performed on 832 gauges which were processed by individual area instrument shops. Of those inspected, 245 were rejected for non-conformance to Standards. This is a 29.4% rejection rate, an increase of 7.7% over last month.

In-board reliability examinations were performed on 313 gauges. Examination revealed 50 substandard gauges which were removed from service for a removal required rate of 12.7%.

A total of 4,422 gauges received in-board Bourdon coil leak examinations. Of this total, 21 were confirmed as "leakers" for a leak rate of 0.47%. Leak rate, established during the past 15 months and 74,042 examinations, is 0.36%.

Failure analysis examination procedures were applied to 15 gauge failures during the month.

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HW-59840 DEL

In-board trip response times were determined for 313 gauges during the month. Of this number, 12 were determined to have response times in excess of 2 seconds, 21 with response times between one and two seconds, and the balance below one second.

Four specifications were documented during the month. These are; HWS-6754 (DT-100-T Switches), HWS-6762 (Bourdon Coil Assemblies), HWS-6746 (Off-Plant Gauge Modification of Model 151 Gauges), and HWS-6741 (Off-Plant Modification of Model 152 Gauges). Twelve prototype DPST switches with 2-B contacts were received and placed under test. These switches are being tested in conjunction with development of a dual relay scram system, for pressure monitor systems, which is calculated to eliminate all scrams except those resulting from pressure increase or decrease exceeding trip setting.

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 March 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)

Title

None

O. H. Gringer
Manager, Research and Engineering
IRRADIATION PROCESSING DEPARTMENT

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HW-59840

B-C REACTOR OPERATION
MARCH, 1959

I. ORGANIZATION AND FUNCTIONS - No change.

II. PERSONNEL

A. Force Summary

	<u>February 28</u>			<u>March 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	4	3	7	4	3	7	0
B Processing Operation	16	39	55	16	39	55	0
C Processing Operation	16	34	50	17	34	51	+ 1
Power Operation	15	96	111	14	97	111	0
Maintenance Operation	<u>22</u>	<u>104</u>	<u>126</u>	<u>23</u>	<u>105</u>	<u>128</u>	<u>+ 2</u>
TOTAL	73	276	349	74	278	352	+ 3

B. Movement of People - Exempt changes were internal only and included
1) the reassignment of D.L. Allred from Supervisor, 100 Power II, B-C Power Operation to Assignment Supervisor, C Processing Operation and
2) one addition through reclassification of L.V. Kinnie (from B-C non-exempt) to Supervisor, Mechanical Maintenance (temporary, relief assignment). Nonexempt changes included one rehire, 9 transfers in, seven transfers out and one temporary reclassification to the B-C exempt roll.

- III. PERSONNEL ACTIVITIES - Management personnel of B-C Reactor Operation were hosts for the monthly meeting (March 10) of the IPD Central Health, Safety and Security Council. J.P. Jones of Traveler's Insurance Company visited 100-B on March 17 to perform a third-party inspection of one boiler and four unfired pressure vessels.
- IV. SAFETY AND SECURITY - There were 13 medical treatment injuries; no disabling injuries, serious accidents or security violations were reported.
- V. NON-ROUTINE REPORTS - HW-59457, "Irradiation Processing Department, Investigation Report, Radiation Occurrence", by J.H. Soehnlein, issued March 2, 1959; HW-59585, "Special Incident Report", by A.R. Maguire, issued March 9, 1959.
- VI. INVENTIONS AND DISCOVERIES - All persons engaged in work that might reasonably be expected to result in inventions and discoveries advised 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. COMPONENT ACTIVITIES

General

- A. Administrative Activities - A system for prompting preparation of Non-exempt Personnel Development Program Reports and Nonexempt Employee Progress Reports was formulated and application initiated within B-C Reactor Operation. Exempt Appraisal and Salary Review activities were continued throughout the month. B-C completed its portion of the non-exempt, non-unit Job Description writing program.
- B. Personnel Development - Twelve exempt and two nonexempt employees attended 9 classes of the IPD Training Program; 7 exempt continued participation in the 5th series PBM-I course; 74 employees participated in In-Plant training sessions dealing with Processing Fundamentals, Radiation Hazards, and the Poison Spline System. One Technical Graduate continued a Rotational Program assignment with B Processing Operation.
- C. Cost Control Activities - The General Manager's approval was requested (and received) for the use of 1200 manhours of overtime in excess of the third quarter FY1959 Upper Control Level; circumstances which necessitated the overrun are reported herein under Component Activities of the B and C Processing, Power and Maintenance Operations.
- D. Landlord - Considerable painting and floor resurfacing (tiling) was done throughout the area. Improvement work was started on and about 1701-B Main Badge House. Plans were initiated for tiling the untiled floors in 1704-B.
- E. Suggestions - Under study at the start of the month: 38, received for study during the month: 35, completed during the month: 23, under study at the end of the month: 50.

B PROCESSING OPERATION

- A. Production - Input production was 119.4 percent of forecast. Power level was limited by tube power considerations. TOE was 86.3 percent. New record power levels were attained due to planned increases in tube power limits.
- B. Operating Experience - There were no scheduled outages and seven unscheduled outages, not including one over the end of February. Scram recoveries were made on three outages and another lasted only 1.1 hr.

<u>Day</u>	<u>Outage Hours</u>	<u>Cause</u>
1	10.6 (In Mar.)	Continuation of February 26 broken ball valve outage.
20	46.5	Panel lit scram - flow reduction on unjumped PCCF tube.

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HW-59840

<u>Day</u>	<u>Outage Hours</u>	<u>Cause</u>
22	0.3	Panellit scram - oscillating Gauge 0166.
23	25.8	Defective ball valve caused poison material to jam. Could not uncouple PCCF machine.
24	0.6	Panellit scram - oscillating Gauge 0472.
24	1.1	Bent perf caused PCCF machine to jam.
24	0.4	Panellit scram - oscillating gauge.
31	16.9	Hole rupture, I&E slug, Tube 2765

- C. Equipment Experience - Efforts have been initiated to modify the existing PCCF ball valves to insure more positive alignment and provide a means to visually check this alignment; it has also been found necessary to accurately ring-gauge all reclaimed perfs used in the PCCF machine. Forty-seven tubes were probologged and two were determined to have sufficient outside corrosion to be charged with solid aluminum preparatory to replacement. Two stuck charges occurred on I&E material in Tubes 2060 and 3987; the charges were removed at forces up to 4,500 psi. The sphincter seal on No. 22 Vertical Safety Rod was found ruptured; it has been replaced. Two front-face high activity chambers failed during the month and were repaired. The oxygen analyzer failed; new parts have been ordered and installed. One of the flux monitors failed and was replaced.

The power calculator required calibration; a drawn-down test was made to verify the flow transmitter calibrations and were found to be satisfactory. 115 Building "C" Area water removal facilities have required a considerable amount of extra maintenance due to the extended demands on the system. A block of 42 tubes below a location which has consistently shown high dewcell readings was hydrostatically tested; no leakers were found. Three faulty tube temperature thermocouples were repaired. Nine outlet water thermocouples were revised for use with the "ten-tube average" recorder. Three rows of 10-90 range gauges were installed; seventy-four percent of the replacement program is now complete. The exhaust fan at the acid decontamination facility was found beyond repair from acid fume damage; a replacement has been ordered.

- D. Improvement Experience - PT-IP-84A, "Evaluation of Slugs having Projections for use in Ribless Tubes" - Two tubes were discharged for inspection and then recharged. PT-IP-171A, "Evaluation of Aluminum Caps and Cans from New Vendors", continued active with four tubes being discharged for inspection. Project CG-780, "Improvements to 105-B Ventilation", has advanced to about 50 percent completion; tie-in to the existing system, plus balancing of flows, is in progress. A new clean clothes facility has been completed. An access door has been provided from the Work Area to the No. 10 Fan Cell and also between the Fan Cells to provide improved metal and equipment storage.

- E. Radiation Monitoring Experience - A survey of the trousers of a Minor Construction employee indicated 400 c/m on the cuff of one leg. The trousers were contaminated while working in another area. Decontamination was unsuccessful.

Maximum personnel dose rates experienced for various jobs were as follows: Discharge special charges, 250 mr/hr; work associated with regular discharge operations and allied maintenance work in the rear face, 200 mr/hr; poison charging, 150 mr/hr; draining condensate in the 115 Building Dryer Rooms, 2,000 mr/hr; maintenance work in the Dryer Rooms, 1,000 mr/hr; Ball 3X lock bar installation, 150 mr/hr; dummy decontamination, 150 mr/hr; burial of tubing pieces, 150 mr/hr and 2,000 mr/hr.

A total of 16 air samples were taken during the month; none indicated activity densities greater than the permissible limits for respiratory protection worn. Of the seventy-two vehicles surveyed, none were contaminated. Survey of some equipment removed from the metal line rooms in 108 Building indicated up to 6,000 c/m due to tritium. Smears of the third floor corridor indicate up to 2,000 c/m tritium.

- F. Events Influencing Costs - 15.6 nonexempt and 15.4 exempt manhours were utilized, including 15 radiation monitoring manhours. The total helium used was 239,400 cubic feet, as compared to 214,600 cubic feet in February. The total gas used was 322,358 cubic feet, as compared to 351,828 cubic feet in February.

C PROCESSING OPERATION

- A. Production - Input production was 107.5 percent of forecast. Power level was limited by a tube power rupture control limit. A new maximum operating level record was achieved; it exceeded February's high by 50 units. TOE was 74.3 percent.
- B. Operating Experience - One scheduled and two unscheduled outages were experienced as follows:

<u>Day</u>	<u>Outage Hours</u>	<u>Cause</u>
4	91.7	Excessive water collection.
21	40.8	Loss of raw water backup.
29	*59.0	Scheduled Outage - Maintenance, leak testing and "K" metal processing.

* Continued over month's end.

- C. Equipment Experience - Water Leak - The reactor was shutdown on March 4 to investigate a water leak. 1,356 process tubes were hydrostatically leak tested. Leaks were confirmed on Tubes 0876, 1074, 3681, and 3957. It was necessary to retube Channels 1074, 3681, and 3957. The leak on Tube 0876 was successfully repaired by replacing the rear nozzle and gasket.

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HW-59840 REL

The tube in Channel 3681 was a zirconium tube which had been installed on August 20, 1958, by authority of Production Test IP-143-A. The rear Vanstone flange was very narrow, flaked in several places and cracked at the 6 O'clock position. Tubes 3957 and 1074 had leaks in the process tubes. A rupture had occurred in Tube 3957 in November, 1958, which was discharged at 3000 pounds force with the hydraulic jack, but the tube hydrostatically tested satisfactorily following the discharge of the ruptured slug. Examination of the tube showed the leak to be at the location where the rupture had occurred in the tube. Tube 1074 had previously contained a thermocouple train with brass couplings. Examination of the tube showed the leak to be at the location where one of the brass couplings had been positioned. Standard aluminum C-Area type tubes with reduced ribs were reinstalled in all three channels.

Repairs were made to 63 faulty tube outlet thermocouples.

Raw Water Line - The reactor was shutdown on March 21 due to a break in the raw water line which supplies raw water backup to the reactor. Three joints were found to be leaking and were repaired. Water was found to be seeping from a fourth joint and a clamp was installed on the line to hold the lead caulking in place until the March 29 outage when the joint was recaulked.

D. Improvement Experience

IP-143-A - Evaluation of In-Reactor Performance of Zircaloy Tubes - Zircaloy Tube 3681 which was installed on August 20, 1958 had to be removed on March 4 as a result of a leaking rear Vanstone flange which could not be repaired. The use of two gaskets sealed the tube and was hydrostatically tested satisfactorily at the time the zircaloy tube was installed. Tube 3681 was the first zircaloy tube to be removed at C Reactor and was removed without incident.

PT-IP-168-A - Long Term Corrosion Monitoring and Evaluation of Operating Limits for I&E Charging - Tube 1074, which had previously been charged with a thermocouple train in accordance with this production test, developed a water leak. Examination of the tube, following its removal, showed the leak to be in the location where one of the brass nuts used in the train was positioned.

PT-IP-231-A - Irradiation of Depleted Uranium to High Exposure - This production test was issued to continue testing of eight depleted uranium charges and their supporting "E" metal columns which were originally charged under Production Test - IP-132-AC. Production Test - IP-132-AC, "Production of High Pu-240 Plutonium at C Reactor", has been terminated.

The total number of PT tubes in the reactor was reduced by 17 during the month

CG-741 - Renovation of Ball 3X System 105-C - The renovation of the Ball 3X System was essentially complete at month's end. All that remains to be done is to remove the construction plugs from the channels and conduct the acceptance tests.

Rear Face Connectors - 693 straight type rear connectors and silicone "O" rings were installed. Straight type connectors have now been installed on rows 26 through 43 inclusive, with the exception of the ball valve pattern on rows 26 and 27. 1073 straight connectors have been installed to date.

- E. Radiation Monitoring Experience - A flange on the ball 3X storage hopper was removed by construction forces prior to having a dose rate established. Irradiated 3X balls dropped to the floor, however, no exposure problems resulted. A pickup truck was found to have gross speck contamination in a small area of the bed, which was readily decontaminated. Two construction employees were possibly exposed to a radiation beam while working in the ball 3X equipment room (ref: HW-59735). A small ground area was contaminated outside the wash pad by water spilling from the burial cart. One employee of Component Testing received a technical over-exposure as a result of shoe contamination (ref: HW-59844). An employee received hand contamination to 20,000 c/m while moving poison pieces from the wash pad to the work area.

External Exposure Experience

<u>Location</u>	<u>Type of Work</u>	<u>Personnel Dose Rates</u>		
		<u>Max.</u>	<u>mrem/hr</u>	<u>Avg.</u>
Metal Examination Facility	To weigh dummy pieces.	500		25
Wash Pad	To bury bucket inserts.	3,000		50
Inner Rod Room	To install ball 3X storage hopper.	100		10
Experimental Level	To modify the 36" test hole.	3,000		50
Experimental Level	Discharge test samples.	2,500		75
Discharge Area	Tube replacement and leak test.	400		100

Thirty-eight vehicles were surveyed and only one was found contaminated, as previously mentioned. There were four instances of personal clothing contamination; all items were decontaminated and released. Of the two reported skin contamination cases, both were easily decontaminated and no exposure problems were involved. A total of 81 air samples was taken; none indicated activity densities greater than the permissible limits for respiratory protection worn.

- F. Events Influencing Costs - 266.3 nonexempt and no exempt overtime man-hours was required. A water leak outage and the failure of the raw water backup line resulted in 132.5 unscheduled outage hours.

POWER OPERATION

- A. Operating Experience - The export was supplied by 100-D Area for the majority of the month with 100-B Area carrying the load from 5:00 p.m. on March 16, to 1:30 a.m. on March 18. 100-B Area also base-loaded one pump for most of the period between March 3 to March 18. At 3:05 p.m. on March 18 a surge occurred on the export system causing 100-B Area to

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HW-59840

lose the pumping unit being base loaded; the pressure was restored at 3:25 p.m.

On March 21 a leak was discovered in the export line south of the 190-B Pump Room. It was necessary to remove a section of the railroad spur and the concrete encasement under the track to repair three bell and spigot joints. When the line was returned to service on March 23 another leak was discovered. This joint was temporarily repaired by installing a holding collar and permanent repairs were completed on March 31.

On March 19, No. 2-A unit in 190-B Annex was put in service and No. 6-A unit removed for exciter repair. The pump developed a noise and was causing more than normal flow fluctuations. The unit was removed from service and inspected. The casing baffles had been removed and a short throated casing wear ring had been installed. The unit was returned to service pending arrival of a newly designed impeller assembly.

On March 23 a fire was started in the insulation on the discharge line of the air compressor. A leak in the air line caused the oil-impregnated insulation to ignite. The fire was extinguished by the operator. Ten dollars damage was incurred.

- B. Equipment Experience - The Class A inspection of No. 12-C pumping unit was completed at 181-B. A new Fire and Sanitary pump and motor was installed at 183-B. A new suction bell and impeller was installed on No. 5 low lift pump at 183-C during a Class A inspection. The impeller and suction bell were victims of cavitation and electrolysis. At 190-B a Class A inspection was completed on the motor driven cone discharge valve of No. 2 unit. The plug and seat were galled on the downstream side and the shaft was bent; a new shaft was installed. At 190-C, No. 10 unit motor was inspected by F.J. Mollerus and A. McDonald. The cooling water piping to the fluid drive and motor cooler was modified, and the motor cooler coils were cleaned. Two bearings were installed in the fluid drive unit.
- C. Improvement Experience - CG-558 - A revised impeller was installed in No. 2-A unit. CG-600 - Representatives from Byron-Jackson Pump Company inspected No. 12 pump to compare impeller vane repairs. Project A-89053 - Process Water Cross Tie - Completed. 58-IP - Aluminum Oxide-Sulfuric Acid Feeders - 183-B - These machines were run intermittently during the month because of the lack of Bauxite, the breakdown of one feeder, and build up in the reaction chambers. Project CA-696 - Coal Car Shakers - 184-B - Complete except for painting.
- D. Events Influencing Costs - The raw water turbidity fluctuations during the month required increased alum and Separan feed, resulting in higher treatment costs. Maintenance costs remained high due to Class A inspection of No. 12-C pump at 181-B, replacement of suction bell and impeller of No. 5 low lift pump during a Class A inspection at 183-C, Class A inspection of No. 2 unit motor and cone valve in 190-B, and work on No. 10 unit at 190-C.

MAINTENANCE OPERATION

- A. Equipment Experience - During the month, 138 10-90 trip panellit gauges were installed at B, making a total of 1,489 to date. During the March 31 outage at B, ball valve repairs, panellit inboard inspection, and flush discharge preparation were performed. Also, since both Areas were down, final repairs were made to the 20-inch raw water emergency backup line.

On March 4th, C Reactor was shut down for leak testing. A total of 1,356 tubes were leak tested; three leaking process tubes were replaced. Tube 3681, a Zirconium tube with defective Vanstone, was replaced; Tube 3957 and Tube 1074, in-tube leakers, were replaced. A total of 21 thermocouples were repaired and 20 rear straight nozzle connectors were installed.

During the March 21 shutdown at C, caused by lack of raw water backup as a result of raw water line failure, the following work was accomplished: 210 straight nozzle connectors were installed, 30 thermocouples repaired, 235 tubes leak tested, and 700 gallons of water were drained from exit gas line.

During the scheduled March 29 shutdown at C, the following work was performed: 426 straight nozzle connectors were installed, 1,627 process tubes were leak tested, 52 thermocouples repaired, located and repaired one front Vanstone failure on Tube 2572 in the OCD pattern, and drained 170 gallons of condensate from the exit gas line. This outage continued through month end.

On March 21st, as a result of a surge on the export water system, there were three bell and spigot joint failures on the 20-inch raw water line. B Reactor was shut down, but C Area was forced to shut down because of loss of raw water backup. Thirty hours were required to repair the failed joints; one joint was encased in a concrete culvert and 20 hours were expended in breaking concrete to obtain access to the joint. A program of attaching gasket clamps to all joints on the 20-inch line has been initiated because of the frequency of failures experienced on this line.

- B. Maintenance Engineering - Thermocouple Wire - The vendor was advised to proceed with fabrication on March 18. Graphite Stringers - The Geminol thermocouple wire, to be used in fabricating graphite stringers, has been received and components are presently being fabricated. The first stringer is scheduled for installation in May. Moisture Detection Systems - B and C Reactors - The modifications made at B Reactor have been evaluated and it appears that all difficulties have been resolved. Similar modifications are scheduled for C Area. Twenty Tube Average Temperature Differential Recorders - The recorder was installed at B Reactor for measuring the temperature differential between the inlet and the average outlet temperature of twenty process tubes.

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HW-59840

Bellows Repair - C Reactor - To reduce gas leakage and high exposure rates, four front gas bellows were filled with Silicone foam. Gas Line Condensate Measuring and Drainage - 115-B and 105-C - During periods of extremely wet operation, considerable personnel exposure is required to drain condensed moisture from the reactor gas piping. Interim provisions have been made for draining both ends of the C exit gas line, and a remotely operated drainage and collection system has been designed for both facilities. Process Pump Motor No. 2 - 190-BA - Motor inspection was completed. Repairs were made to coil insulation and motor connection leads were re-insulated.

- C. Planning and Scheduling - During March, 3,757 manhours of work were scheduled. This included 2,704 manhours scheduled for March and 1,053 manhours carried over from previous months. The total included 77 Class A overhauls, 228 Class B overhauls, 20 Class C overhauls, and 11 lubrications. Of this total, 2,022 manhours, or 54 percent, were completed. Reasons for non-completion were: Jobs in progress, 12%; shutdown items, 8%, equipment not available, 1%; insufficient manpower, 23%; waiting for parts, 2%; total 46%. During this period, equipment condition dictated changing 6 Class A overhauls to Class B, 8 Class B to Class A, and 1 lubrication to Class B. The percentage of completion was low due to the large amount of work performed during outages.
- D. Events Influencing Costs - Applied labor costs were increased due to the large amount of work performed at 105-C (which required overtime and extra personnel for leak testing), straight pigtail installation, and thermocouple repair.

A. R. Maguire

Manager
B-C REACTOR OPERATION

AR Maguire: ILH:mbc

D-DR REACTOR OPERATION
MARCH, 1959

I. ORGANIZATION AND FUNCTIONS

There was no change of assigned responsibilities during March.

II. PERSONNEL

A. <u>Force Summary</u>	<u>Feb. 28, 1959</u>			<u>March 31, 1959</u>			<u>Net Change</u>
	<u>NE</u>	<u>E</u>	<u>Total</u>	<u>NE</u>	<u>E</u>	<u>Total</u>	
General	3	5	8	3	5	8	0
D Processing	39	16	55	39	17	56	+ 1
DR Processing	35	17	52	34	16	50	- 2
Power	100	19	115	102	14	116	+ 1
Maintenance	<u>130</u>	<u>22</u>	<u>152</u>	<u>129</u>	<u>22</u>	<u>151</u>	<u>- 1</u>
Total	307	75	382	307	74	381	- 1

B. Movement of People

Effective March 1, the following changes in assignment were made in D-DR Reactor Operation: O. L. Olson, Specialist, Reactor Operations, DR Processing Operation, was transferred to Supplemental Crews Operation, KE-KW Reactor Operation, as Supervisor, 100 Operations. A. E. Brown, Supervisor, 100 Power, D-DR Power Operation, was transferred to D Processing Operation as Assignment Supervisor.

Nonexempt personnel movement during March included five transfers in, seven transfers out, two reactivations, one termination, one rehire, one new hire, and one deactivation. The continuity of service of one employee in deactivate status was broken due to personal illness exceeding one year in duration.

III. PERSONNEL ACTIVITIES

Nothing to report.

IV. SAFETY AND SECURITY

One serious accident occurred when a CO₂ meter exploded in the 115-D Building from application of excessive pressure. This incident was formally investigated and reported as IPD Serious Accident No. 59-4.

There were 16 medical treatment injuries during March. No security violations were incurred.

V. NON-ROUTINE REPORTS

None were issued.

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HW 59840

VI. INVENTIONS AND DISCOVERIES

All personnel engaged in work that might reasonably be expected to result in inventions and discoveries advised 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. Notebook records, if any, kept in the course of their work have been examined for possible inventions and discoveries.

VII. COMPONENT ACTIVITIES

GENERAL

A. Administration Activities

Special artificial respiration instruction posters were placed in approximately 20 buildings in 100-D Area. These posters include a mouth-to-mouth airway for applying artificial respiration. Publicity of these posters was obtained in the G.E. News.

A meeting of D-DR Reactor Operation's suggestion evaluators was held on March 12. It is planned to hold these meetings on a monthly basis as a means of obtaining uniform interpretation of the Suggestion Plan. Suggestion statistics for the month were:

Suggestions by D-DR Reactor Employees:

In process at beginning of month	40
Submitted	17
Reopened	5
Completed	22
In process at end of month	40

B. Personnel Development

An analysis of D-DR Reactor Operation exempt employee tenure in present assignments was made in order to aid in reviewing the policies relative to moving exempt people.

One rotational pool technical graduate was on assignment to D-DR Reactor Operation during the month.

C.. Cost Control Activities

Expenditure patterns for planned and programmed maintenance for FY-1960 and FY-1961 were established during the month in meetings with D-DR Reactor Power and Processing Operations personnel and the representative from the Financial Operation

A cost meeting was conducted on March 18 by a representative of the Financial Operations. The meeting was concerned with a revision of the monthly operating cost report intended to show controllable costs more distinctly.

D. Landlord Activities

Beneficial use of the new 101 pair telephone cable from the White Bluff's exchange to 100-D Area (Project CAR-795 - Telephone Cable Addition, White Bluff's exchange to 100-D Area) was achieved during the month.

A limited area on the external walls of Building 190-D was treated with applications of Thoroseal and Chemseal. Short term indications of results obtained with these masonry waterproofing and crack filling agents are encouraging.

Through arrangements with the Construction Engineering Operation by the IPD Project Engineering Operation, repair of a limited number of roof leaks in 100-D Area was started during the month.

A revised procedure for administration of the 100-D Area landlord functions was issued in order to bring it up to date.

Spraying of weeds with C.M.U. (soil sterilizing agent) in appropriate areas in 100-D Area was started during the month.

D PROCESSING OPERATION

A. Production

Input production was 101.9 per cent of official forecast. Maximum operating levels were limited by a rupture control tube power limit.

Time operated efficiency for March was 78.7 per cent, which was 95.7% of forecast.

B. Operating Experience

1. Operating Continuity

There were five outages during the month. One outage, caused by a rupture, was extended to complete scheduled charge-discharge and tube replacement work. Four scrams occurred during the month. Recovery from one of these scrams was unsuccessful and resulted in a minimum outage.

<u>Date</u>	<u>Hours</u>	<u>Reason</u>
3-13-59	118.1	Rupture 3391-D, scheduled shutdown work.
3-18-59	0.9	Unexplained Panellit scram.
3-22-59	0.3	Scram - pump change and surge - 190-D.
3-27-59	0.2	Scram - Error in jumpering a PCCF gauge.
3-27-59	39.0	Scram - Beckman trip during scram recovery, charge-discharge.
Total	158.5	

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2. Equipment Experience

a. Vertical Safety Rods

During the 3-13-59 outage, VSR channels 13 and 36 were borescoped to determine the cause of the VSR's binding. In the #13 channel, the liner blocks are broken at 16' and the channel is partially obstructed at this point. In #36 channel, the step plug is slightly out of line and there was evidence that the rod was binding as a result. At month end, #13 and #36 rods remain out of service.

b. Horizontal Control Rods

The electrical brakes were inspected and tested for proper operation. Adjustment was required on #9 rod brake. Response checks were made on the HCR Panellit lines. Seven rods had slow response times due to partially plugged sensing lines, which required cleaning.

c. Tube Replacement

A total of 31 tubes were replaced during the 3-13-59 outage. Of the 31, 24 were below row 5 and were replaced due to external corrosion. This work completed replacement of tubes in the region below row 5 where external corrosion had been present.

A total of 52 tubes, including all PCCF tubes, was probologged and were found in satisfactory condition.

d. Panellit

On 3-16-59, 36 defective gauges were found during an inboard inspection. Of the defective gauges, 17 were replaced. The remaining 19 gauges have only minor leaks and were not changed for lack of replacements. No operational problems are anticipated as a result of the minor leaks.

e. Splines

Splines were successfully used for turnaround control and flattening during the month. There was no production lost due to the use of splines.

Difficulties in operation of the equipment continued. A spline cap leak on tube 1460-D required installation of a pressure cap seal. In several cases, splines could not be inserted into the tubes selected because of binding within the first 10 feet of the tube. However, difficulty with spline insertion was less of a problem this month than during previous months. This is attributed to more careful installation of spline caps and more skill and experience in insertion.

e. Splines (Con't.)

Removal of splines proved more troublesome because of difficulties with the choppers. On two occasions, it was necessary to borrow the KW spline chopper as the D chopper became fouled with radioactive splines. The KW chopper was no more effective, as it also failed. Maintenance of the chopper proved challenging; however, production was not affected.

f. Ruptures

An I & E rupture occurred in tube 3391-D on 3-13-59. The metal piece from log No. CL-035-C with a concentration of 793 MWD/ton failed inside the hole. The rupture was located by a pigtail survey following a simultaneous Panellit scram and a gamma monitor indication. The rupture was discharged using a charge machine at normal pressure.

g. Beckman Flux Monitors

To eliminate any possible interaction between Beckman relays, Design Change #269, which provides parallel contacts in the relay matrix, was prepared. Installation and testing is completed. Beckman operation has been stable during the month except for one spurious trip on #2 Beckman. This occurred before installation of the arc suppressors.

h. Material Handling

The installation of air motors for operation of the front face valves was completed. This equipment will speed the charge-discharge operation.

i. Ball 3X

The ball 3X components were functionally checked during the outage of 3-27-59. Fourteen gates were not checked because of high radiation. All gates tested operated satisfactorily. There was rust on the balls in several hoppers, indicating the presence of moisture.

j. Venturi Replacement

A program to revise the orifice pattern for more effective use of the available water was started during the month. Approximately 85 orifices were changed during the 3-13-59 outage and 42 during the 3-27-59 outage. In addition, 135 "vendor" venturis and 21 reamed venturis were installed in the central zone.

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DECLASSIFIED**C. Improvement Experience****1. Production and Process Tests****a. IP-105-C - "Graphite Power Coefficient Determination"**

During the 3-13-59 shutdown, tests were made to obtain reliable data concerning the dependence of the reactor graphite power coefficient on the exposure of the uranium load. The reactor was made critical to a level of less than one MW during these tests. Shutdown work was not interrupted.

b. DT-IP-159-F - "Power Rate Meter"

Five RTD's were installed on the rear face to complete installation of the power rate meter equipment. Additional adjustments will be required to put this equipment in operation.

2. Projects**a. CG-666 - "Zone Temperature Monitor"**

During the reactor outage on 3-17-59, RTD's of new design were installed in all "Y" pigtails. Faulty RTD's were repaired during the 3-27-59 outage. The equipment is now operating satisfactorily.

b. CG-780 - "Improved Ventilation, Buildings 105 and 115-B, D, and F"

Work has begun in the 105 and 115 buildings in preparation for installation of new duct work in conjunction with the project.

D. Radiation Monitoring Experience**1. Radiation Occurrences**

Six radiation occurrence reports were issued during the month of March. Following is a listing of the occurrences by types:

<u>No. of Occurrences</u>	<u>Nature of Occurrence</u>
2	Step-off pad and corridor contamination spread
1	Skin contamination
1	Three men received dose rates in excess of 3 rems/hr.
1	Routine survey of clean laundry revealed contamination up to 30,000 c/m on rubber glove.
<u>1</u>	Barrier removed from around spline chopper and employees worked in unmonitored dose rate for 10 minutes.
6	

The spline chopper occurrence was classified as a lapse of radiation control. Three operators were found working about 5 feet from the chopper in a dose rate of 150 mr/hr. Each man received an estimated 25 mrem of unplanned exposure.

2. External Exposure Control

D Processing Operation's Radiation Monitors accumulated an average of 550 mr gamma exposure during the 12-week period ending March 11, 1959. Pile and Utility Operators accumulated an average of 447 mr during the same period. For 1959, to date, Monitors and Operators have accumulated exposure at an average rate of 46 mr/week and 37 mr/week, respectively.

3. Contamination Control

During the March 27 outage, an attempt was made to seal the rod cooling water downcomer opening in the outer rod room. The attempt was not completely successful, but effluent vapor leakage was reduced to one-tenth former levels.

E. Events Influencing Costs

No unusual cost variances are expected in the March report.

DR PROCESSING OPERATION

A. Production

Production was 122.4% of official forecast and time operated efficiency was 109.4% of the official forecast. The maximum power level was 50 units higher than the previous highest level achieved in February, 1959.

B. Operating Experience

1. Operating Continuity

Operation was interrupted by one unscheduled outage and three scrams. Details follow:

<u>Date</u>	<u>Hours</u>	<u>Cause</u>
3-7-59	97.0	Ruptured slug in tube 1674-DR
3-16-59	0.4	Scram. Unknown gauge tripped panellit.
3-17-59	0.4	Scram. Panellit trip row 10. Unknown gauge.
3-17-59	29.2	Scram. Beckman trip while recovering from previous scram. Ruptured slug verified in tube 0970-DR charge-discharge.

2. Equipment Experience

Sewers

Repair work authorized under MJA-8 was completed.

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2. Equipment Experience (Con't)Ruptured Slugs

1674-DR - I & E, lot CL-007-C, concentration 828 MWD/ton, charged 10-6-58, hole classification, discharged with charging machine.

0970-DR - I & E, lot CL-812-D, concentration 713 MWD/ton, charged 10-31-58, unable to save for inspection, discharged with charging machine, pigtail reading 30 r/hr.

Process Tube Venturis

Replaced the 0.243 orifices in 12 fringe tubes with 0.283 venturis to provide increased cooling for the solid metal charges in these tubes. Replaced 0.283 venturis with 0.310 venturis in 235 tubes charged with I & E. These changes are a continuation of a gradual reorificing program to attain more efficient water utilization.

Graphite Stack

A vertical traverse was conducted in tubes 4675-DR, 4456-DR and 4492-DR. The maximum distortion from the center line was a dip of 1.18 inches in 4675-DR at a distance of 19' from the front of the pile.

Front Nozzle Alignment

Out of 56 front nozzles checked for alignment, 20 had greater than .020 inch misalignment and 3 had about 0.030 inch misalignment.

Graphite Stringer Thermocouples

Thermocouples were replaced in channels 1266-DR, 1284-DR, 2581-DR and 3773-DR. A force of 3000 pounds was required to discharge the stringer from 3773-DR. A boroscopic inspection of the channel after the discharge showed a 1/2" gap at 10' from the front flange, a 1/2" gap at 14' and that the bottom half of the last block is missing.

Tube 4373-DR

The I & E enriched charge of 4373 DR was removed at about 50% of total concentration because the panellit gauge had shown a 20 psi increase. The rear pigtail radiation reading was normal. The cause of the increase was not determined.

C. Improvement Experience1. Production and Process Tests

<u>Test No.</u>		<u>Tubes</u> <u>Charged</u>	<u>Tubes</u> <u>Discharged</u>	<u>Tubes In</u> <u>Reactor</u> <u>March 31</u>
PITA-IP-4-I	Use of I & E E-Metal	35	34	99
PITA-IP-6-I	Central Zone Loading of I & E into DR Reactor	490	483	1333

Production and Process Tests (Con't.)

<u>Test No.</u>	<u>Description</u>	<u>Tubes Charged</u>	<u>Tubes Discharged</u>	<u>Tubes In Reactor March 31</u>
PT-IP-081-A	Irradiation of Fuel Elements having Blunt Nose Tru Line Contours (M-388 cans)	0	0	100
PT-IP-220-A	Evaluation of the Dimensional Instability of Core Blank Heated Treated Uranium.	6	0	6

2. Projects

CG-707 Improvement to Reactor Nuclear Instrumentation

Installed neutron monitoring chamber in "E" hole.

AEC-160 Recirculating Gas Loop

Construction of the facility is progressing according to the schedule.

D. Radiation Monitoring Experience

1. Radiation Occurrences

One lapse of radiation control, adjudged at a severity of 8, was experienced during the month. This lapse resulted when a box of trash reading 500 mr/hr was found at the work area step-off pad, causing dose rates of 50 to 100 mr/hr to exist just outside the zone boundary.

Two technical overexposures resulted from radiation work activities at the reactor; both apparently occurred during the tube replacement outage in January and were later discovered through the film-badge record. Both instances involved other component responsibilities. In one, a Supplemental Crews Operator received an exposure of 375 mr in a five day period, and in the other, a D-DR Maintenance employee received an exposure of about 400 mr during the same five day period. The two involved employees worked the same regular shift during the outage; however, no correlation was evident between the two occurrences.

2. External Exposure Control

Three employees received whole body dose rates of 4 r/hr on one occasion during rupture discharge in which a pigtail reading of 100 rads/hr was found. Other discharge area dose rates received by personnel included rates to 1000 mr/hr during work on problem channel 3666-DR.

Dose rates to 5 r/hr were encountered on the top of the unit filter box which was associated with work on problem channel 3666. Subsequently, the box was buried at a dose rate of 1 r/hr to personnel.

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3. Contamination Experience

One case of personal clothing contamination, involving levels to 2,000 c/m, was reported during the month. Three instances were encountered of contaminated articles being found outside of posted radiation zones; the maximum contamination level was 7000 c/m on a pipe fitting found in the Maintenance white tool shop.

E. Events Influencing Costs

No unusual variances in controllable costs are expected in the March report.

D-DR POWER OPERATION

A. Operating Experience

Water treatment has been satisfactory during the month, although some difficulty was experienced due to erratic changes in the raw water turbidity. This condition is due to the work being done at Priest Rapids Dam. This has reduced filter runs and increased chemical feed at each water plant.

Boiler operation was satisfactory during March. The steam generating load was 94,806 pounds per hour average and 134,000 pounds per hour maximum. The average evaporation rate was 9.04 pounds of steam per pound of coal.

The export pumping load was supplied by 100-D Area during the month except for a two day interruption for removal of tumbleweeds at 182-D. It has been necessary for 100-B Area to assist 100-D Area to maintain pressure on the system most of the month.

The raw water export line from the "T" between 105-D and 105-DR was removed from service on March 18 to repair a leak in the system near the 105-DR badge house. The leak was caused by a surge on the system when the 182-D north 2.4 K.V. bus oil circuit breaker tripped out after being opened for maintenance on the Number 2 transformer. The 105-DR raw water line was returned to normal on March 19.

B. Equipment Experience

Inspections

1. No. 1 Link Belt traveling screen - 181-D, Class A
2. 13.8/2.4 KV transformers: No. 1 in 181-D, 182-D, 183-D, No. 2 in 182-D and 183-D - by R.U.O.
3. Air receivers: 183-D - 1, 183-DR - 1, 183-DR - 2 by Travelers Insurance Co.
4. Tanks: No. 1 clearwell in 183-DR, No. 4 process storage in 190-D, near high tanks in 105-D and 105-DR - drained and inspected by Principle Engineer, F.E.O.

190-D Building

Inspection and repairs were completed on the Number 8 process pump motor on March 9. Several end coils between the bracing rings and bull rings at each end of the motor had to be re-tied. The inboard motor bearing was inspected. The pump was released to Project Engineering Operation and Minor Construction to grind the pump case under the direction of the DeLaval field representative. A re-worked primary impeller with new design wear rings was installed in the pump on March 16.

The governor and overspeed trips were inspected and tested on all turbine drives during March.

Number 5 annex pump unit was removed from service at 8:50 a.m. on March 22 due to failure of the 41-X D.C. relay. The steam driven pump turbines accelerated due to the relay action, causing a 105-D scram. Number 2 annex pump unit was placed in service in time for the reactor to recover.

190-DR Building

A performance and production test was conducted on the Number 8 process pump with a new design Byron-Jackson first stage impeller and wear rings. (HW-59375) The pump did not come up to expectations and additional tests will be conducted at a later date.

Two successful performance tests were conducted on the Number 6 process pump to spot-check the head capacity characteristics with the new replacement first stage impeller assembly. (HW-59522)

Repairs were completed on the Number 2 process pump motor on March 31. The end coils between the bracing rings and bull rings at each end of the motor were re-tied. New brush holders were installed on the exciter.

C. Events Influencing Costs

1. Repairs on the 190-D Number 8 and the 190-DR No. 2 annex pump motors.
2. Increased chemical feed at each water plant.
3. Removal of tumbleweeds from the south reservoir.
4. Repair water leak in the raw water export line at 105-DR badge house.

D-DR MAINTENANCE OPERATIONA. Equipment Experience1. Instrumentsa. Pressure Monitor System

An unsatisfactory jumpering system discovered in the K Areas prompted research on Panellit gauge jumpering procedures, and subsequently brought about the removal of all trip check circuit jumpers in D and DR. In 105-DR jack plug buttons were

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HW 59840 JEL

Pressure Monitor System (Con't.)

Installed in one of the trip check circuit jacks on each Panellit gauge, but time did not permit this work to be done in 105-D.

b. Pile Control Instrumentation

105-D - B-Test Hole (Triple PC)

It was necessary to replace the hot start-up and cold start-up chambers this month, as well as their respective signal cables, and to reposition the hot start-up chamber in order to get it to a more sensitive position. This was to eliminate a delay time of approximately 5 minutes between the time the cold start chamber reached its maximum useable limit, and the hot start chamber started to give a reading.

105-DR

A new subcritical PC chamber was installed in the "E" test hole to replace one which failed. The high voltage and signal cables were also replaced. No. 1 Galvanometer became erratic during the recent outage. Inspection revealed an accumulation of metal filings on the permanent magnet. Other filings were removed from the instrument cubical. They were caused by recent cutting of holes in the steel console panel.

2. Electrical

105-D - A new annunciator panel was mounted in the control room to replace and up grade the old panel. The new panel has dust tight relays and neon glow indicators, both of which will reduce maintenance requirements and give more dependable operation.

3. Mechanical

105-D - During two outages this month 31 tubes were replaced at a rate of 31.2 minutes per tube. The venturi and orifice replacement was carried on during both outages.

105-DR - The main outage work performed this month was venturi replacement, repair of #13 V.S.R., replacement of the grating on the "D" elevator, and an unsuccessful attempt to remove the drill from Channel 3666-DR. Fourteen hours were spent on this channel, finding that broken pieces of graphite were blocking the attempt to remove the drill. The downstream channel was over-bored .030", without success in moving the obstruction. All of the broken graphite on both sides of the drill must be removed during a future outage.

184 Building - Drain valves were installed in the #1 and #4 boiler feed water piping system as recommended in IPD Serious Accident Investigation No. 58-16. This work will continue as the boilers are available to be taken off the line.

C. Maintenance Engineering

1. Instrument Engineering

105-DR Oxygen Analyzer

Air leaks in the associated piping were located and repaired. Final connection of the control room slave recorder and the inner instrument room master recorder was accomplished. The system is now complete and operating satisfactorily.

Thermal Shield Flow Compensation

Revisions to the Foxboro power calculator which provide for automatic thermal shield power compensation were completed. This automatic compensation will improve the accuracy of production accounting to the extent that the contribution of the thermal shield will be accurately integrated rather than being included as a manually set constant.

Conductivity Meter for Control Room Acid Concentration

Tests were performed which demonstrated the practicality of using a conductivity meter for control of the acid concentration in the wash pad dummy decontamination tanks. A proposal and cost estimate have been submitted for the permanent installation.

Safety Circuit Training

Safety circuit block diagrams and prints for the training of 105-D instrument personnel were prepared. Training sessions will be held as opportunity permits.

2. Electrical Engineering

"C" Elevator Productivity Devices

A meeting was held with representatives of interested groups concerning protective devices needed to prevent damage to the front face of the reactors by the overhead charging machines and the PCC charging machines. It was agreed that pending development of a survey device to detect any obstructions protruding from the reactor to the "C" elevator or vice versa, protection against damage by the overhead charging machines while water pressure is 'up' would be provided. The design change to install limit switches on the track of the overhead charging machines is being prepared.

3. Mechanical Engineering

Work Area Crane Safety Features

A report containing eight recommendations to improve work area crane safety was issued. The report is based on safety considerations which

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HW 59840

Work Area Crane Safety Features (Con't.)

were to be included in a contemplated "up grading" of the crane on a proposed future project. Cost estimates are in preparation.

105-DR Downcomer

Modifications to the near downcomer, as specified by FED, were completed during the month. Final clean up remains to be done. Interim pressure instrumentation to gain premodification data will be installed on the far downcomer during the current outage. After collection of data during the next operating period, flow will be diverted to the near downcomer and modification of the far downcomer started. Far downcomer work will conclude with more extensive instrumentation from which comparative data will be developed.

Dryer Room Drains

Installation of remotely operated condensate drain systems on all five dryer rooms are complete. This eliminates expenditure of personnel exposure for routine 115 operation.

110-Modifications

Modifications of high pressure storage piping and safety devices continues. All piping in the gas tunnel, which must be done under SWP conditions, is complete. This will expedite the remaining work which will include compliance with the recommendations made as a result of the recent explosion of a gas meter.

Metal Handling System 105-DR

Conveyer section to provide a front face metal handling system similar to 105-D equipment have been ordered for 105-DR. The promised delivery date is May 20.

4. Planning and Scheduling

During the month the following PM work was done:

Inspections and overhauls - 17 Class A
42 Class B
115 Class C

Programmed Preventative Maintenance proceeded well and within schedule during the month of March until the 16th, when both 105-D and DR were down simultaneously. Work connected with the shutdown, along with work previously begun but not completed, has consumed the time normally allotted to PM work. Accordingly, the Preventative Maintenance schedule is somewhat behind in all phases, particularly in the instrument craft. All crafts spent an average of 25% of available manhours on PM work.

D. Events Influencing Costs

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

Nonexempt	- 1884.2	manhours
Exempt	219	manhours

J. H. Brown

Manager
D & DR Reactor Operation

JH Brown:JDR:ab

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HW-59840 **DEL**

F REACTOR OPERATION
MARCH, 1959

I. ORGANIZATION AND FUNCTIONS

No changes in assigned responsibilities.

II. PERSONNEL

A. Force Report

	<u>February 28</u>			<u>March 31</u>			<u>Net Change of Total</u>
	<u>E</u>	<u>NE</u>	<u>Total</u>	<u>E</u>	<u>NE</u>	<u>Total</u>	
General	2	2	4	2	2	4	0
Processing	15	37	52	15	38	53	+1
Power	7	51	58	7	50	57	-1
Maintenance	<u>14</u>	<u>72</u>	<u>86</u>	<u>14</u>	<u>72</u>	<u>86</u>	<u>0</u>
Total	38	162	200	38	162	200	0

B. Movement of People

There were no changes in exempt personnel during the month.

Nonexempt personnel moves consisted of seven transfers out (including two deactivates and one retirement), seven transfers in, and one reassignment within the Operation.

III. PERSONNEL ACTIVITIES

One person participated in a scheduled I.P.D. training program. Maintenance Engineering personnel attended a vendor demonstration on hydraulic controls and systems.

Dr. A. B. Greninger's "Report to Employees" was shown to thirty-three exempt and nonexempt day and shift personnel.

Three educational films were shown to area personnel: one demonstrated the technique of "mouth-to-mouth" resuscitation and the other two dealing with symptoms and treatment of cancer.

IV. SAFETY AND SECURITY

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

Security Patrol presented a movie entitled "Invitation to Dinner" and a talk to area personnel.

V. NONROUTINE REPORTS ISSUED

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 ACTIVITIESGENERALA. Administrative Activities

An English-produced semi-technical film on "Criticality" was shown to approximately 206 F Area personnel.

The Specialist - Suggestion Administration, conducted two seminars on suggestion evaluation procedures.

B. Cost Control Activities

Cost figures (available in March) disclosed that unit costs for February set an all-time record low for F Reactor Operation.

C. Landlord Activities

A study is presently underway to determine the feasibility of using the 1713-F Building for either drafting and/or general office space use. Work on Phase II of the rearrangement of the 1717-F Maintenance Shops is 90 per cent complete.

Leaks in the 105 Building roof were corrected by the contractor who originally repaired the roof in October, 1958.

D. Suggestion Plan Activities

To be evaluated - start of month	26
Received for evaluation	22
Evaluated and returned	12
Unanswered - end of month	36

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F PROCESSING OPERATION

A. Production

F Reactor production was 88.3 per cent of forecast during March with a time-operated efficiency of 65.4 per cent. Water leak experience contributed to the low time-operated efficiency.

B. Operating Experience

1. Operating Continuity

<u>Outage Date</u>	<u>Hours</u>	<u>Reason</u>
3/2/59	152.9	Charge-discharge, tube replacement and excessive water collection.
3/16/59	104.4	Excessive water collection.

2. Equipment Experience

a. Water Leaks

An increased water collection rate necessitated an outage one week ahead of schedule on March 2; tube replacements and tube leak corrections were made. The reactor was again shut down on March 16 because of excessive water collection. The following leaks were confirmed during the two outages:

<u>3/2/59 OUTAGE</u>	<u>3/16/59 OUTAGE</u>
0160 - tube leak	0375 - rear gasket leak
0168 - tube leak	0466 - rear & front gasket leaks
0175 - rear gasket leak	0494 - tube leak
0178 - rear gasket leak	0553 - rear Van Stone
1469 - tube leak	0569 - rear gasket leak
	0573 - rear Van Stone
	1568 - front gasket leak
	1668 - front gasket leak
	3576 - rear gasket leak
	3580 - rear gasket leak
	4079 - tube leak

The Van Stone leaks were correctable without removing or replacing the tubes. At month's end, water collection rate was constant at 12 to 14 gallons per day.

b. Tube Replacement

A total of 49 tubes were replaced during the month of the 155 probologged for external corrosion. Included were 4 air channels which were previous tube leaks.

c. VSR No. 27

During the start-up of the March 2 outage, an 11' section of flexible vertical rod No. 27 was found to have parted at the first joint; start-up was delayed approximately 24 hours while the broken tip section was removed from the reactor. The entire rod was removed and radiographed. All other joints were found mechanically sound and metallurgical work was continued.

During the March 16 outage, VSR No. 24, which was previously reported as having several cracks in one of the unions, was disassembled and several sections were replaced.

C. Improvement Experience1. Projects

Project CG-666 - "Zone Temperature Monitor" - Installation was accepted for beneficial use.

2. Other Improvements

- a. Panellit - Continued installation of 10-90 trip gages. Approximately 75 per cent of central zone is now complete.
- b. PCCF Scram Delay (D.C. No. 245) - Installation started and approximately 75 per cent complete.
- c. Rear Face Viewing Window - Completed installation of auxiliary lead glass viewing window in the 30' lead room.

D. Radiation Monitoring Activities

Three employees were exposed to a radiation field of approximately 4000 mr/hour for less than one minute when irradiated dummies were flushed onto the discharge elevator. The incident was investigated and reported in Document HW-59750.

An irradiated fuel element was accidentally lodged in the rear face pigtail assembly during normal discharge in the March 16 outage and removed by remote techniques in dose rates of less than 100 mr/hour. By contrast, a dose rate of 16 r/hour outside of the 30' far lead room represented dose rates at various discharge area entrances.

Rear wall contamination of 12 rads/hour was encountered in the discharge area and readily reduced. Five cases of personal clothing contamination up to 4000 c/m and one case of personal skin contamination to 4000 c/m were readily reduced.

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DECLASSIFIEDF POWER OPERATIONA. Operating Activities

Raw water turbidity varied from 29 ppm to a maximum 268 ppm. Reduced process water flow tests were conducted to obtain information for the F Area conditions under evacuation standards.

B. Equipment Experience

1. An internal inspection of No. 2 process water storage tank in 190 Building was completed on March 4. A metallurgy report showed the depth of pitting under tubercles to be .120 inch or approximately 48 per cent of metal thickness.
2. The No. 2 boiler in 184 Building was removed from service on March 18 due to a leak in hand hole plate and No. 1 boiler was placed in service. The leak and relief valve repairs on No. 2 boiler were completed on March 25. A one-inch drain valve was installed in the main feed water lines to Nos. 2 and 3 boilers in accordance with the recommendations of Safety Investigating Committee on investigation of IPD Serious Accident No. 58-16.
3. Numerous inspections and repairs were made to equipment in Building 183 (raw water valve, Nos. 2 and 4 pump motors, and No. 4 pump impeller), Building 190-A (all pump motors and exciters, and stator windings on Nos. 5A and 6A pumps), and Building 181 (No. 10 pump and Nos. 1 and 3 screen rollers).

C. Improvement ExperienceProject CG-558 - 190-A Building

Minor Construction forces completed realignment work to No. 8A pump on March 6. The unit was placed in service at 2:20 p.m. and operated satisfactorily with exception of vortex action that developed with the removal of the first stage splitters in pump casing.

D. Events Influencing Costs

Items which will increase costs are:

1. Repairs to Nos. 2 and 4 183 Building process water pump motor stators.
2. Repair work to No. 10 181 Building raw water pump and Nos. 1 and 3 traveling screen rollers.
3. The boiler change made on March 18 and repair work required on No. 2 boiler.

F MAINTENANCE OPERATION

A. Equipment Experience

1. Instrument

The graphite thermocouple stringer with an experimental neutron detector element was installed in tube channel No. 1266 on March 6.

The rehabilitation program of the moisture monitor dewcell equipment is 95 per cent complete. Due to a high content of moisture in the pile atmosphere, considerable reworking of the elements was required. To expedite reactivating the dewcell elements and to improve response time, a glass tape without a bonding agent was utilized.

Approximately 80 per cent of the pressure monitor Panellit gages have been modified to include the 10-90 trip settings. Twelve gages were replaced as being leaker suspects.

During the two reactor outage periods, 34 rear face thermocouples were repaired. The majority of cases involved corrosion at the thermocouple tip.

2. Electrical

Necessary wiring for the installation of a Hydrovac pump in the 105-F inner instrument room was completed.

Grade D slip ring brushes were installed on Nos. 1 and 5 process pump motor units in 190-A Building.

The No. 5 process pump motor at the 190 Annex Building underwent a thorough inspection and repairs were made because of slight corona damage throughout the stator winding.

3. Mechanical

A total of 49 process tubes were installed at a rate of 0.6 hours per tube. This is the best replacement rate achieved to date in F.

No. 37 VSR channel was cleared of a broken piece of a key way block. The rod was reactivated following the cleaning of the channel.

Excavation work on the F Reactor effluent line revealed a leaking Dresser-type coupling. To properly support the line, a concrete pad was installed under the pipe and the coupling realigned and packed with oakum and lead wool. All leakage ceased.

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A six-inch relief hole was drilled into the annulus of the downcomer from the inner rod room. A two-inch drain line was installed from this hole to a drain located in the outer rod room. Holes were also drilled into each landing and each wall was grooved to divert the water for eventual flow into the riser room through a hole drilled at the zero level elevation.

B. Maintenance Engineering

1. 105-F Rod Water Instrumentation

Design Change No. 270 was issued for approval to cover revisions of the horizontal rod cooling water instruments.

2. 105-F High Tank Level Controls

Reviewed and approved bids for replacement level control valves for the high tanks. Replacements will be single-seated valves capable of tight shut-off.

3. 105-F Power Calculator Temperature Element Relocation

Installation of the new temperature elements on Design Change 203 has been delayed due to lack of downtime. Couplings for the wells were installed in the crosstie and one well installed. Distortion of the other couplings during welding operations caused a delay in installation of the remaining wells.

4. 105-F No. 2 RXG Start-up Chamber

An additional chamber has been installed under the unit to give increased sensitivity on start-up. This chamber is to be used with No. 2 Beckman. A new sled was designed and built for the chamber.

5. 110-115-F Gas System Safety Study

To correct possible unsafe conditions, the safety valve located at the pressure reducing station has been increased to full two-inch line size. This is adequate to relieve the full flow of CO₂ in the event the line downstream should become blocked by frost accumulation or improper valving.

6. New Ball 3X System

The electrical tracings for the new Ball 3X System are being reviewed prior to approval. A revised future shutdown schedule has changed the proposed first installation from B to F Reactor with July established as a target date.

7. Process Events Recorder System

Operation of a prototype events recorder was witnessed and details of installation of a typical system discussed. An estimate of \$2,244 equipment costs was made for a ten-point monitor for 105-190 application. Additional points could be added at a cost of \$105 per point minus labor to a maximum of 32 points total.

8. Revision of Undervoltage Protection of 2300 Volt Line - 184-F Building, Design Change No. 273-F

This design change has been completed (equivalent to the D Area original minor design change) and is being circulated for approval signatures.

9. Control Room Air Conditioner - 105-F Building

A York ten horsepower air conditioner with a 12 KVA strip heater was received. The unit will be located at the ten foot level in the accumulator room. A Work Review was issued to determine if the work will be approved for Plant Forces.

10. Gunbarrel Tip Modification - 105-F

Mechanical design to provide a gunbarrel sleeve for thermal expansion of process tubes has been undertaken by Process Engineering. A prototype sleeve has been designed and ordered from Central Shops.

11. Loading of "C" Elevator - 105-F

The loading of "C" elevator, which has a capacity of 8,000 pounds, was reviewed and found satisfactory for present operating conditions.

12. Work Area Crane Safety Features - 105-F

Vendor recommendations for improving the safety of the work area cranes were reviewed and recommended for installation at 105-F.

C. Planning and Scheduling

Approximately 22 per cent of available manpower was assigned to Productive Maintenance work which included the completion of 9 Class "A" overhauls and 256 Class "B" overhauls.

D. Events Influencing Costs

A total of 49 requisitions were issued at an approximate cost of \$3,268. At month's end, 57 requisitions were outstanding which represented a cost of \$9,387. Three stock adjustment requests were issued for a total estimated cost of \$200.

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MANAGER, F REACTOR

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H REACTOR OPERATION

March, 1959

I. ORGANIZATION AND FUNCTIONS

No change.

II. PERSONNEL

A. Force Summary

	<u>February 28</u>			<u>March 31</u>			<u>Net Change of Total</u>
	<u>E</u>	<u>NE</u>	<u>Total</u>	<u>E</u>	<u>NE</u>	<u>Total</u>	
General	3	2	5	3	2	5	0
Processing Operation	16	39	55	16	35	51	-4
Power Operation	8	52	60	8	52	60	0
Maintenance Operation	14	63	77	14	62	76	-1
Cent. Maint. Oper.	17	104	121	17	105	122	+1
Total	58	260	318	58	256	314	-4

B. Movement of People

There was no movement of exempt personnel within the Operation during March. Nonexempt personnel movements included six transfers into the Operation, seven transfers out, one termination, two deactivations, one retirement, and one new hire.

III. PERSONNEL ACTIVITIES

R. C. Knop, Maintenance Engineer, visited the General Electric Service Shop in Spokane on March 13, to observe repair of No. 8 Building 190-H annex process water pump motor.

IV. SAFETY AND SECURITY

A disabling injury occurred within the Operation on March 16, when an electrician journeyman fell onto a concrete floor while getting down from a work bench on which he had been standing. The fall caused a back injury requiring hospitalization. There were no other serious incidents, radiation incidents, or security violations during the month. A total of 19 medical treatment injuries were reported.

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 - The first alphabetical roster of all IPD Power Operations employees was prepared and issued as part of the unit nonexempt manpower coordination function. Assistance was provided in the preparation of position guides, functional charts and functional charters related to the reorganization of Facilities Engineering Operation and organization of NPR Project Operation. Coordinated appraisal of all exempt employees.
- B. Personnel Development - Five exempt employees continued participation in the fifth presentation of Professional Business Management I. One secretary completed the Secretarial Proficiency course. Thirteen exempt employees were enrolled in a total of six IPD training courses. One Technical Graduate was on rotational assignment at month end.
- C. Cost Control Activities - Activities were routine during March.
- D. Landlord Activities - A review of space allocations and charges was made. Charges were adjusted to give a closer correlation of liquidation and costs, and to bring liquidations closer to the budgeted figures.
- E. Suggestion Evaluation - At start of month, 37; received for evaluation, six; evaluated and returned, 15; balance at month end, 28.

H Processing Operation

A. Production

H Reactor operated continuously during March to set a new production record. Input production was 38.5 per cent above forecast. A new high level 10 units above the February record high was reached and held as the administrative operating limit.

B. Operating Experience

1. Operating Continuity

The reactor operated continuously during the month.

2. Equipment Experience

- a. Downcomers - At month end, removal of vent pipes in the near downcomer was partially completed. The work was accomplished during reactor operation without serious difficulty.

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HW-59840

- b. Gas Storage - The relief valves on the high pressure helium storage tanks and low pressure helium and carbon dioxide tanks were replaced to comply with ASME code. Further study is being made of the high pressure carbon dioxide storage to determine compliance with code.

C. Improvement Experience

1. "C" Elevator - Alterations to "C" elevator for improving charging rates were continued.

D. Radiation Experience

Downcomer vent pipe removal was accomplished at dose rates of 100 mr/hr, and with good contamination control. H Reactor Operation experienced four radiation occurrences including on Lapse of Control. One skin contamination and two personal clothing contaminations occurred. Exposure to H Maintenance Operation pipefitters and welders continued to be 22 per cent and 32 per cent respectively above the 3 r/year curve.

E. Events Influencing Costs

Because of no charge-discharge during the month, dummy costs will be less than normal. Overtime for the month consisted of only 0.5 hour which was required for a paid lunch period.

H Power Operation

A. Operating Experience

The average steam generating rate was 45,000 lbs/hr, with an evaporation rate of 7.92 pounds of steam per pound of coal. Standard quality water was produced with an average alum and separan feed of 7.8 ppm and .017 ppm, respectively. Higher than normal raw water turbidity was experienced throughout the month, and was attributed in part to construction work at Priest Rapids Dam. Two power surges occurred on the BPA system at 8:40 a.m. and 9:30 a.m. on March 7. No equipment was affected.

B. Equipment Experience

Building 182-H - A test was run on No. 3 export water pump to determine the effects of low pressure system surges on continuity of equipment operation. Under current instrument settings, if a low pressure surge of less than 100 psi is maintained in excess of 14 seconds, the export pump motor will be tripped off due to closure of the roto-check valve.

Building 183-H - New impellers were installed in Nos. 1 and 3 filtered water pumps by Project CG-558. The west raw water cone valve was inoperative most of the month because of power piston failure. Repairs are scheduled for the early part of April. The steam lines to the starting jets on condensers for the three emergency pumps were removed from service.

Building 184-H - No. 4 boiler, No. 2 air receiver and the air receiver in Building 182-H were inspected by J. A. Jones of Travelers Insurance Company on March 16. A considerable amount of corrosion material was removed from

the No. 2 receiver before it was returned to service.

Building 190-H - Fisher control valves on turbines Nos. 2, 3, 4, 9, 11, 12 and 13 were adjusted to reduce idling speed. The stator for No. 8 annex motor was shipped to Spokane, Washington for repairs. The spare stator from Building 189-F was installed and the pump unit was placed in service for flow characteristic tests which indicated satisfactory operation. As the result of subsequent flow variance tests, it is planned to install straightening vanes in the pump suction line and run additional tests in April.

C. Improvement Experience

Project CA-696 - Coal Car Shake Out - A permanent electrical breaker was installed by the contractor and a work order has been issued to plant forces to correct miscellaneous electrical items. The structure remains to be painted.

H Maintenance Operation

A. Field Maintenance

1. KAPL-120 Modification - Work is complete except for outage work consisting of insulation of pile tube piping, installation of shielding, and miscellaneous pipe supports. Work accomplished this month included insulation of the heat exchanger and auxiliary piping, extensive revision of flow and temperature controls, installation of new heat exchanger thermocouples, and recalibration of instruments for startup. Power for the KAPL-120 pumps will be fed from three separate sources to provide a more reliable power system. Even with two simultaneous power failures, an adequate supply of water should be available to prevent fuel damage.
2. Process Pumping Unit - 190-H Annex - Loose coil slot fillers and wedging resulted in sending No. 8 motor stator to the General Electric Service Shop in Spokane for thorough analysis of the apparent difficulties. No significant wear was noted on the coils in the slots. However, the coil insulation at the bullring was found to be wearing rapidly, even at points where the tying was tight. The coils are being insulated from the bullring by means of Mylar plus suitable adhesives. An inspection of No. 5 motor indicated evidence of similar breakdown. The inboard bullring was partially reinsulated with Mylar and epoxy resins.
3. Helium Compressor and Piping System - An extensive study of the helium piping arrangement, compressor piping, relief valves and pressure controls was started. The existing and replacement relief valves are being studied to determine if they are of adequate capacity. The helium unloading compressor was removed from service due to faulty operation resulting from a general condition which indicated the need for a complete A Class repair. This was completed and the unit returned to service.
4. C Elevator Revision - Work included completion of assembly of the charging machine cylinders, completion of revision of the top-of-the-unit air duct, and installation of high pressure hose reels under the floor of the C elevator. The air cylinder overhead support assemblies have been placed on order.

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5. Gamma Monitor Sample Lines - Increasing gamma monitor sample line failures have indicated the need for priority action on this problem. Temporary replacements for the copper tubing from the stainless steel lines to the entrance of the heat exchanger have been fabricated and are available for installation on the near sample room during the next outage, permitting thorough engineering evaluation of the problem leading to an ultimate permanent solution.

B. Engineering

1. Rear Face Cap and Tool Decontamination Facilities - H Reactor - Redesign of the original proposal for installation of rear face cap and tool decontamination facilities was continued and sketches were completed. A rough draft of the revised proposal has been prepared.
2. Horizontal Control Rod Seals - Work continued on this design and is about 75 per cent complete.
3. Miscellaneous
 - a. Prepared and issued comments on Specification HWS-6741.
 - b. Assisted CEO engineers on the location and routing of Ball 3X equipment to be installed at the reactor.
 - c. The reactor C elevator photocell system was inspected and recommendations were made on the system shortcomings.
 - d. The revised design for the rear face slug flushing chute with the shear pin release mechanism, was tested to determine the forces required to remove it from a nozzle. The results indicated that another approach to the problem of flush discharge should be undertaken.
4. Manual Writing Activities - Work continued on Temperature Monitor System drawings and the Instrument Manual rough draft write-ups. A detailed study and outline was made to permit simplification of relay circuitry through elimination of corner interlocking circuits. Schematic diagrams of the VSR and SN circuits were prepared for the electrical training manuals.

Central Maintenance Operation

A. Engineering

Assisted the machine shop on special work for Research and Engineering Operation on zirconium tubes as well as other parts. Located special drills and taps to expedite high burnout work in 1706-KER. Recommended procurement of mine safety duct for experimental installations, rather than fabrication of sheet metal duct, with considerable savings resulting. Reviewed Project CG-706 field work, which indicated the possibility of using existing ducts rather than installing new ones. Existing wiring is also available.

B. Hot Shop

Tool work for tube removal programs included repairing of 46 broaches, 107 splitters, three starters and 15 vanstone removers. Reamed 206 venturis. Repaired 24 leak testers. Reclaimed 200 stud bolts. Revised 120 aluminum slugs.

C. Instrument-Electronic Shop

Fabricated three thermocouple stringers for KW and D Reactors. Continued visicorder transducer work for P & IE. Continued bundle and harness fabrications for projects.

D. Machine Shop

Completed special work on zirconium tubes for Building 1706-KER. Bored and bushed 15 river pump bearings for 100-K Area. Completed parts and assemblies for poison spline systems. Completed five thermocouple stringers for 100-B Area. Rebuilt five turbine steam chests.

E. Fabrication Shop

Fabricated hot graphite equipment for 100-K Area. Modified duct transition for thermocouple work at 100-K Area. Installed safety guards on 100-D Area pumps. Fabricated and installed duct at C Reactor. Fabricated heat exchangers for 100-K Area.

F. Paint Shop

The regularly scheduled period of painting was completed in 100-K Area. The most significant work performed was the painting of piping in the tunnels at KE Reactor. The regularly scheduled period of painting in 100-B Area was started.

G. Planning and Scheduling

Firm schedules have been formulated relative to the KE Reactor extended outage for thermohm replacement. A fiscal year approach to scheduling of painting has been completed for 100-B and F Areas.

H. Special Services

Projects active this month were: CG-666, CG-706, CG-707, CG-708, CG-817 and MJA-8. The most significant activity occurred around outage work for CG-666.

Acting Manager
H Reactor

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5. Gamma Monitor Sample Lines - Increasing gamma monitor sample line failures have indicated the need for priority action on this problem. Temporary replacements for the copper tubing from the stainless steel lines to the entrance of the heat exchanger have been fabricated and are available for installation on the near sample room during the next outage, permitting thorough engineering evaluation of the problem leading to an ultimate permanent solution.

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Central Maintenance Operation

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Assisted the machine shop on special work for Research and Engineering Operation on zirconium tubes as well as other parts. Located special drills and taps to expedite high burnout work in 1706-KER. Recommended procurement of mine safety duct for experimental installations, rather than fabrication of sheet metal duct, with considerable savings resulting. Reviewed Project CG-706 field work, which indicated the possibility of using existing ducts rather than installing new ones. Existing wiring is also available.

B. Hot Shop

Tool work for tube removal programs included repairing of 46 broaches, 107 splitters, three starters and 15 vanstone removers. Reamed 206 venturis. Repaired 24 leak testers. Reclaimed 200 stud bolts. Revised 120 aluminum slugs.

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G. Planning and Scheduling

Firm schedules have been formulated relative to the KE Reactor extended outage for thermohm replacement. A fiscal year approach to scheduling of painting has been completed for 100-B and F Areas.

H. Special Services

Projects active this month were: CG-666, CG-706, CG-707, CG-708, CG-817 and MJA-8. The most significant activity occurred around outage work for CG-666.

Acting Manager
H Reactor

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KE-KW REACTOR OPERATION
MONTHLY REPORT
MARCH, 1959

I. ORGANIZATION AND FUNCTIONS

There were no changes of assigned responsibilities during the month.

II. PERSONNELA. Force Summary

	<u>February 28</u>			<u>March 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</u>
							<u>Total</u>
General	3	2	5	3	2	5	0
KE Processing Oper.	16	41	57	16	42	58	+ 1
KW Processing Oper.	16	40	56	15	39	54	- 2
Power Oper.	13	72	85	13	72	85	0
Maintenance Oper.	23	123	146	23	123	146	0
Supp. Crews Oper.	9	56	65	10	57	67	+ 2
TOTALS	80	334	414	80	335	415	+ 1

B. Movement of People

C. W. Higby, Supervisor, 100 Operations, KW Processing Operation, was transferred to the Equipment Development Operation, FEO, effective March 1, 1959.

O. L. Olson, Specialist, Reactor Operations, DR Processing Operation, was transferred to Supplemental Crews Operation, KE-KW Reactor Operation, and assumed the duties of Supervisor, 100 Operations effective March 1, 1959.

G. W. Wells, Engineer, Power Operations, KE-KW Power Operation, was transferred to KW Processing Operation as Assignment Supervisor effective March 16, 1959.

E. A. Wegener, Supervisor, 100 Operations, KW Processing Operation, was transferred to KE-KW Power Operation as Engineer, Power Operations effective March 16, 1959

Changes for the month included 13 transfers in, and 12 transfers out.

III. PERSONNEL ACTIVITIES

R. Beddo, representing Builder's Providence, Incorporated, visited the plant relative to spare parts procurement.

M. Parr of the Foxboro Company consulted with Instrument Maintenance supervision regarding equipment maintenance. He was accompanied by E. W. Day, Jr. of Instrument Design Operation.

IV. SAFETY AND SECURITY

Nineteen medical treatment injuries were experienced for a frequency rate of 2.64.

The safety program developed by the K Plant Safety Council for emphasis during the month in carrying out the 1959 theme "As Ye Sow, So Shall Ye Reap", was related to safety rule knowledge. A check sheet was prepared for use in safety meetings to serve as a guide in reviewing safety rules.

No security violations were incurred.

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

Suggestion Plan statistics for the month were as follows:

Suggestions at start of month	-- 71
Received for evaluation	----- 14
Replies submitted	----- 32
On hand at end of month	----- 53

Two conferences were arranged between K Plant Suggestion evaluators and the IPD Suggestion Specialist, to expedite evaluation of specific suggestions in an attempt to reduce Suggestion Plan backlog.

A guide containing questions and answers on the various GE Benefit Plans was prepared and distributed to Supervisors for use in Round Table Meetings.

A summary of the results of the recent K Plant opinion survey was completed and issued to appropriate members of management.

B. Personnel Development Activities

An English film entitled "Criticality" was shown to five groups of plant personnel. Eighty-five people viewed the film, which describes various aspects of criticality as applied to nuclear research and industry.

A second series of "off hours" meetings to study the American competitive enterprise economy was begun. The series was scheduled to accommodate personnel from "C" and "Day" shifts. The material used was that prepared under the direction of the U. S. Chamber of Commerce to promote better understanding of the American economy.

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Thirty-three plant personnel attended an information meeting on the subject of critical concentrations of fissionable material with emphasis on nuclear reactor operation. J. E. Faulkner, Manager, Nuclear Physics Research Operation was guest speaker.

Attendance to IPD Training Courses was as follows:

Principles & Methods of Supervision & Leadership --- E. N. Miner
E. Weasner
J. K. Grady

Labor Management Relations --- G. E. Greger

C. Cost

A review of the proposed FY-60 Operating Expense Budget was made in conjunction with representatives of the Financial Operation. A pattern of Planned Maintenance expenditure distribution was developed.

Extended outage dates and associated schedules were supplied to the Plant Utilities Operation of FEO to facilitate planned electrical usage reductions during April.

D. Landlord

A work order was written to the Construction Operation to provide and install flashing and downspouts for 165 KE-KW Building ventilator extensions.

The approach to the 105-KE metal unloading ramp was enlarged to facilitate heavy truck handling.

A survey of combination lock filing cabinets located in 105 exclusion areas was completed to determine how many combination type locks could be replaced by key type ones. This is a possible cost saving program.

KE PROCESSING OPERATION

A. Production

Input production was 96.9 per cent of forecast. A maximum level, 35 units above the previous high, was achieved. During the latter part of the month, power level was limited by the rupture control point. Removal of one pump unit on March 26 in preparation for Project CG-775 prototype pump tests necessitated lowering of the rupture control point.

B. Operating Experience

1. Operating Continuity

Reactor outages totaled 159.6 hours for this month. Operating continuity was affected by the following events:

<u>Day</u>	<u>Hours</u>	<u>Remarks</u>
1	60.1	Reactor down at start of month due to slug failure in tube 2470.

<u>Day</u>	<u>Hours</u>	<u>Remarks</u>
3	0.8	Two panellit scrams during reactor start-up due to oscillating gages.
13	31.1	Scram caused by loss of instrument power to KER Loop 2.
24	36.4	Rupture in tube 3487.
26	0.7	Scram caused by Panellit 2686.
29	30.5	Scram caused by fuse failure in the instrument power supply to KER Loop Number 1.

2. Equipment Experience

- a. Instrument and Circuitry - A surge suppressor and a 10-90 psi range gage were installed on the panellit system for front to rear test hole 3865 to reduce the scram potential from fluctuating coolant water pressure.

All panellit gages and process water pressure switches were adjusted for five pump operation on March 25. Panellit gages with loose C. washers were replaced following the inboard inspection as recommended by Component Testing Operation.

The BDR-A and BDR-B relays were jumpered to prevent scrams from inadvertent operation of the relays. These relays are not required in the safety circuit.

- b. Process Water System - The V-73 cross-tie valve was tripped open during the March 29 outage due to the lowering of process water pressure without by-pass of the cross-tie VLP trips. A scram at KW Reactor resulted. The front crossheader screens on the A-B riser side became partially plugged with loose scale from the cross-tie line. All crossheader screens on the far side and seven on the near side were removed and cleaned, and the A and B risers were flushed.
- c. KER Facilities - Two scrams were initiated by the KER facility during the month and caused 61.6 hours outage time. Both scrams were caused by fuse failures in the instrument power supply to the loops.
- d. Gas Leaks - The oil cooler of drier Number 2 failed, allowing oil and water to mix. As a result, the oil seals were blown allowing gas to escape. The condition was corrected by removing the cooling unit and blanking the line. During the March 29 outage, the rupture disc in Number 1 drier was blown, causing considerable gas loss. Following a testing program and leak repair gas usage was reduced by month end.
- e. Ruptured Slugs - One slug failure occurred in March, a side failure in an I&E regular slug charged with a mixer dummy. All metal from this lot number was discharged.

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C. Improvement Experience

1. Production and Process Tests

- a. PT-IP-21-D - Effect of Pile Operation on Charge of Graphite - One sample of graphite was removed from test hole 2-B on March 2.
- b. PT-IP-198-A - Supplement A (105-550-E) Irradiation Of Dummy Fuel Elements in Tube 3043 KE - Material from tubes 2843, 2943, and 3043 was discharged on March 1 as required by the test.
- c. PT-IP-214-A - Irradiation of Enriched Zircaloy-2 Jacketed Seven Rod Cluster Elements - On March 17, rupture indications were noted on KER Loop 2 which contained this charge. The rupture was confirmed just prior to the March 24 shutdown, and the loop was discharged during the outage.
- d. PT-IP-226-A - Irradiation of Enriched Seven Rod Cluster Elements With 20 Mil and 30 Mil Zircaloy-2 Jackets - This PT was discharged from KER Loop 1 on March 29.
- e. PT-IP-229-A - Evaluation of the Uranium - Al-si Bond at High Temperatures - A fuel element failure was confirmed in the KER Loop 3 charge during the shutdown on March 24. The charge was removed from the loop.

D. Radiation Monitoring Experience

1. Radiation Occurrences

Three Lapses of Radiation Control occurred. These involved a film badge dropped into the storage basin, a tubular dummy with radiation levels over limits and a piece of irradiated thermocouple wire not properly shielded.

2. External Exposure Control

Average dose rates for the rear face work during outages were 100 to 150 mr/hr.

In 1706 KER, a maximum dose of 15.5 rads/hr at surface including 400 mr/hr at two inches, was measured on a chemical pump removed for repair. Average dose rate to personnel while taking pH samples from loop Number 3 was 600 mr/hr.

KW PROCESSING OPERATION

A. Production

Input production was 118.4 per cent of forecast. Maximum power levels were limited by the planned power increase program. Judicious use of poison splines for long-term reactivity gain control resulted in an extended operating period at maximum power levels. A new monthly production record for K Reactors was achieved.

B. Operating Experience

1. Operating Continuity

Reactor outages totaled 93.3 hours. Operating continuity was affected by the following events.

<u>Day</u>	<u>Hours</u>	<u>Remarks</u>
24	62.8	Scheduled outage for metal processing.
29	30.5	Panel trip due to opening of the V-73 emergency cross-tie valve at KE Reactor.

2. Operating Experience

- a. Vertical Safety Rods - The Number 22 rod failed to withdraw during the recovery attempt on March 29 due to a stuck check valve in the exhaust system. Repairs were completed. A defective latching solenoid on VSR Number 61 was replaced.
- b. Graphite Stringers - Replacement of RS-2 graphite stringer was attempted. However, it stuck firmly in the channel after six feet of movement. The work was postponed until stringer RS-7 can be replaced.
- c. Ruptured Slugs - A high pigtail radiation level indicated the possibility of a rupture in tube 1262. The indication was found during routine metal processing and the rupture suspect could not be segregated from the regular discharge.

C. Improvement Experience

1. Production and Process Tests

- a. PT-IP-128-CE, Supplement C, "Poison Spline Flexible Control System Tests at K Piles" - Eighteen splines were used during the extended operating period prior to the March 24 outage. Repetitive difficulties were encountered with the K type and the older reactor type spline choppers during removal work.
- b. PT-IP-183-A-98-FP, "Evaluation of Projection Fuel Elements for Use In K Process Tubes" - Ten bumper slug columns and ten KIII N Control Slug columns were charged into the reactor during the scheduled outage.
- c. PITA-IP-8-I, "Charging KIII Fuel Elements Into K Reactors" - A total of 645 KIII N and 70 KIII E metal columns were charged. An increase of approximately 2000 gpm of total reactor flow was experienced at start-up.

D. Radiation Experience

1. Radiation Occurrences

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HW-59840 DEL

Three Lapses of Radiation Control occurred. Two involved a contamination to clothing of personnel, and the other was a failure to follow specified procedures for timekeeping in radiation zones.

2. External Exposure Control

The dose rates in the discharge area were back to the level approximately 200 mr/hr that existed prior to the November, 1958 Turco internal decontamination.

3. Contamination Control

In two cases, contamination spread to the floor of the X-2 level occurred, with a maximum of 125 mrad/hr at surface. Contamination control and cleanup was effective in both cases.

KE-KW POWER OPERATION

A. Operating Experience

Peak control efforts were required for approximately 60 hours to control the electrical peak at 317 megawatts.

B. Equipment Experience

1. Air Cooler Leak - Number 3 Hi-Lift - 190-KE

Following reactor start-up on March 3, a water leak was observed on the flywheel air cooler of the Number 3 hi-lift pump. The cooling coil was changed out while the reactor was down for the discharge of temporary poison. The pump was returned to normal service at start-up.

2. Change to Five Pump Flow

The Number 6 pump at 181-KE was removed from service during the outage of March 25 for a Class "A" overhaul. The change to five pump operation was made in preparation for CG-775 prototype pump test.

C. Improvement Experience

1. Gravity Acid Feed System - 183-KE

Installation of the gravity acid feed system at the 183-KE building was completed during the March 2 outage. The system was placed in service and performed satisfactorily.

2. CG-663 - Steam Driven Auxiliaries - Fire-Eye System

Testing of the Fire-eye system on all boiler units in both powerhouses was completed. The equipment is in service.

3. CG-775 - K Water Plant Expansion

Modification of the Number 1 pump set at 190-KE was made possible with

the change from six pump to five pump usage. A summary of the work is listed:

- a. Removal and shipment of the low lift motor to Portland was completed on March 27.
- b. Dismantling and removal of the low lift pump was completed on March 31.
- c. Dismantling of the high lift unit was essentially complete by month end.
- d. Installation of the test piping was approximately 90 per cent complete.

D. Events Influencing Costs

1. Water Treatment

Activity at the Priest Rapids Dam site plus early run-off caused higher than normal raw water turbidities throughout the month. The additional chemicals required to produce quality water raised unit costs approximately 18 per cent over last month.

KE-KW MAINTENANCE OPERATION

A. Equipment Experience

1. Instruments

- a. Panellit System - Range changes were made on 7,702 gages, including those made during the change from six pump to five pump operation at 105-KE. Eleven faulty toggle valves were replaced in 105-KE and 36 panellit sensing lines were repaired. Seventeen resistance elements were replaced and nineteen elements were repaired. Power supply checks of the temperature monitor systems were made in both 105 buildings.

2. Electrical

- a. Horizontal Control Rods - New rectifiers and a "plug in" spare were installed in each 105 building.
- b. Cross-tie System - A low pressure alarm was installed on the V-73 air header tank in 105-KW. The alarm will indicate when the pressure is below 70 psi.
- c. High Lift Pumps - 190-KW - New double pigtail brushes were installed on the center and outboard slip rings of Number 5 motor. All other brushes were inspected. The 40 brushes installed are part of a test group of 100 brushes supplied by the vendor.

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HW-59840 DEL

3. Mechanical

- a. Cross Headers - All 105-KW front face valves were lubricated. Sixteen front face and all rear face valves were repacked.
- b. Process Tubes - Process tubes 2470 and 3487 were removed and replaced. Tube 3487 required smoothing of the gunbarrel before replacement could be made. More than normal pressures were required to insert the tube past the 103 inch position.
- c. Turco Flushing System - 105-KE - Installation of the piping was completed in preparation for the extended outage.
- d. Process Pumps - Number 1 high lift and low lift pumps in 190-KE were dismantled for prototype impeller installation relative to the water plant expansion program. Three-way valves were installed on the 181-KW pump cooling water drain lines to facilitate flow tests while pumps are in operation.

B. Engineering and Planning and Scheduling

1. Instrument Engineering

The Lewis Engineering Company subjected 439 detectors returned to them to vibration tests. All but two passed the tests and were returned to HAPO. With this shipment, sufficient detectors were made ready to complete the 105-KE replacement.

Design Change 201 - Temperature Monitor Power Supply Revisions - 105 KE-KW, addendum Number 1, was prepared and routed for approvals. The change was made to reduce interaction between the 24-volt regulated power supplies.

2. Electrical Engineering

A group of 180 grade T-869 brushes were received as routine replacement for T-948 brushes when changes are required.

An addendum was completed to Design Change 240, Inner-outer Ball 3X System, 105-KE-KW, and routed for approval. The addendum permits bypassing of the outer system manual pushbutton, installation of individual rectifiers on the Beckman, loss of voltage relays, and added a VSR position to the Seismoscope selector switch.

3. Mechanical Engineering

The Maintenance Job Authorization and Plant Forces Work Review on graphite stack restoration were initiated. Process Design Operation and Project Engineering Operation began arrangements for the drilling operation to be conducted during the 105-KE extended outage. Plans were made to monitor progress of stack restoration by rechecks of previously made traverses.

Design Change 274, equalizer line modification, 105-KE-KW was approved. The modification will prevent moisture laden gas from entering the reactor from a regenerating dryer.

4. Planning and Scheduling

Class "A" overhauls were completed on 135 items of equipment and class "B" overhauls on 184 items. The class "B" overhauls included two generators in 165-KE, two high lift pump motors in 190-KE, three generators in 165-KW and one high lift pump motor in 190-KW.

Class "A" overhauls were completed on 58 instruments and class "B" overhauls on 11 instruments of the 1706 buildings. .

SUPPLEMENTAL CREWS OPERATION

A. Improvement Experience

Supplemental Crews met with Industrial Engineering and Equipment Development personnel to incorporate Supplemental Crews experience into the equipment development planning. Activities were as follows:

1. A meeting was held with Industrial Engineering, Project Engineering, and DR Processing Operation personnel to discuss feasibility and justification for a rear cross-under line for "full line" discharge set ups. The change would apply to all older type reactors.
2. A meeting was held on long-range planning for K Plant charge-discharge equipment and charge seaters on order.
3. Accompanied by the Safety Engineer, an inspection was made of 105-KE heavy duty metal hoist and conveyor system.

R. S. Bell
Manager
KE-KW REACTOR OPERATION

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HW-59840

PRODUCTION OPERATION

MARCH, 1959

I. ORGANIZATION AND FUNCTIONS

No change.

II. PERSONNEL

A. Force Report

	<u>February 28</u>			<u>March 31</u>			<u>Net</u>
	<u>Ex.</u>	<u>N.E.</u>	<u>Total</u>	<u>Ex.</u>	<u>N.E.</u>	<u>Total</u>	<u>Change</u>
General	2	1	3	2	1	3	0
Prod'n Reports & Statistics	1	2	3	1	2	3	0
Prod'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

T. Prudich completed a training course in "Understanding Human Behavior".

IV. SAFETY AND SECURITY

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

V. NON-ROUTINE REPORTS

<u>Doc. No.</u>	<u>Title</u>	<u>Author</u>	<u>Date</u>	<u>Classification</u>
HW-59551	Fuel Element Geometry - K Reactors	R. W. Bown	3-5-59	Confidential - Undocumented

The above document is the record of a meeting at which it was decided to use KIIIN, KIIIE, KIIN, and CIIE fuel elements at the K Reactors. Also includes discussion of the timing and procurement of canning components for the above.

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

A. Production Forecasting, Scheduling and Analysis

1. Production Scheduling

a. Discharge Concentrations

Although rupture experience in enriched I & E slugs at the old reactors has been limited, enough failures have occurred to indicate the necessity of a goal reduction. A R & EO interim recommendation to make a 100 MWD/ton reduction was received (HW-59459) and is being effected. The recommendation is being implemented by taking a major portion of the 100 MWD/ton cut on the subsequent outage at each reactor with final adjustments to be made in April. For ease of application, this goal is being administered through an adjustment to the slope of the former variable goal line. The new goal is described by the equation:

$$G = I - MF$$

Where I = 1900 (variable goal intercept)

M = 1050 (variable goal slope)

F = tube factor (relative tube power)

No other goal changes were initiated during March. Goal reductions during April are anticipated for regular and enriched slugs at C Reactor where some trading of exposure for tube power is expected. Also, it is likely that some reduction in the goal for "O" size I & E regular slugs will be initiated in April as a result of the recent accumulation of more rupture experience.

Small metal losses were incurred due to discharge of some material significantly below goal as shown in the table below.

BELOW GOAL DISCHARGING - MARCH, 1959

<u>Reactor</u>	<u>Tons Disch.</u>	<u>Tons Excess Usage</u>	<u>Mat'l. Type</u>	<u>Reason</u>
B	1.3	0.5	Regular	Material discharged from vicinity of tube 3675-B (poison flushed out after nozzle was broken) as a precautionary measure following a known local power excursion.
C	1.1	0.3	Regular	Solid slugs discharged from flow zone 2 for rupture considerations. This zone is being converted to the use of I & E slugs.
D	1.7	0.7	Regular	Process tube replacement.

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BELOW GOAL DISCHARGING - MARCH, 1959 (Cont'd.)

<u>Reactor</u>	<u>Tons Disch.</u>	<u>Tons Excess Usage</u>	<u>Mat'l. Type</u>	<u>Reason</u>
D	0.6	0.1	Enriched	Adjustment of enriched loading pattern.
KE	3.2	1.0	Regular	Rupture prone lots CK029D, CK072D, and SK007D plus eleven tubes having mixer slugs in an off-standard position.
KW	2.8	0.5	Regular	Rupture prone lot SK032D.
	10.1	3.0	Totals for Regular Uranium	
	0.6	0.1	Totals for Enriched Uranium	

COMPARISON OF MARCH DISCHARGE EXPOSURES (MWD/TON)

<u>Month</u>	<u>Regular U</u>		<u>Enriched U</u>	
	<u>Solid</u>	<u>I & E</u>	<u>Solid</u>	<u>I & E</u>
January	670	713	840	713
February	706	782	1176*	755
March	704	747	914	717

* Less than one ton discharged.

b. Process Tube Replacement

Tube replacement outages were taken at D and F Reactors resulting in replacement of 31 and 47 tubes, respectively. Tube replacement incidental to other work resulted in replacement of two additional tubes at F Reactor and three tubes at C Reactor.

2. Operations Analysis

Material for the Five-Year Program Document, HW-59633 RD, was accumulated, assembled in order and sent out to selected individuals for review, correction and comment. Final draft will be completed during April.

Process tube replacement schedules were completed in rough draft form. These were being reviewed at month-end prior to issuance.

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

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

An IBM machine was installed in the Production Computing offices in order to transmit reactor data by direct wire to the Data Processing Operation offices in the 700 Area. The addition of this equipment, called a Transceiver, is intended to bring closer coordination between the two computing components.

This month a study of the existing functions of the Production Computing Operation was started for the purpose of determining the extent these functions can be performed on the 709 EDM.

Data processing work was completed on a five year tube replacement forecast being directed by the Specialist, Operations Analysis.

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.

2. Monthly Reporting

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

The February 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 February.

3. Special Reporting

Data for CY 1958 titled "Operating Experience - Reactors and Critical Facilities", was given to the AEC-HOO. These data included, by reactor, the number and causes of reactor scrams, time operated efficiency, number of start-ups and number of personnel working in reactor buildings.

4. Production Statistics

Significant production statistics work performed during March included the following:

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HW-59840 DEL

- 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.) Project Engineering Operation was given a detailed breakdown of KE and KW outages for January and February.
- 7.) Employee Relations Operation was given data showing the worst periods of reactor operation from January 1, 1957 to date.
- 8.) Process Technology Operation was given the number of reactor outages, excluding scrams from which recovery was successful, and percent of time required for charge-discharge and rupture removal by reactor during CY 1958.
- 9.) Construction Engineering Operation was given time operated efficiency by reactor by quarter for 1954 through 1958.

D. Essential Materials

Rail and truck shipments received in March were as follows:

Carload shipments for IPD	174
Carload shipments for other Depts.	284
Truck shipments for IPD	<u>111</u>
Total shipments received	569

Helium consumption during the month of March for all reactors was as follows:

100-B	256,340 cu. ft.
100-C	277,050 " "
100-D	273,487 " "
100-DR	220,348 " "
100-F	284,319 " "
100-H	140,671 " "
100-KE	816,065 " "
100-KW	<u>270,055 " "</u>
Total	2,538,335 cu. ft.

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 March:

1. Dry aluminum sulphate shipments were stepped up during the month to cover the increase in consumption resulting from the high turbidity in the Columbia River water treated. The amount of this material used in March was nearly double the amount used during the same month in 1958.
2. Arrangements were made with the Stauffer Chemical Co. to lease five covered hopper cars under a trip lease agreement. The cars will be used for transporting aluminum sulphate from Stauffer's Plant to Hanford for the balance of the spring run-off season. These cars may be held on the plant for ten days after arrival without incurring demurrage penalties.

E. Miscellaneous Activities

Central assistance with administration (test design and grading methods) of the formalized Pile Operator selection procedure continued to be given the Employee Relations Operation and the Reactor Operations.

Security classification matters continued to be handled for the department. New guidance from the AEC-HOO and from HLO was given appropriate distribution within IPD. Special consideration was accorded: (1) Permissible publication of production-related plant performance information in unclassified employee newsletters; (2) the classification required for photographs showing only gas piping, but taken within Bldg. 115-D; and (3) the classification of maintenance manual material relating to special reactor tools.

Meetings were held on March 24 and 25 with AEC-HOO representatives and the following four visitors associated with the N. S. Savannah Project: W. A. Hepburn and M. J. Gross of the Maritime Administration (and the Maritime Reactors Branch, AEC), and O. W. Durant and G. K. Wicks of Babcock and Wilcox. The proposed Hanford (IPD) assistance with the training of the ship's personnel (and certain associated people) was discussed, with agreement that General Electric (HAPO) would study the proposal and return comments through the AEC-HOO. The program would involve three groups of 8-15 men each, coming for 8-week periods beginning about May 15.

Assistance was given the B Processing Operation in connection with the formal reporting of an operational interruption which occurred at B Reactor on February 26.

Further work was done on the up-dating and supplementing of IPD's production-related OPG's and Advices. Needs for new issues indicated by the Power and Maintenance Operations were given special consideration.

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[Signature]
Manager
Production Operation

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REACTOR OPERATIONS STATISTICS - PROCESSING

REACTOR OPERATIONS STATISTICS - PROCESSING														
MONTH March, 1959														
	B		C		D	DR		F		H	KE	KW	TOTAL	
INPUT PROD.-Pu (S OF FORECAST)	119.4		107.5		101.9	122.4		88.3		138.5	96.9	118.4	110.9	
TIME OPER. EFF. (S OVERALL)	86.3		74.3		78.7	82.9		65.4		100.0	78.5	87.5	81.7	
NO. OF REACTOR OUTAGES & HOURS	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.
SCHEDULED	0	67.1	1	112.1	0	131.9	0	95.1	0	118.9	0	79.6	1	60.5
UNREACTOR - SCRAMS	4	10.3	0	0	4	7.1	3	9.1	0	0	5	49.3	1	30.5
- OTHER	3	24.8	2	79.4	1	19.5	1	22.8	2	138.4	0	1	30.7	0
TOTAL	7	102.2	3	191.5	5	158.5	4	127.0	2	257.3	0	6	159.6	2
BREAKDOWN OF REACTOR OTGE HRS.														
PLANNED														
CHARGE-DISCHARGE	23.0		30.1		53.7		31.4		41.5		0		63.3	
TUBE REPLACEMENT	8.0		0		30.2		0		65.1		0		0	
PROJECT WORK	0		0		35.3		21.8		2.3		0		0	
PRODUCTION TEST	0		7.8		2.7		5.9		0		0		4.5	
MAINTENANCE	36.1		74.2		10.0		36.0		10.0		0		9.1	
MISCELLANEOUS	0		0		0		0		0		0		2.7	
SUB - TOTAL	67.1		112.1		131.9		95.1		118.9		0		79.6	
UNPLANNED														
CHARGE - DISCHARGE	5.6		0		(2) 14.3		0		9.0		0		0	
PRODUCTION TEST	0		8.8		0		0		0		0		(6) 54.0	
RUPTURE REMOVAL	5.9		0		2.0		(3) 22.8		0		0		(5) 18.6	
WATER LEAK	2.0		62.3		0		0		91.4		0		0	
MAINTENANCE	(1) 11.3		8.3		3.5		0		(4) 38.0		0		4.1	
INSTRUMENTATION	0		0		5.7		8.3		0		0		0	
PANELLIT	10.3		0		1.1		0.8		0		0		1.5	
MISCELLANEOUS	0		0		0		0		0		0		0	
SUB - TOTAL	35.1		79.4		26.6		31.9		138.4		0		(7) 30.5	
TOTAL	102.2		191.5		158.5		127.0		257.3		0		80.0	
NO. SLUG RUPT. (ALL TYPES)	1		0		1		2		0		0		1	
NO. NEW TUBES INSTALLED	0		3		31		0		49		0		2	
TYPE OF WATER LEAK - TUBE	0		2		0		0		5		0		0	
VAN STONE	0		2		0		0		2		0		0	

(1) Includes 8.3 hrs. for removal of stuck PCCF machine from ball valve tube.

(2) Includes 4.8 hrs. for spline work.

(3) Includes 12.8 hrs. for work on a previous rupture problem tube.

(4) Includes 24.7 hrs. for removal of VSR tip.

(5) Includes 10.7 hrs. for removal of February rupture.

(6) Includes 47.8 hrs. for trip caused by blown fuse in the KER instrument supply circuit and 6.2 hrs. for removal of ruptures from KER Loops #2 and #3.

(7) Panellit trip caused by V73 crosstie valve opening when improper bypassing procedure was used at KE.

MON
March, 1959

REACTOR OPERATION STATISTICS – SLUG RUPTURES

HW-59840

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BM-5000-051 (12-58) ARC-95 RICHLAND WASH

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MONTH March 1959		REACTOR OPERATIONS STATISTICS -- POWER									SHEET 1	
		100-B	100-C	100-D	100-DR	100-F	100-H	100-KE	100-KW	TOTAL		
RIVER WATER (BLDG. 181)												
TO RESERVOIR (BLDG. 182)	GPM AVG.	4822		15655		2650	2884			26011		
TO FILTER PLANT (BLDG. 183)	GPM AVG.	67680		81296		63460	85700	144100	164100	606336		
TO FILTER PLANT (C&DR)	GPM AVG.	96730		60954						157684		
TO R & E (KER) & FEO	GPM AVG.			203				532		735		
TOTAL	GPM AVG.	169232		158108		66110	88584	144632	164100	790766		
TOTAL	M GAL.	7554.5		7057.9		2951.2	3954.4	6456.4	7325.4	35299.8		
RESERVOIR WATER (BLDG. 182)												
TO POWER HOUSE (BLDG. 184)	GPM AVG.	30		72		44	34			180		
TO COND. SYSTEM (BLDG. 190)	GPM AVG.	3000		1585		2604	2850			10039		
TO COND. SYSTEM (190DR & 183F)	GPM AVG.			2700		2				2702		
TO EXPORT SYSTEM	GPM AVG.	1792		11298						13090		
TOTAL	M GAL.	215.2		698.8		118.4	128.7			1161.1		
FILTER WATER (BLDG. 183)												
TO POWER HOUSE (BLDG. 184)	GPM AVG.	167		181		109	128'			585		
TO PROCESS (BLDG. 190)	GPM AVG.	72645	80577	66535	67581	60123	80500	139271	159581	726813		
TO 108	GPM AVG.	2500	4000	2038		1144	1290			10972		
TO 108DR	GPM AVG.			2039						2039		
TO FILTER PLANT (BLDG. 183DR)	GPM AVG.		(9691)	(7755)						(17446)		
TO F & S SYSTEM	GPM AVG.	104		308		134	117	6	50	713		
TO R & E (KER) & FEO	GPM AVG.			153						159		
BACKWASH	GPM AVG.	1955	2462	2287	1128	1950	3665	4823	4469	22739		
TOTAL	M GAL.	3453.8	3885.4	3282.9	3067.2	2832.9	3825.6	6432.6	7325.4	34105.8		
PROCESS WATER (BLDG. 190)												
TO REACTOR	GPM AVG.	72245	80177	66135	67181	59723	80000	138300	154800	718561		
TO REACTOR	GPM NOR.	79700	95600	80000	80000	80800	80000	168500	171200	835800		
POWER HOUSE (K AREA)	GPM AVG.							33	13	46		
108 (KE - KW)	GPM AVG.							422	4368	4790		
TO R & E (KER)	GPM AVG.							116		116		
BUILDING USAGE	GPM AVG.	400	400	400	400	400	500	400	400	3300		
TOTAL	M GAL.	3242.9	3597.0	2970.1	3016.8	2683.9	3593.5	6217.1	7123.7	32444.9		
RIVER DATA												
ELEVATION (MSL. FT.)	(MAX.)	390.9		382.3		369.5	374.5		385.1			
	(MIN.)	390.0		378.1		367.9	373.6		384.0			
	(AVG.)	390.5		381.2		368.4	374.1		384.7			
TEMPERATURE	AVG. °F	40.7		41.0		42.8	41.4		39.9			

MONTH March 1959		REACTOR OPERATIONS STATISTICS -- POWER										SHEET 2
<u>WATER TREATMENT DATA</u>		100-B	100-C	100-D	100-DR	100-F	100-H	100-KZ	100-KW	TOTAL		
MM GALS				203.5		119.2					322.7	
MM GALS		3021.2	4318.0	3629.1	2720.9	2832.9	3825.6	6432.6	7325.4		34105.8	
<u>CHEMICAL CONSUMPTION</u>												
LBS.												
LBS		15810	20916	18590	9430	14869	16800	31700	42000		170115	
AVG PPM		.6	.6	.6	.4	.6	.5	.6	.7		.6	
Bauxite lbs.		34315									34315	
		--									--	
ALUM		169489	299502	324740	207550	265405	248450	476900	510100		2502136	
LBS		6.7	8.3	10.7	9.2	11.2	7.8	8.9	8.4		8.8	
AVG PPM												
SEPARAN		550	275	664	458	950	550	1100	1300		5847	
LBS		.022	.008	.022	.020	.040	.017	.021	.021		.021	
AVG PPM												
SULPHURIC ACID		219681	290282	152716	190042	156200	218780	401200	392200		2021101	
LBS		8.7	8.1	5.1	8.4	6.6	6.9	7.5	6.4		7.1	
(A8 100%)												
AVG PPM												
DICHROMATE		48200	53600	44550	45250	39588	52830	87700	98100		469818	
LBS												
<u>PURGE MATERIAL CONSUMPTION</u>												
SOLIDS			650								650	
LBS												

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FACILITIES ENGINEERING OPERATION
MONTHLY RECORD REPORT

MARCH, 1959

I. ORGANIZATION AND PERSONNEL

A. Responsibility

There were no changes of assigned responsibilities during the month.

B. Personnel Statistics

	<u>February 28,</u> <u>1959</u>	<u>March 31,</u> <u>1959</u>	<u>Net</u> <u>Change</u>
Employees on Permanent Payroll	212	216	+4
Technical Graduates (Rotational)	1	0	-1
Technical Trainees	2	2	0

	<u>FEO</u>	<u>Technical Graduates</u> <u>(Rotational)</u>
Transferred into Operation	6	0
Transferred Out of Operation	1	1
Payroll Removals	1	0

C. Personnel Changes

C. W. Higby, Engineer, transferred from Research and Engineering to Equipment Development on March 1, 1959.

W. D. Bainard, Engineer, transferred from Research and Engineering to Process Design on March 1, 1959.

H. J. McAlister, Steno-typist, was placed on the rolls with Plant and Industrial Engineering on March 30, 1959.

Carol Lynne Schuster, Steno-typist, terminated on March 13, 1959.

R. W. Hutchinson and M. C. Buckley, Design Draftsmen, were placed on the rolls with Plant and Industrial Engineering on March 9, 1959.

J. H. Welch, Design Draftsman, transferred from the Large Steam Turbine Department to Plant and Industrial Engineering on February 21, 1959.

J. C. Major, Engineer, transferred to Vallecitos effective March 31, 1959.

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HW-59840

D. Personnel Development

<u>Title of Course</u>	<u>Personnel Attending</u>
Reactor Processing Fundamentals	12
Radiation Protection Program	6
Principles and Methods of Supervision	1
Labor Management Relations	1
Secretarial Proficiency	3
Understanding Human Behavior	4
Process Orientation	4

E. Safety and Security Experience

No medical treatment injuries were reported.

One security violation was 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>
E. C. Arbuckle	A pneumatic tool to assist in the manual lifting, transfer and positioning of uranium fuel elements
B. C. Benedictson	
H. A. Kramer	Control of vapor "steaming" from the surface of a body of water at elevated temperatures in a temperature zone from ambient to near boiling point

III. ACHIEVEMENT

A. Process Design

1. Research and Development

a. Category I - Existing Reactor Support

Preliminary design study has been initiated on the plant modifications recommended by the task force which reviewed the K Area emergency back-up system. Specific items include an additional high pressure process water cross-tie line, installation of a steam driven back-up water pump in each area with a steam cross-tie line between areas, and installation of a 4160 volt emergency electrical cross-tie. Pump and turbine vendors have been contacted to determine the type of equipment most suitable for installation in the space available. A system hydraulic characteristic curve has been calculated to establish pump head requirements and an estimate is being made of uninterrupted service water flows so that total additional water flow requirements can be established. These pre-scope design studies will permit formal design to proceed without delay when project action has been authorized.

Support of the downcomer model test program was shifted from plant assistance to research and development funds during the month as work progressed to more general studies of downcomer design technology.

b. Category II - New Reactor Studies

Final equipment installation was made on the high pressure process tube rupture test facility while procurement of the machined graphite was being completed. Loop modifications were made to permit calculation of critical flow conditions from a simulated primary cooling system pipe rupture. Pressure testing of the complete loop was performed late in the month. The design test request has been issued for approval and fabrication has been initiated on the simulated seven-element cluster fuel element which will be used in the initial tests since it represents the worst case hydraulically.

Very brief review was made of the Prototype Enriched Gas Cooled Power Reactor design being prepared by ACF. Although some comments were offered, this did not constitute a complete appraisal of the design nor does failure to comment indicate Process Design concurrence on any particular design feature.

2. Design Projects

a. CG-704 - 100-K Outfall Study

Following review and acceptance within IPD, the final report on this program was formally issued and steps were taken to

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HW-59840

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close out the project.

b. CG-775 - 100-K Area Water Plant Modifications

Installation of piping for the planned test of a prototype modified K process pump set has been completed. Work on modification of the high lift pump and installation of the new low lift pump in 190-KB was initiated. The production test was approved and issued. A visit was made to the low lift pump vendor's plant to witness a performance test. Results indicated that specifications have been met and that the pump will be satisfactory for operational use.

Revisions are being made to the scope of this project to conform with the conclusions of the task force which reviewed the K Area emergency back-up system. As a result, the estimated project cost has increased 25 percent to cover additional raw water supply and electrical power supply facilities required.

c. CG-791 - Reactor Confinement

Over-all design is estimated to be 64 percent complete at month's end, proportioned as 92, 64, and 41 percent for Phases I, II, and III, respectively. Twenty-eight Phase I detail drawings were issued as Design Approved during the month with a balance of fourteen drawings for this phase scheduled for approval by the April 15 deadline, set by the reactor outage schedule. In addition, the Phase I Construction Specification and Acceptance Test Procedures were issued for comment during the month.

Uranium oxidation tests being conducted at ORNL and HAPO in support of this project were limited to cold and trace irradiation sample runs this month.

On the halogen collector test program, four candidate testing agencies were visited to discuss the proposed evaluation work and to appraise their staff and facilities. A. D. Little, Incorporated, of Cambridge, Massachusetts, was selected as the best qualified to conduct this program and contract negotiations have been initiated.

On the building sealing evaluation study, flexure test results on pre-cast concrete roof tile were received from Oregon State College, the testing agency for this work. Results are being incorporated in the final study report.

d. CA-816 - New Production Reactor

Six reactor plant design criteria were issued for comment, bringing the total to fourteen out of forty scheduled for the complete scope package. Two of these criteria were approved by the Reactor Plant Project Representatives during the month and three by the NPR Design Council. Two were approved by the Atomic Energy Commission and issued in final form. As of month's end, over-all design completion was estimated to be 10.4 percent, compared to 7.5 percent scheduled.

On the heat dissipation system design, eight criteria were issued for comment during the month, bringing the total to nine out of sixteen scheduled for the complete scope package. Scope drawings of the Emergency Power House, previously approved by the Project Representatives, were approved by the NPR Design Council and the AEC. Scope drawings and design criteria for the Administration Building were approved by the NPR Design Council. Over-all design progress at the end of March was estimated to be seven percent, compared to 12 percent originally scheduled.

The most significant design decision made during the month was in regard to primary loop material. It was concluded that loop piping should be carbon steel except for the main heat exchangers, pumps, and associated piping which can be isolated from the remainder of the primary cooling system.

In addition, final decision was reached with the architect-engineer in regard to primary pump drive horse-power requirements which permitted preparation of pump, pump drive, and heat exchanger specifications to proceed. A draft of the heat exchanger specifications was issued for comment during the month.

In regard to design progress, original scheduling assumed considerable overlap on the timing of scope and detail design to shorten the over-all schedule and to avoid peaks in engineering man-power requirements. Such integration is difficult to attain with the architect-engineer since the contract under which the work is being done calls for Title II design to be performed in accordance with approved scope. Quite understandably, then, the architect-engineer is reluctant to initiate detail design work until scope approval has been obtained unless specifically directed to do so. Steps were initiated during the month to provide the necessary authorization of the desired integration of scope and detail design schedules.

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Although no contractual considerations are involved, a parallel situation has developed on the reactor plant design work. Specifically, there has been a reluctance noted in the initiation of reactor building detailed design until scope approval has been obtained on all items affecting the building design. There are indications at month's end that an extension in the original schedule for completion of the initial construction package which is to include all work up to the 0' 0" level will be requested. Discussions have been held with responsible CEO personnel and further steps are planned to correct this condition.

A preliminary issue of the 105-N Acceptance Test Procedure Schedule has been distributed for comment and to assist in design planning.

Initial experimental data on the stress conditions in deflected process tubes verifies the results of stress analysis computations made previously.

A program has been initiated for preparation of information on the confinement system design for ultimate presentation to the ACRS. A target date of June 1, 1959 has been selected for completion of data compilation.

3. Visitors

R. E. Lindenmeyer of Great Lakes Carbon, visited Reactor Plant Design to discuss the Process Tube Rupture Test graphite order.

K. A. Trichett, Chief Mechanical Engineer, and J. F. Neely, Supervisor, Core Design, for ACF, and F. Hunton, Project Engineer for Kaiser Engineers on the gas-cooled reactor project, discussed their proposed design for the Prototype Enriched Gas Cooled Power Reactor with members of Process Design.

J. L. Barnes of Transdynamic visited Reactor Plant Design to discuss applicability of the Teleflex valve drive mechanism to the NPR design.

Dr. R. L. Plunkett and D. J. H. Meier of the General Engineering Laboratory visited Reactor Modification Design to review the various process water systems and to discuss other reactor component problems of interest to GEL.

L. G. Gitzendammer of General Engineering Laboratory also visited Reactor Modification Design to discuss reactor mechanical systems and components.

R. B. Richards and V. D. Nixon of Atomic Power Equipment Department visited Process Design to discuss development problems and areas of potential APED assistance.

4. Trips

C. A. Pursel visited AEC offices in Chicago as well as ANP in Cincinnati to discuss items of mutual interest. He also visited Futurecraft, Los Angeles, to discuss a gas-operated, rupture disc valve design of potential application to critical flow testing.

D. L. Condotta and R. A. Rohrbacher visited Burns and Roe, New York City; GEL, Schenectady; and Canadian GE in Peterborough, Ontario, to discuss reactor coolant system control problems and analytical procedures.

M. H. Russ visited Combustion Engineering, Chattanooga, Tennessee, and Burns and Roe, New York City, in connection with NPR design work.

E. M. Kratz and H. R. Kosmata met with Burns and Roe personnel in New York during the month to reach agreement on primary loop pump drive power requirements and to discuss heat exchanger arrangement and capacity.

H. S. Davis visited Vancouver, B.C. to witness trial runs of the Guniting method of placing magnetite concrete.

N. E. Bennewitz visited the computing center at Washington State College to check the piping stress program and Hanford control panel for application to their IBM-650 computer.

E. L. Etheridge and R. C. Walker visited Mine Safety Appliance Research Corporation, Callery, Pa.; Air Products, Incorporated, Allentown, Pa.; Nuclear Science and Engineering Corporation, Pittsburgh, Pa.; A. D. Little, Incorporated, Cambridge, Mass.; and Harvard School of Public Health, Cambridge, Mass., to discuss our proposed halogen collector test program.

M. H. Schack and D. F. Watson visited Washington State College to discuss the downcomer model test program.

N. F. Fifer visited Washington State College to review progress on the 181-K model test program.

H. W. Heacock visited Byron Jackson Company, Los Angeles, to witness CG-775 low lift pump performance tests and to discuss other Hanford pump problems.

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HW-59840 DEL

5. Significant Reports Issued

- HW-55529 RD - "Design Test Request Environmental Component Testing," E. L. Etheridge, March 4, 1959.
- HW-57041 RD - "100-N Design Bases - Part V - Functional Requirements of the Plant Auxiliary Control and Instrumentation Systems," D. L. Condotta, March 10, 1959.
- HW-57014 RD4 - "Ball Safety Systems," J. F. Nesbitt, March 20, 1959.
- HW-57043 - "100-N Design Bases - Part I - General," E. R. Astley and G. L. Locke, March 17, 1959.
- HW-57045 RD4 - "100-N Design Bases - Part II - Functional Requirements of the Confinement System," C. A. Pursel, March 16, 1959.
- HW-57046 RD - "100-N Design Bases - Part IV - Functional Requirements of the Nuclear Control and Safety Systems," March 26, 1959.
- HW-57960 RD - "Project Representatives Meeting Minutes No. 13, March 4, 1959.
- HW-57961 RD - "Project Representatives Meeting Minutes No. 14, March 9, 1959.
- HW-58899 - "CG-704 - 100-K Outfall Study - Final Report," D. F. Watson, January 31, 1959.
- HW-59522 - "Performance Test of CG-558 - 190 Building Pump With Replacement Rotating Assembly," N. F. Fifer and M. H. Schack, March 4, 1959.
- HW-59670 - "Second Performance Test of CG-558 - 190 Building Pump With Replacement Rotating Assembly," N. F. Fifer and M. H. Schack, March 16, 1959.
- HW-59672 - "Production Test IP-234-AE, Project CG-775 - Prototype Testing of the 190-K Process Pumping Units," M. H. Schack and S. S. Jones, March 17, 1959.
- HW-59673 - "Performance Test of CG-558, 190 Building Pump With Byron Jackson First Stage Impeller," N. F. Fifer and M. H. Schack, March 17, 1959.
- HW-59689 - "Reactor Auxiliary Water Requirements," G. E. Wade, March 17, 1959.

- HW-59690 RD - "Design Test Request - Process Tube Rupture Test," D. Marinos, March 22, 1959.
 - HW-59696 - "K Water Plant Improvements," R. E. Trumble, et al., March 19, 1959.
 - HW-59710 - "Design Test Request No. DT-1044, Evaluation of Ceramic Sleeves for K HCR's," ER Rudock, March 20, 1959.
 - HW-59715 - "Trip Report - Visit to Candidate Halogen Collector Test Program Contractors," E. L. Etheridge and R. C. Walker, March 20, 1959.
 - HW-59716 - "Design Test No. 1039 - Graphite Stack Pushing Test," E. R. Rudock, March 20, 1959.
 - HW-59757 - "Trip Report - Removal of Radio-Iodine at ANP, Arco," E. L. Etheridge and W. C. Schmidt, March 24, 1959.
 - HW-59777 - "Final Design of UO₂ Temperature Experiment," F. J. Mollerus, Jr., March 27, 1959.
- "K Water Plant Study by K Water Plant Study Group," March 4, 1959.

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HW-59840

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B. Equipment Development

Installation of the Prototype Concept Evaluation Loop in 189-D Building for the New Production Reactor is more than 95% complete and flushing and pressure testing are under way. Remaining construction work includes completion of insulation, check out of electrical circuits, and instrument calibration. A modification to the loop has been scoped, designed, and fabrication started which will permit bending of joints while they are being thermal-cycled; similar bending moments will be encountered in the New Production Reactor; since these bending-cycling tests may reveal defective joints such testing will be performed in a blast box.

Laboratory tests have been performed and data delivered to Process Design on (a) stresses in riser-to-nozzle connectors when deflected in a cold flow condition, (b) stresses in a zirconium process tube when deflected to simulate graphite contraction of 5 and 15 years with the process tube both empty and with simulated element loadings, and (c) critical flows for butterfly valves in riser-to-nozzle connectors with the valves operated from 20% open to wide open. Testing continued in attempts to overcome jerking motions in the mechanism of the prototype horizontal control rod drive when the rod is operated at very low speed. Slug dropping tests were resumed in the mockups on the roof on the 190-D Building and in the test tank in the 189-D Building. A first model of a diversion valve for the New Production Reactor froze after being cycled empty several times in a 600°F furnace.

In joint development for the New Production Reactor: (a) a sample of a rolled zirconium joint, received from the Canadian General Electric Company, Ltd., has been thermal-cycled successfully more than 1800 times from 275 to 525°F at 1325 psi, (b) a sample of a 37° flared zirconium joint, with serrations on the mating flange to concentrate forces, developed a leak after thermal-cycling more than 2500 times from 200-325 to 475-580°F at 1340-1900 psi, (c) a sample of a metallic bell-ring closure completed more than 1600 hours without leaking in a steady-state condition of 525°F and 1340 psi and 580°F and 1900 psi, (d) a sample of a spiral-wound gasket closure leaked after 1500 hours at steady conditions of 1900 psi and 580°F, and (e) a test section of two butt-welded and one flash-welded zirconium joints (annealed) reached 7500 psi and 350°C before swelling and leaking occurred, in a rupture test; a blank sample of 40% cold-worked zirconium tubing reached 10,800 psi at 343°C before failing at the heat-affected zone of one end cap-closure.

In Instrument Development, recent test results on Barton and other Delta P pressure-to-motion cells show that the hydraulic pulser facility provides an accelerated test for bellows and other mechanical components. It has shown transducers which were prone to zero drift as well as mechanically weak designs and construction. The Barton Delta P transducers have withstood the cycling better than any other transducer tested and are considered the most acceptable to date.

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Installation drawings for the "stop-gap" power-rate-of-rise instrumentation for Project CGI-806 were completed, approved, and released for construction. All materials for the "stop-gap" instrumentation have been ordered and 60% has been received. Fabrication of electronic cabinets in the Technical Shops is 2% complete. The goal for use of the first "stop-gap" power-rate-of-rise meter on a reactor is August 1959.

A development contract between Battelle Memorial Institute and Hanford was approved whereby Battelle will develop a thermally-compensated, thermal neutron sensing system for in-core flux monitoring.

Prototypes of a new slip-joint-type rear-face pigtail have been fabricated and tested. This new design features O-rings on the U-shaped aluminum tubing for ready replacement of O-rings and use of a cast bronze wye-type crossheader-adaptor for cheapness and to cover present and future needs for a pigtail entry, a thermocouple, and a resistance temperature detector or water sample line. A development test was processed to install 1000 of these units during tube replacement at B, D, DR, and F Reactors in the next year. A second prototype of a pigtail adaptor for use at K Area was fabricated and tested which contains two openings for resistance temperature detectors, one for the normal temperature monitoring system and one for "stop-gap" power-rate-of-rise instrumentation.

Following the successful discharging and recharging while operating and without any scrams of 50 uranium columns at C Reactor, minor revisions have been made to the system preparatory to the training of C Reactor personnel in its use and transfer of the equipment to C Reactor. Circuit changes were made to automatically close a rear-face ball valve upon completion of discharging and to automatically reposition the auxiliary flow addition valve to the charging machine. The transmission of the charging machine was repaired and tested and the piping of the auxiliary water system was changed from temporary to permanent.

Thirteen tubes of B Reactor were flushed with Turco-4306-B on February 27, 1959. Decontamination of six tubes was accomplished in 30 minutes at 5 ounces of Turco-4306-B per gallon, 3.5 gallons per minute, and 30°C compared to a previous standard of 20 minutes, 5 ounces of Turco-4306-B per gallon, 5 gallons per minute and 50°C. These tests are directed at determining the effects of Turco-4306-B on corrosion of weighted fuel elements.

In poison spline development, a sample was received and ten splines were ordered of a solid-sintered-boron-carbide-alumina. If successful, such a spline would eliminate the present swelling problem with boron-carbide-filled, flattened aluminum tubing. Metallurgical Products Department reports that it has reduced its sample of 430-boron stainless-steel (an alternate spline candidate) to strips and should cold-form splines in rolls in April 1959.

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HW-59840

Visitors

Mr. D. L. Snellman of Norfin, Inc., Seattle, Wash., visited Mechanical Development A on March 24, 1959, to discuss the design of a winch that his Company is supplying.

Mr. Dunning of Sheldon-Dunning Co., and Mr. D. Williams of Chem Seal Co., both from Seattle, Wash., visited Materials Development on March 4 and March 6, 1959, respectively, to discuss materials for sealing concrete brick walls for the containment study now under way.

The following off-site personnel visited Instrument Development:

Mr. B. H. Smith, Manager, Advanced Systems, and Mr. W. Riendo, Vice-President and Manager of EPSCO West, visited on February 27 and 28, 1959, to discuss the high-speed scanner system - CGI-802, NPR data acquisition systems, and possible closed-loop control computer systems.

Mr. C. E. Hoefener, Western District Sales Manager for Applied Science Corp. of Princeton, visited on March 4, 1959, to discuss application of their bargraph cathode-ray system to graphic presentation of rod position, and the possibility of obtaining a display unit on a rental basis.

Messrs. Ivan Jacobs, Bruce McClintic, and Howard Warshaw, General Electric Company, San Jose, California, visited on March 12 and 13, 1959, to discuss rod instrumentation as pertains to Assistance-to-Hanford Contract No. ATH-IP-3-59.

Mr. W. A. Kates, President of W. A. Kates Company, visited on March 2, 1959, for consultation on flow regulation problems in the fuel rupture monitor system.

Mr. D. C. Griffith, Manager, Technical Service, Contract Division of the Swartwout Company, Cleveland, Ohio, and Mr. Warren May, their West Coast representative from San Francisco, California, visited on March 3, 1959, to discuss a possible development contract for a differential pressure transducer and to present information on their developments pertaining to high-pressure reactor instrumentation.

Messrs. Joseph M. Devine, Howard Elliot, and Arthur Dickson of Norwood Controls Unit of American Standard, Norwood, Mass., visited on March 10, 11, and 12, 1959, to discuss the flow monitor development program, to assist in adjustment of a prototype limit detector, and to discuss their new high-impedance transistor amplifier now under development.

Trips

C. W. Botsford visited Peters Company in Portland, Oregon, on March 2, 1959, for engineering consultation regarding pressure tubing, tube couplings, and special machine fabrication .

E. Hollister visited Western Gear Company, Norfin, Inc., and Bayview Manufacturing Company, all in Seattle, Washington, on March 25 and 26, 1959, to consult on tube removal devices.

Harry F. Jensen visited Turco Products Company and G. E. Silicone Products Department in Los Angeles, California, on March 18-21, 1959, to participate in technical discussions and material evaluation.

Significant Reports Issued

- Undocumented - "C Elevator Interlock - All Reactors," M. Pociluyko, March 26, 1959.

- HW-55068 - Revision - "Budget Study Report - Fiscal 1960 Plant and Equipment Budget - Reduced Personnel Exposure," C. E. Frantz, February 26, 1959.

- HW-58872 - Revision - "Final Report - Design Test No. 1019 - Comparison of Shield Cooling Methods as Applied to One-Inch Thick Steel Plates," J. P. Cooke, March 12, 1959.

- HW-59449 - "Scope Report - Discharge Area Remote Manipulator," C. E. Frantz, March 4, 1959.

- HW-59655 - "Final Report - Design Test No. 1038 - Thermal Shock Test of Borated Mortars," J. P. Cooke, March 17, 1959.

- HW-59669 - "Seismoscope Amplifier Utilizing Silicon Controlled Rectifiers," H. J. Miller, March 20, 1959

- HW-56863B - "Development Test IP-193-E - Supplement 2 - Rear-Face Pigtail Development Test," J. W. Hedges, March 17, 1959.

- HW-59724 - "Interim Report No. 2 - Design Test No. 1024 - NPR Fuel Handling," C. W. Higby, March 25, 1959.

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HW-59840

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C. Plant and Industrial Engineering

1. Drafting Operation

Summary of Drafting Operation services provided is:

Revised or New Drawings, BPFs, Graphs and As-Builts	113
Microfilm drawings added or retired	565
Film prints produced	133
Check prints produced	816
Catalogs added	209
Total customers serviced by Files	292

2. Industrial Engineering

Metal Handling, 300-100, All Old Areas

A detailed Industrial Engineering analysis of 300-100 metal handling and shipping has been completed. The analysis revealed that redesign of the 300 Area metal transport pallets is not required for IPD use at the present time. Improvement to loading and unloading facilities of transportation equipment is being considered. A detailed report is being prepared for FPD Processing Operation and IPD Processing Operation. A budget study reason sheet totaling \$265,000 for metal handling systems in six (6) old reactors was issued and approved.

A request for detailed design of a work area and "C" elevator fuel element material handling system at 105-F has been issued.

Elimination of Water Vapor from the 107 Basin

One feasible method of reducing or eliminating the emission of water vapor (steam) from the 107 Basins has been found. Some of the plausible benefits associated with reduction of steaming are: reduction of area fog; reduction of electrical maintenance in basin areas because less ice will be deposited on electrical equipment; reduction of contamination carryover; level and time of reactor operation will not be observable because the area steam plume will be eliminated. Responsibility for further activity was referred to Equipment Development Operation.

Protective Clothing

Two hundred SWP garments with zippered closures have been procured for service tests. The garments are being used in 105-F. The F Area personnel are enthusiastic about the use of zippers in protective clothing, because there is additional protection from contamination and because it is easier and faster to remove zippered garments.

3. Reactor, Plant Engineering

Noise Studies

A noise problem arising from the compressed air system in the 1717-H shop has been investigated. A pulse suppressor for installation between the compressor and the storage tank has been recommended. Recommendations on acoustical treatment of the 1717-F lunch room have been furnished to "F" Maintenance as requested by them.

Tool Steel Marking and Identification

A meeting was held with representatives from CPD, HLO, Purchasing, CEO Standards, IPD Central Maintenance and FEO Standards Engineering to discuss requirements for a HAPO Standard on "Tool Steel Identification". General agreement was reached and a rough draft of a standard will be prepared in conjunction with the CEO Standards group and circulated for comment to interested components.

Electric Lighting and Load Study - 105-C

All the engineering field survey was completed, and a rough draft of the report has been written. Two prints were "as-built": P-6080, Single Line Diagram and P-6176, Lighting Panel Schedule.

105-B, D, F Electrical Distribution Systems

Two meetings were held with Project Engineering Operation to plan the schedule for a project for expanding the 105-B, D, F Electrical Distribution Systems. A project proposal is being written to obtain necessary funds.

4. Water Plant & Utilities Engineering

Reduction of Chemical Cost in 100 Areas

The aluminum oxide-sulfuric acid feeder has been re-designed to eliminate operating difficulties as well as structural weakness experienced with the first model. This new design will be fabricated and installed at 183-B immediately for testing purposes.

A new shipment of aluminum oxide, conforming to the revised specification, containing considerably less of the very fine particles (passing No. 325 screen) has been received and preliminary use of this material indicates less trouble from alum caking on the reaction vessel.

Engineering in Support of Power Forecasting

Studies were continued for preparation of the FY-1960 and five-year forecasts. Details of possible future projects and operating conditions were assembled and analyzed as to their effects on electric power demand.

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Engineering in Support of Power Forecasting (continued)

The power control program to take advantage of the planned extended outage at KE was developed and steps were taken to place the program in effect during April.

Assistance was given to Financial Operation with analysis of individual area loads.

105-F Downcomer

A six-inch hole drilled through the concrete wall to the annulus of the downcomer during the last outage is draining an estimated five to ten gpm from the annulus during operation. This new drain, however, has not stopped the water seeping through the joints and cracks in the concrete wall at the stairwell near the top of the downcomer. Further investigations are planned.

Columbia River Studies

A scope study for procurement and installation of a scale model of the river from 100-B to 100-F was issued. Initial use of the model would be for investigation of the effects on Hanford operations of upstream river regulation, a proposed dam, and a proposed navigation channel. Palliative measures for these or other problems could also be investigated. Fabrication off-plant and installation in 185-189-F is proposed.

4500 HP Motors, 190 Buildings

Three of these units were inspected this month. It was necessary to send one of the stators to the G.E. Service Shop for modification of the wedges and retaining rings. Mr. R.W. Stevens, the insulation engineer of Large Motors and Generator Division, came out from Schenectady to inspect this unit while it was in Spokane. He recommended an epoxy and mylar modification of the brace ring to minimize maintenance on these units.

Investigation of Increased River Turbidity

The Priest Rapids and Crab Creek areas were visited and it was determined that some of the continued high turbidity of the Columbia River was caused by the Grant County Public Utility District contractor digging a channel and dynamiting in the river below the dam, plus removal of cofferdams. We requested that we receive an early alert at the start of other activities which would affect turbidity.

5. Standards Engineering

Spare Parts

Stock Adjustment Requests processed		51
Maximum Authorized dollar value of new items added by SARs	\$ 3,834	
Maximum Authorized dollar value of spare parts requested by letter to Project Engineering	70	
Maximum Authorized dollar value of spare parts requested for Projects by SARs	710	
Number of Engineered spare parts items reviewed		49
Number of Drawings ordered revised		0
Actual dollar value of items deleted from spare parts stock	12,966	
Maximum Authorized dollar value of items deleted from spare parts stock	14,355	

A corrected SAR covering spare parts for Panellit Gauges was prepared, and forwarded to Spare Parts, adding approximately 25 new line items.

Craft Training

Nine classes of 2 hours each were conducted on the operation and maintenance of the Poison Spline System. One hundred-sixteen operators, millwrights, supervisors and engineers attended one of the sessions.

A report on the study of the training and servicing problems relative to the Foxboro Power Calculator Systems was completed, and report copies were issued to the involved people. Two alternate methods for providing the requested maintenance training on the Power Calculator Systems were made in this report.

6. Trips

W. W. Windsheimer and P. H. Hutton visited Boeing Airplane Co. in Seattle, Washington, to discuss vibration measuring techniques and instrumentation with Boeing engineers.

J. H. Hoage visited Los Angeles, California, to contact several individuals at Heat Treating and Engineering Companies; he also attended several sessions at the Western Metals Show.

A. McDonald made a trip to the G. E. Service Shop in Spokane, Washington, to observe motor inspection and repair.

H. A. Kramer visited Portland, Oregon, on March 9, 1959, to confer with personnel of Bonneville Power regarding the transmittal of river data to FEO.

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H. A. Kramer visited Priest Rapids Dam on March 2, 1959, to review possible changes in river water quality due to the completion of certain construction phases in dam construction.

W. W. Windsheimer visited Portland, Oregon, on March 11, 1959, to listen to proceedings at a hearing relative to opening the Columbia River as far as Wenatchee to navigation.

7. Significant Reports

HW-58936, SECRET, "Modification to 1706-KER Fuel Element Test Facilities Scope and Justification", LB Brinkman and ML Faught, 2/24/59.

Scope Study - Columbia River Scale Model, JP Corley, 3/20/59.

D. Project EngineeringL. Projects

<u>Number of Assignments</u>	<u>Description</u>	<u>Balance</u>
17	Active Construction Projects	\$2 980 002
3	Active Design Projects	13 635
3	Active Expense Jobs	342 383
18	Completed Projects - Accrued	3 627 090
35	Customer Work Orders	60 290
	Plant Assistance	31 588
	Total	\$7 054 988

AEC-160 - Recirculating Gas-Cooled Test Loop

Instrument calibration work is starting. The three centrifugal compressors manufactured by the General Engineering Laboratory have been installed in the loop. Rotating elements have not been installed. These will be supervised by an engineering representative from the Laboratory.

CG-558 - Reactor Plant Modifications for Increased Production

Baffles in the first stage of eleven of the DeLaval process water pumps in 190 Annex have been removed under the supervision of their Mr. Budde. Operation of the units after the baffles have been removed has indicated a flow fluctuation of serious enough proportion to cause postponement of further removal of baffles until the cause has been resolved and a remedy proved.

At the request of Mr. Gartmann, straightening vanes are being installed in the suction piping in one or more test units. No further new rotating elements have been received other than presently installed in 6-DR and 8-H.

Pump Test Stand

The information for preparation of the bid package was delivered to the AEC on March 20, 1959.

CG-600 - 100-C Alterations

Byron-Jackson has promised shipment of four replacement impellers by mid May.

CG-674 - Water Plant Component Test Loop, Building 1706-KE

The test loop arrived on Plant site slightly damaged. Repairs are being made on site after examination of the damage by railroad and transportation officials.

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HW-59840

CG-775 - Water Plant Capacity Expansion, 100-K Area

Test piping for testing of prototype pumps is complete. Installation of pumps will be by 100-K Maintenance Operation during the forthcoming outage in K Area. Factory tests on the low-lift pump were successfully completed. The pump arrived on site March 23.

CG-780 - Improved Ventilation, Buildings 105 and 115-B, D, and F

Purchase orders for all engineered equipment have now been placed. This equipment consists principally of fans and associated motors and control equipment. The installation of duct work and equipment supports previously fabricated in Construction Operation's shop has started at 105-B. Although the first fan equipment has been received at B, there has been a delay in certain of the pieces of control equipment which may result in a delay to the completion at 105-B.

CG-781 - Service Building Additions, 1706-KER Building

The contractor started excavation for the hot loop room and office foundation on February 25, 1959. As of March 20, concrete had been poured and the foundation work was about 75% complete. Interior electrical and piping revisions have been started.

CG-791 - Reactor Confinement

The Construction Release was given to Construction Operation on March 23 for the Rear Face Fog Spray piping installation at 105-KE which will be installed during the forthcoming outage in April.

MJA-8 - Ball 3X Modifications, 105-B, D, DR, F, and H

Complete design has been received for 105-B and D Buildings. Design for 105-F and DR is each 75% complete. Design for 105-H is approximately 35% complete. The preparation of requisitions for engineered equipment is approximately 50% complete. Central Maintenance has made inspections of the tops of reactor units at 105-B, DR, and F. These inspections are planned so that adverse conditions existing on the top of the units in the vicinity of the Ball 3X equipment can be cleaned up.

2. Project Proposals

Project Proposals Approved

AEC-160, Rev. 6	Recirculating Gas-Cooled Test Loop
CG-708, Rev. 2	Installation of Additional VSR's, KE and KW
CAI-831	Fence and Badge House Relocation, 100-F Area
	(\$94,000 total funds for design and construction)

Projects Awaiting AEC Approval

CGI-824	Remotely Operated Cap Removers, KE and KW Reactor Discharge Areas
CAI-835	Additional Office Space, 100-D Area
CGI-839	Modification of Fuel Element Test Facilities, 1706-KER

Project Proposals Submitted

CAI-835	Additional Office Space, 100-D Area (3-3-59)
CGI-839	Modification of Fuel Element Test Facilities, 1706-KER (3-16-59)

Requests Received for Project Preparation, Revisions, and Changes

CGI-802, Rev. 1	Process Safety Monitoring System, High-Speed Scanning Type for Temperature Monitoring
R-20918	Reduction of Water Treatment Costs, B, C, D, DR, F, and H
R-20919	100-K Area Coolant Backup
R-20920	NPR Supporting Facilities - 230 KV Electrical Facilities
	NPR Supporting Facilities - Telephone Facilities
	NPR Supporting Facilities - Railroad Facilities
	NPR Supporting Facilities - Road Facilities

3. Trips

Approximately 12 days, beginning March 27, will be spent on a business trip by H. H. Hubble to the Ingersoll-Rand Company, New York Navy Yard, DeLaval Steam Turbine Company, A. O. Smith Company, and the General Electric Company for consultation on process water pump cavitation problems.

J. W. Scoggin traveled to Los Angeles to witness the performance test of the primary pump developed by Byron-Jackson Pump, Inc. for Project CG-775. While in Los Angeles, Mr. Scoggin attended the Western Metal Congress sponsored by the American Society of Metals; the Society for Non-Destructive Testing; American Institute of Mining, Metallurgical, and Petroleum Engineers; and the American Welding Society. The trip lasted from March 11 through March 21.

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DECLASSIFIED**E. EXPANSION OPERATION****1. Activities****Construction Planning**

The majority of effort for the reporting period was spent on routine commenting on scope documents. A considerable portion of time was also spent in planning for the organization changes. Activities of note were:

- A. Study was started on the most desirable method of obtaining water at the 100-N site during the construction period. Cost estimates were obtained for bringing water from the area export system (about \$37,000 for 8" line and \$47,000 for 12" line) or for using wells, local pumps and storage tanks (about \$32,000).
- B. Assistance was given to Plant and Industrial Engineering in the forecasting of power requirements during the construction period and after start-up of the plant.

Graphite Planning

An estimate for the modification of 2101 Building to arrange for offices and shops for Electrical Distribution was prepared and submitted to Financial for action. The estimate is \$47,000 to include all project costs.

Research and Engineering continued the study of graphite requirements to determine if the planned procurement action of ordering graphite immediately after the tube rupture test is feasible.

Zirconium Planning

The processing proposals submitted by five vendors for fabrication of the pilot lot of zirconium tubes is being reviewed. Considerable technical discussion is required with each vendor before a satisfactory review can be made. The Commission originally refrained from entering into discussions with vendors because of not having procurement funds; however, since a meeting March 23, 1959, they have decided to enter into complete negotiation with each, including requests for prices. We agreed that technically all proposals are satisfactory. Final review and evaluation must wait until discussions are held with each.

Discussions were conducted with Chase Brass and Copper Company, Allegheny-Ludlum Steel Corporation, and Harvey Aluminum Company. Chase Brass presented a large cost figure, \$650,000, for facilities to make the tubes, and to date discussions have been on these costs. Discussions with Allegheny-Ludlum and Harvey Aluminum have largely been in regard to contract terms and conditions since each object to certain general conditions in AEC and GE contracts. Thorough technical discussions were held with

Allegheny-Ludlum and their subcontractors at Richland March 26, 1959.

A rather tight schedule was arranged for the next two weeks to complete negotiations with all vendors. Bridgeport Brass Company and Harvey Aluminum Company have each offered to cold-draw samples of tubes and have requested that these be reviewed for technical evaluation.

A letter has been received from GE Union Relations stating that from the Davis-Bacon Act standpoint plant forces may perform the on-site preparation work on the zirconium tubes.

Administrative

Eight Burns & Roe Criteria have been received this month to date. The first purchase specification from Burns & Roe was received on March 23, 1959.

The following material was processed by Drawing and Specification Control this month:

Drawings	19
Criteria	18
Specifications	1
Others	<u>19</u>

57

Summary information on the over-all impact of NPR on HAPO manpower requirements was compiled and transmitted to all HAPO Level II components by letter of the General Manager, IPD, dated March 4, 1959. A new HAPO-wide new-hire forecast was prepared and forwarded to the General Manager, IPD, March 20, 1959.

Organization planning for structure and functions required for assumption of the General Electric field engineering responsibilities was completed. Key position guides were prepared and key positions were evaluated.

Design Review and Consultation

Reviews were completed and comments were offered on the following scope design items:

- a) HW-57029 Pile Motion, Seismoscope and Optical Systems
- b) HW-57020 Power Calculator, Boiling Point and Bulk Coolant Flow and Temperature Measurement Systems
- c) HW-57041 Functional Requirements of the Plant Auxiliary Control and Instrumentation Systems

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HW-59840

- d) HW-57035 Elevator Facilities
- e) HW-57013 HCR System
- f) HW-59490 Standby Power House
- g) HW-59474 Electrical Distribution System
- h) HW-59473 River Water Pump House
- i) HW-59478 Circulating Water Systems
- j) HW-59480 Primary Coolant and Afterheat Removal Systems
- k) HW-59471 Site and Area
- l) HW-59481 River Water Treatment Facilities

NPR Design Council

The NPR Design Council approved the following scope material:

SK-1-29006	General Arrangement Scope Drawings of Standby Power
SK-1-29007	House
SK-1-31300	Administration Building - Floor Plan, Elevations
SK-1-31302	and Sections
HW-57039-RD-3	105-N Design Criteria, Item No. 2.8 - Electrical Systems (Final Approval)
HW-57902-RD-3	105-N Design Criteria, Item No. 1.5 - Pile Gas System
HW-59476	100-N Design Criteria, Item 3.7 - 1704-N Administration Building
HW-57014-RD-4	105-N Design Criteria 1.7 - Ball Safety System (Final Approval)
HW-57045-RD-4	105-N Design Bases Part III - Functional Requirements of the Confinement System

The Council also approved of the use of carbon steel as the material for construction of the primary coolant loop between the reactor and the heat exchanger loop cut-off valves. The use of stainless steel material of construction in contact with the primary coolant within the heat exchanger loops was also approved.

2. Visitors

Mr. G. Maudry, Technical Director, and Mr. C. Crawford, Assistant to the President, of Harvey Aluminum Company visited the plant March 24 and 25, 1959, to discuss technical details and negotiate procurement contracts for the NPR zirconium process tubes.

Mr. R. E. Lindenmeyer, Special Sales representative, Great Lakes Carbon Corporation, visited the plant March 24, 1959, to discuss the NPR graphite program and view the 2101 graphite fabrication facilities.

Allegheny-Ludlum Steel Company personnel, including Messrs. R. Swan, Assistant Comptroller, E. Eiswerth, Sales Manager, J. Preston, Technical Representative, and A. Smith and H. Lucas, Northwest Representatives, visited the plant March 26 to discuss the NPR zirconium tube procurement contract. With them were Mr. K. Donle, Tube Reducing Corporation, and W. Dickhart, Budd Company, engineers from the sub-contracting firms.

Mr. O'Connor of Johnson Drake and Piper visited the plant March 30, 1959, to discuss construction planning.

3. Trips

A trip was taken by C. E. Love March 11 and 12, 1959, to Chase Brass and Copper Company, and Allegheny-Ludlum Steel Company with J. W. Riches, HLO, and L. L. Sadler, AEC, to discuss the zirconium process tube procurement.

E. W. Wilson and D. C. Keck, of the Expansion Operation, W. D. Bainard of the System Design Operation, and W. F. Dietrich of Burns and Roe., Inc. visited the Longview Fiber Company and Weyerhouser Lumber Company at Longview, Washington on March 5, and the Shell Oil Company at Anacortes, Washington, on March 6. The purpose of the trip was to observe demineralization and water treatment facilities and operations.

4. Significant Reports Issued

HW-59347 "Inspection Manual, Production Machining of Graphite Moderator", was jointly prepared by C. E. Love, D. M. Diediker, and R. C. Walker and issued March 16, 1959.

Undocumented Trip Report, Visit to Demineralization and Water Treatment Facilities at Longview, Washington and Anacortes, Washington, dated March 18, 1959. Co-authors, D. C. Keck, E. W. Wilson, and W. D. Bainard.

Undocumented NPR Report No. 5 for General Electric Management, dated March 2, 1959, by W. D. Richmond.

F. Principal Engineers

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Principal Engineer1. Trips

Meetings were attended in Washington, D. C. on March 17 and 18 with E. J. Bloch, W. E. Johnson and some members of the Joint Committee on Atomic Energy and staff to discuss the new production reactor program.

2. Significant Reports Issued

HW-54907 - "Comments on Stone and Webster Report - HAN-71010"

HW-59775 - "Comparison of Unit Energy Costs from Federal Plants of Nuclear, Hydroelectric, and Conventional Thermal Types"

J. S. McMahon
MANAGER
FACILITIES ENGINEERING
PZH

EMPLOYEE RELATIONS OPERATION
MARCH 1959

PERSONNEL DEVELOPMENT & PLACEMENT

The manpower requirement study initiated last month will be discontinued with the issuance of the Part I report. The report presented a tabulation of additions required in selected nonexempt personnel classifications.

The first round of the 1959 "Understanding Human Behavior" Course was completed in March. Pre-employment selection criteria for coal handlers, miscellaneous operations, etc., in Power was worked up for consideration and possible adaptation in other HAPO departments.

Experienced BS/MS and PhD recruitment continued at a very high level. Transfer activity decreased while nonunit placement activity was the heaviest thus far for the year. Eleven experienced BS/MS candidates were interviewed during the month with five offers being extended. We have received three offer rejections and have four open offers at month end. There were eight PhD candidates interviewed during the month, with three offers being extended, two rejections of prior offers, and two open offers at month end.

There was one exempt transfer into the department from Relations and Utilities Operation, and one transfer out of the department to the Vallecitos Atomic Laboratory. There were two other exempt losses, both to accept outside employment.

There were eight nonunit additions to the rolls, four removals and four transfers within the department. Twelve requisitions were filled, with sixteen remaining open at month end.

MAIL AND DUPLICATING

A new procedure for addressographing Radiation Exposure Cards was implemented this month which will provide more pre-printed information on each card, and thus reduce the amount of information which must be filled in by hand. Cards will also be made more legible.

Accessory duplicating equipment was obtained this month and installed in the 1761-H duplicating office. The equipment makes possible a more precise chemical control in the multilith lithographic process. Better quality finished work and reduced "down time" should result.

In order to assist in uniform compliance with Security regulations, an item was included in the April 2 News Bulletin reiterating instructions for handling "extra" duplicated copies of classified documents. The action was taken as a result of a request made by Security Procedures and Practices.

COMMUNICATION

Mass communication activities included the publication of eight Management NEWS Bulletins, one Memo from the General Manager, one Round Table Guide, two IPD Employee Headliners, and one letter to supervisors and managers from the General Manager. GE NEWS coverage included 11 items about IPD activities

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totaling 165 column inches, or 24% of all available spaces. Three Priority Messages were disseminated; both Management Information Meetings scheduled for the month were cancelled.

UNION RELATIONS

The wording of a request to the NLRB for a determination on whether the work being performed by exempt Instrument Development Specialists is Production and Maintenance or Research and Development work has been agreed upon by the HAMTC and the Company. This request has been presented to the Board as a joint petition.

Notice was received of the HAMTC's desire to arbitrate a grievance from Instrument Technicians regarding overtime distribution. The Company does not consider this an arbitrable grievance and has so informed the Council.

Two more IPD Firemen have joined in the lawsuit against the Company for overtime pay for the twenty-minute period from the time the bus arrives until they actually start work. Mr. DeGarmo, Seattle attorney who is representing the Company in the suit, was in town this month for preliminary meetings.

The Van Reenen Arbitration Case (overtime pay calculation) was scheduled to be heard in Seattle on Tuesday, March 24, 1959. At a meeting on March 20 the HAMTC withdrew the charge cancelling the arbitration.

Five issues of the "Union Relations Information" bulletin were prepared and distributed during the report period.

The HOO-AEC Labor Standards Board approved five jobs for assignment to plant forces which are estimated to cost \$264,325. Since the procedure for obtaining LSB approval was initiated in IPD, 132 jobs have been approved, representing a total cost of \$4,215,050.66.

EMPLOYEE COMPENSATION

An analysis of salary statistics and their comparison to similar statistics for the Company was made. Data were prepared as a basis for salary review action and the schedule and control criteria for an over-all exempt salary review were established.

New appraisals for all exempt employees who had not been appraised since October 1, 1958 have been prepared. Appraisal ratings and their distribution with relation to salary zones has been analyzed.

Satisfactory progress has been made on the over-all salary review which will be completed about the middle of April.

HEALTH & SAFETY

Disabling Injury IPD No. 59-6, 3-16-59, involving an electrician journeyman who fell a distance of 3 ft. involved a more severe injury than anticipated. Two vertebrae and kidney involvement are now reported.

Serious Accident IPD No. 59-4, D Area, involving a helium meter explosion occurred on 3-16-59. Property Damage loss of \$1500 is involved. The investigation revealed various design deficiencies. Examples: the PRV for the system were inadequate in size, piping sizes were not sufficient to meet the demand and the PRV for the protection of the gas meters were not designed into the system. Specific recommendations will correct all such deficiencies; however, this accident has resulted in a "new look" into current designs on the proposed NPR project piping systems. Current reviews reflect the need of an IPD Safety Standard on valving. Work is in progress on this Standard.

A comprehensive inspection of B Area was conducted during March. F Area will be reviewed in April.

Approval of the test fabrication in 212-P (North Area) was granted on 3-29-59. Building pressure tests are to be conducted for criteria determination.

Approval to use compressed gas adaptors on a helium-water-pumped nitrogen system was granted for exclusive use in the recirculating gas cooled test loop - 105DR.

Considerable Safety considerations are being given to the NPR Prototype Concept Evaluation Loop in 189-D. Regular safety meetings as work progresses are held with all interested parties in attendance.

FIRE PROTECTION

IPD Fire Protection responded to two alarms during the month of March: March 17, 1959, 3:50 P.M. - Hanford Area between A St. and the River -- High winds extended controlled burning to grass and dead trees making extinguishment necessary. Approximately one acre burned. Loss: \$10. March 18, 1959, 10:50 A.M. - 100-B Area, Outside 105-B Bldg., improper disposal of smoking material ignited trash in a Load Luger. Loss: \$160.

IPD Fire Protection Operation will transfer to C.E. & U.O. Plant Auxiliaries effective April 1, 1959.

E. J. Fitzmaurice

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FINANCIAL OPERATION
MONTHLY RECORD REPORT
MARCH, 1959

General Accounting

The Plant Acquisition and Construction Budget for FY 1961 and Revision of FY 1960 and the Equipment Budget for FY 1961 and Revision of FY 1960 were transmitted to Contract Accounting.

The forecast of year-end balances for FY 1960 and FY 1961 for Spare Parts was transmitted to Contract Accounting.

Physical inventory of fixed plant and equipment commenced in 100-B and 100-D on March 23. The primary purpose of this inventory is to obtain complete description of property units in order to facilitate mechanization of fixed property.

The semi-annual physical inventory of Precious Metals and Special Materials, taken on March 31, 1959, resulted in a \$.69 charge to cost for platinum consumed.

Product Cost and Budgets

The Operating Expenses Budget for FY 1961 and Revision of FY 1960 was completed and ready for submission to Contract Accounting.

Investigation of a purchase order with Toledo Scale Company of Yakima for the quarterly inspection of SS Material scales (\$2,600/year) disclosed that while a third party inspection is considered necessary, the frequency may be reduced. This recommendation was made to those responsible for placing future orders.

Personnel Accounting

Tuition refund checks were prepared and mailed to employees completing fall semester courses at the University of Washington Center for Graduate Study. Thirty-six IPD employees received tuition refunds in the gross amount of \$810.

Auditing

Cancellations of periodical subscriptions have resulted from the list circulated to Level 3 managers in February.

Changes in procedures for the control of Material Passes, which were agreed to by HAPO auditors and Security and Patrol representatives, have been postponed pending settlement of organizational changes.

Several AEC Manual chapters were reviewed for possible problems arising from the AEC request for conformance.

An auditor observed the semiannual inventory of precious metals taken March 31, 1959.

Procedures

Negotiations were completed with Production Operation for the transfer of the IBM Transceiver equipment to that component from Personnel Accounting.

A procedural review was made in conjunction with Chemical Processing Department and Relations and Utilities Operation personnel evaluating possible revisions in the system used for inspecting incoming spare parts and materials.

A personnel analysis was made in connection with reorganization of plant-wide financial functions. A comparison was made of the number of exempt and nonexempt people in each financial function in each department over the period from June 30, 1956 to the present.

General

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

DR MacNaughton
 Manager-Finance
 IRRADIATION PROCESSING DEPARTMENT

DR MacNaughton:kd

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