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IRRADIATION PROCESSING DEPARTMENT
MONTHLY RECORD REPORT
MARCH, 1960

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Compiled By
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SUMMARY

RESEARCH AND ENGINEERING OPERATION

The IBM program for calculating flux-skewing and step-by-step analysis of fuel operating conditions in the process tube has been revised. Analysis for a 22 lb./ft. NPR element shows that, in the absence of appropriate horizontal rod control, the power density tends to peak approximately 4-5 feet upstream from center at a level insignificantly higher than for the usual symmetrical cosine distribution.

Preliminary results of a dynamic analysis of the NPR indicate that the dynamic stability of the present design is satisfactory.

Analyses of data from PT-IP-233-I show that turbidity levels up to 0.2 ppm do not affect fuel jacket corrosion rates.

Autoradiographs of severely oxidized graphite burnout monitors, which were discharged from 1960-C in January, show high activity in the oxidized pits. Analysis has confirmed the presence of iron, vanadium and silicon in the pits and the catalytic effect of impurities has been demonstrated in the laboratory.

The first appreciable increase in river water turbidity for this year occurred on March 23. No treatment difficulties were encountered.

The installation of both channels of the subcritical monitor in all reactors is complete and operating satisfactorily.

The primary limit to power level was based on fuel element failure control for all but the D and DR Reactors which were restricted by bulk outlet temperature limits.

MANUFACTURING OPERATION

Reactor input production was 5.9 percent above forecast; 3.0 percent above at the six old reactors and 10.3 percent above at the K's.

Overall time operated efficiency was 80.9 percent (81 percent forecast); 79.9 percent at the six old reactors and 83.8 percent at the K's.

The combined reactor instantaneous power level was not increased. The individual reactor record power level was increased 50 megawatts at DR (1780 to 1830).

Fourteen ruptures, eleven I&E regular, two I&E enriched and one solid regular, were removed from the reactors. Three of the I&E regular metal ruptures were at KW, 2 at D, 2 at F and one each at B, C, DR and H. The two I&E enriched failures were at C and DR and the solid regular at KE.

Processing and Power statistics for individual reactor areas are shown on pages C-5 through C-9.

FACILITIES ENGINEERING OPERATION

The downcomer model testing program being performed at Washington State University continued. The model of the DR reactor downcomer is being used to investigate downcomer performance at high temperature.

Results of the study of the export water system, performed on a McIlroy Analyzer were received. The study investigated 48 cases with different combinations of pumps and loads.

A new order for ceramic sleeves for the horizontal control rods at the K Area reactors was placed with the Coors Manufacturing Company. Cancellation of the original order with a foreign vendor is pending.

A revised design impeller was installed in the prototype pump at the 190-KE Water Pumping Building as part of Project CG-775, Water Plant Expansion, 100-KE and 100-KW.

Overall detail design for Project CGI-791, Reactor Confinement, is 90 percent complete. All supporting test work has been completed with the exception of DT-1050, Environmental Component Testing. Thirty-two detail design drawings were approved and 20 drawings were issued for comment.

Cell piping drawings for Project CGI-839, Modification of Fuel Element Test Facilities, 1706-KER, are approximately 75 percent complete. Drawings of the building addition have been returned to the architect-engineer for correction prior to final approval. Vendor drawings of the loop heat exchanger have been reviewed and comments returned to the vendor.

Project CGI-883, Increased Process Water Flow, 100-K Area, was initiated by preliminary approval of the project proposal. The preparation of scope design for the project is 90 percent complete. Detail design for the total project was initiated by a Design Work Release dated March 25, 1960.

The interim charging machine for self-supported fuel elements seems to be acceptable, as do mechanical tests of reamed Parker fittings that will permit a six to eight percent flow increase.

The prototype cap remover head operated satisfactorily.

In NPR work, tests of metal chain link net arrangement for a mattress pad were successful and a review of flow monitor tests shows that the Daystrom-Barton-Luther system is technically accepted.

Previous predictions for outage time reduction through adoption of new methods and equipment for handling nozzle caps and valving crossheaders were confirmed in actual practice at the K reactors.

Nine charge seaters were delivered to the areas for operational use. Three new vendors have shown interest in supplying poison splines.

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The test portion of the Instrument Specialist Selection Program was completed on March 22. Thirty-one instrument technicians from IPD, CPD, and FPD participated in this program.

The annual two year and five year power forecasts were initiated. Liaison with Priest Rapids Dam operators continued. Design of the recording river temperature and flow installation was completed and requisitions issued. Extensive analysis of area trip-out test data continued with the goal of developing improved perception of power house operation. Several 4500 HP motor problems which developed during the month, including a failure of No. 2-F on March 11, were investigated.

Revision to the last process pump is in progress. This will complete the revisions currently contemplated by the DeLaval Company on Project CG-558, Reactor Plant Modifications for Increased Production.

Byron-Jackson has supplied two new impellers of the latest generation for the 100-C Area process pumps. They will continue to repair older model impellers until the operation of these latest impellers is evaluated.

On Project CGI-791, Reactor Confinement, the work assigned to J. A. Jones to prepare the building site for the fixed price contractor has been completed. The fixed price contractor is estimated to be 22 percent complete. The proposal for the entire project was transmitted to the AEC on March 24, 1960.

RELATIONS PRACTICES OPERATION

Twenty-three BS/MS and five PhD candidates were interviewed with four offers extended. Six exempt employees transferred into the Department from other HAPO and GE Components. Twelve Summer Program candidates have accepted offers. Two exempt employees transferred out of the Department. Two IPD employees retired during March. Three security violations occurred during the month. IPD completed its first disabling injury-free year March 17, 1960.

FINANCIAL OPERATION

The quarterly custodial inventory of Precious Metals was taken on March 31, 1960.

The annual physical inventory of Property of Others (POO) was taken on March 28, 1960.

Planning, scheduling and preparing details for the budget has been a major effort. AEC schedules were submitted to Contract Accounting April 1.

Estimates of incremental power costs (water treatment chemicals) was prepared on three case studies of Reactor Plant Expansion for the Measurements Specialist.

Plans were made to revise the monthly operating report forms to book Rotational Trainee cost as a direct service. Formerly this was considered an indirect service. The change will be made effective with the July report.

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A total of 15,072 overtime hours were worked by the Department during the month. Hours worked during February were 12,782.

A procedures review was made of the work of two general clerks in Central Maintenance Operation as a followup of recommendations made by the Traveling auditors.

NPR PROJECT OPERATION

Construction was started on excavation for the 105 Reactor and 109 Heat Exchange Buildings and continued on the 181 River Pump House, 1704 Administration Building, the 1734 Storage Facility, the sanitary sewer system and T.C. facilities, including renovation of the White Bluffs Tube Shop.

Bids were opened on the production orders for zirconium alloy process tubes and were in the process of being evaluated at the end of this reporting period. Price redetermination negotiations were completed with all three process tube pilot order vendors. Bids were received and opened for the zirconium alloy graphite cooling tubes and were being evaluated.

Pre-bid conferences were held with prospective vendors of graphite moderator core materials. Bids were postponed a week to April 18, 1960, to permit revisions to the specifications regarding methods of sampling.

The problem of controlling the potential release of air-borne contamination from the NPR was once again discussed with the ACRS during the month. It is our understanding that, subsequent to this meeting the ACRS has stated in writing their acceptance of the basic approach, specifically for the NPR plant, at Hanford. Design effort on the confinement system was accelerated to incorporate back-up provisions to vent closures, requested by the ACRS, and to integrate the 105 and 109 Building systems.

A detailed programming meeting with APED representatives on the engineering audit they are performing on the NPR design was held during the month. The initial design information package was transmitted to them and their preliminary review has been initiated.

Design progress has continued along the lines previously noted. Reactor plant scope is virtually complete and reactor detail design has kept slightly ahead of schedule. Development and testing is still somewhat behind schedule, but no further ground is being lost. Engineering work in support of procurement has been accelerated with some progress noted in the effort to reach the scheduled status.

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GENERAL

ORGANIZATION AND PERSONNEL

ORGANIZATION

There were no significant organization changes.

FORCE SUMMARY

	<u>Exempt</u>	<u>Non-Exempt</u>	<u>Total</u>	<u>Changes This Month</u>
General	1	2	3	0
Research & Engineering Operation	103	62	165	-2
Manufacturing Operation	349	1373	1722	+3
Facilities Engineering Operation	138	44	182	+1
Relations Practices Operation	7	18	25	0
Financial Operation	17	15	32	0
NPR Project Operation	68	22	90	+3
Total	683	1536	2219	+5

R. L. Turner, Engineer I and M. L. Mutch, Engineering Assistant, transferred from R & EO to APED and Vallecitos Atomic Laboratory, respectively. C. A. Fick and R. P. Walton, transferred from Evandale, ANP, to Facilities Engineering Operation and Manufacturing Operation, respectively. E. M. Bernhagen transferred from CE & UO to NPR Project Operation and Carolyn L. Goss was employed as an Engineer, NPR Project Operation.

PERSONNEL ACTIVITIES

IPD's new training course, "Fundamentals of Manufacturing", was started on schedule with the first class of 16 participants holding its first session on March 14. Manufacturing Operation management met with two G.E. Manufacturing Services representatives March 9 to discuss HAPO participation in the Company's "Manufacturing Training Program". The new non-exempt, non-unit wage plan was discussed with employees March 29. Two Management Information Meetings were held by the Department General Manager. Five employees attended meetings of Professional and Trade Societies. One employee participated in a two-day Executive Study Group.

SAFETY, SECURITY AND RADIATION EXPERIENCES

There were no disabling injuries or radiation over-exposures. Three security violations and 79 medical treatment injuries occurred. IPD completed its first disabling injury-free year March 17. H Area celebrated its seventh disabling injury-free year.

RESEARCH AND ENGINEERING OPERATIONPROCESS AND REACTOR DEVELOPMENT OPERATIONREACTOR FUELSPresent Reactor TechnologyProjection Fuel Testing

Irradiation of the self-supported elements in B and C Reactors continued uneventfully.

Twenty tubes of bumper elements prepared for charging under PT-IP-262-A-FP, "Evaluation of Projection Fuel Elements for Use in Ribbed Process Tubes", R. E. Hall, 10-7-59, (HW-60444 C and D), were rejected as a result of support attachment weld penetrations. These penetrations became apparent during examination after autoclaving, and upon metallographic examination this condition was found to be general.

Dingot Uranium Testing

Irradiation of fuel under PT-IP-280-A-FP, "Irradiation of Alloyed Dingot Uranium Fuel Elements", R. E. Hall, 10-10-59, (HW-61619 C) continued during March. Four of the eight monitor columns were discharged at a goal exposure of 400 MWD/T for special measurement and to check for early stability effects. Results of these measurements will form a basis for the goal exposure of the remainder of the 30 tons still under irradiation. The only measurement performed to date on this metal is for warp, and these results indicate no significant difference between ingot and dingot uranium.

A rupture was sustained in lot V1009D which was one of the lots of alloyed dingot charged under PT-IP-280-A. Examination of the failure classed as a "side-other" did not indicate a failure mechanism related to the dingot core.

Alternate Component Vendor Evaluation

Fuel elements fabricated using aluminum components provided by the Hunter-Douglas Division of Bridgeport Brass Company were charged under authorization of PT-IP-171-A-FP, "Evaluation of Aluminum Caps and Cans from New Vendors", R. E. Hall, 7-29-58, (HW-56942). Successful irradiation of this material will include Hunter-Douglas in the list of "qualified" component vendors currently limited to ALCOA and Harvey Aluminum Co.

Advanced Reactor FuelsFuel Development at NPR

Fabrication of 50' of natural NPR inner tube for irradiation testing in KER which had been scheduled for March 18, was postponed until April 2, because of temporary shutdown of the American Brass Company plant.

<u>Test No.</u>	<u>Type Metal</u>	<u>Tubes</u>	<u>Reactor</u>	<u>Goal Exposure</u>	<u>Current Exposure</u>	<u>Remarks</u>
IP-56-A	Low Hydrogen Dingot U Elements	18	D,KE	Variable		Semi-production scale testing of low hydrogen dingot uranium fuel, solid. Test is discontinued but will not be terminated until material discharged.
IP-84-A	Projection Self-Supported fuel in ribless aluminum tubes	12	B	900 MWD/T		Preliminary evaluation of self-supported fuel elements. Routine charging to continue until tubes are replaced. ultrasonically attached supports currently being used.
IP-171-A	a) Solid X-8001 & C64-F	1	B,DR,F	Variable 500 MWD/T	630 MWD/T	Provide for evaluation of alternate aluminum component vendors. Control columns are only ones carried special. Rest are lot charged.
	b) I&E X-8001 OIIIN	6	D	Variable	50 MWD/T	Provide for evaluation of alternate aluminum component vendors. Control columns are only ones carried special. Rest are lot charged. Bridgeport Brass wrought blank components now under irradiation.
IP-216-A	Normal Prod. Nat. OII,KII and KIII fuel elements	82	All	Normal Variable Goal		Provides for monitoring the performance of a sample of all Natural Uranium Lots to assist in development of a Quality Index for Production use. Test is continuous.
IP-219-A	OIIIN cores SORT tested	0	DR	800 MWD/T		Provides for monitored irradiation of fuel cores categorized by the Sonic Orientation tests to evaluate its ability to isolate dimensionally unstable pieces prior to irradiation. Test discharged at goal.

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<u>Test No.</u>	<u>Type Metal</u>	<u>Tubes</u>	<u>Reactor</u>	<u>Goal Exposure</u>	<u>Current Exposure</u>	<u>Remarks</u>
IP-255-A	Solid Black Mint	7	H	2 years except 5 Mo. for 3 columns scheduled for special extrac-tion at approxi-mately 3 Mo.		Provides for long term irradiation of solid black mint for conversion ratio, and fuel performance determination. Control columns discharged.
	OII & I&E Black Mint	0	H	Six columns to be irradiated to 800 MWD/T, rest till one rupture is sustained		Provides for irradiation of the "striped" portion of the load to determine con-version ratio data, physics parameters, and fuel performance. Monitor columns discharged previously. Remainder dis-charged this month.
IP-272-A	CIVN Geometry I&E self-supported fuel	9	C	Variable	600 MWD/T	Provides for testing of CIVN geometry fuel in C Reactor ribless zirconium process tubes. Seven additional tubes charged.
IP-288-A	Seven Zr-2 jack-eted Nat. U 7-rod cluster elements with hot headed end closures.	1	KE	2000 MWD/T	1570 MWD/T	Charged in KER Loop 3 on October 29, 1959.
IP-280-A	OIIN alloyed Dingot	8	D	400 and 800 MWD/T	250 MWD/T	Provides for evaluation of the stability and performance of cores having 100-200 ppm Si and Fe additives as grain refiners. Low exposure columns discharged.
IP-292-A	Four Zr-2 jack-eted 18-inch en-riched tube-and-tube elements	1	KE	3500 MWD/T	1470 MWD/T	Charged in KER Loop 2 on January 11, 1960.
IP-250-A Supp. C IP-292-A	Enriched tube-and-tube elements	1	KE	2000 MWD/T	710 MWD/T	Charged Feb. 21, 1960, in KER Loop 4.

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The development of a fabrication process for the braze alloy is continuing. It has been demonstrated that repeated arc melting and re-extrusion will give a homogeneous product which melts uniformly. Additional work will be done to optimize the process so that a specification for procurement of this material can be written.

KER Loop Irradiations

Irradiations in Loops 2, 3, and 4 proceeded in a normal manner. Loop 1 remains empty awaiting tube replacement.

IBM Design Analysis

The recently revised and rewritten IBM program for calculating flux skewing and step-by-step analyses of fuel operating conditions in the process tube has been completed. Results for a 22 lb/ft NFR fuel element show that, in the absence of corrective action taken by the appropriate use of horizontal control rods, the fuel power density tends to peak upstream from center approximately 4-5 feet at a level insignificantly higher than for the usual symmetrical cosine distribution.

REACTOR PHYSICS

Present Reactor Technology

Lattice Physics Calculations

Miscellaneous calculations have continued to evaluate the Physics aspects of various possible reactor lattice modifications. Small errors were eliminated from reactivity and conversion ratio computations,, but no significant changes in conclusions regarding control requirements were necessary. Included in these calculations were both large changes of the type associated with over-boring process channels and minor slug redesign cases which would be of use in minimizing rupture problems.

Attempts have continued to eliminate discrepancies between the old and new SS Accountability programs. Errors were located in the graphite density assumptions and in the Doppler coefficient formulation.

Work continues on speed of control studies with the principle effort directed at minimizing the uncertainties in the Doppler coefficient variation of temperature.

A theoretical study of resonance absorption has been completed for the I & E geometry. Attempts to correlate the theoretical findings with experimental Pu distribution in I & E slugs has been unsuccessful because of an inability to decompose the absorption into appropriate surface and volume contributions.

Advanced Reactor Physics

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Ceramic Balls

The gamma activity induced in Ball 3X candidate material was monitored following irradiation with a 256 spectrometer-analyzer. Representative activities of samples essentially equivalent in size and geometry at various times after shutdown appear in the following table.

<u>Sample</u>	<u>Relative Activity Below 2.5 Mev.</u>		
	<u>1 Hr.</u>	<u>3 Hr.</u>	<u>20 Hr.</u>
Eu ₂ O ₃ - Ceramic	15	21	157
1.2% Boron in Carbon Steel*	1	1	1
Pyroceram - no poison**	.08	.12	1.9
1.3% Boron in Stainless Steel	.08	.09	.8
Sm-Ceramic	.01	.09	.6
Gd ₂ O ₃ - Ceramic	.04	.05	.4

* Used as reference. Unusual high activity of C-S compared to S-S due to aluminum coating on C-S ball - note at 20 hr. activities of C-S and S-S are essentially same.

** Although this is just plain ceramic, it was hotter than Sm or Gd ceramic balls. Mfg'r of pyroceram different than others - may have impurities present.

Delivery of additional ceramic ball samples is expected about April 1, and reactivity and radioactivity testing will follow.

A survey of the possible NPR ball materials from the standpoint of adequacy of control strength results from the tests already run, and those to be run on new materials will be combined to provide a final choice of Ball 3X material.

Reactor Dynamics

Preliminary results of a dynamic analysis of the NPR indicate that the present design passes satisfactory dynamic stability. The estimated amplitudes of power overshoots associated with small sudden rod movement are within satisfactory limits.

IBM Neutron Moderation Program

A single unresolved flaw in the geometry routine continues to hold this program in the debugging stages. A summary of Monte Carlo procedures used or developed during the course of this investigation will be prepared as a contribution to the art of Monte Carlo calculations.

In-Cell Fast Neutron Spectra

Multi-group calculations obtained from ORNL on the various spatial and energy dependent in a graphite cell have been reviewed and compared with simpler hand calculations. A reasonably good agreement exists for fast

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spectra of interest in consideration of graphite damage. Comparison of these results will also be made with the Monte Carlo calculations being done as mentioned above.

REACTOR ENGINEERING

Present Reactor Technology

Zirconium Tubes

Two orders each for 100 smooth bore, C-Reactor Zr-2 process tubes were placed with Bridgeport Brass Company and Harvey Aluminum Company. Total cost will be about \$210,000.

Bridgeport Brass Company has completed their initial order of 50 smooth bore C-Reactor zircaloy tubes; Harvey Aluminum Company will complete their initial order in April.

Flow Protection

Calculations have been completed which provide for extending the TAI (Trip After Instability) limits protection to include higher rear cross header pressures.

Analyses of the possibility of boiling burnout in K reactor process tubes for various transient conditions were completed. Conclusions reached were that no burnout will result from BPA power loss or from loss of a single low or high lift pump. The analyses also showed that significant power surges could be tolerated on either 5 or 6 pump operation without encountering film boiling in the process tubes. Results will be documented.

Corrosion

Data on the effects of up to 0.20 ppm turbidity on fuel jacket corrosion rates obtained from FT-IP-233-I have been analyzed. The data show that turbidity levels up to 0.2 ppm do not affect corrosion rates.

Two charges of fuel elements which had been coated with a water soluble silicate coating were irradiated in C-Reactor for ten days under the terms of IP-308-F. The coating caused no detectable ill effects and did reduce the degree of rib galling. The main part of the test will now be changed to determine long term corrosion effects.

Graphite

Autoradiographs of two of the severely oxidized 0.4 inch diameter 4 inch long burnout monitors discharged in January from 1960-C show high activity in the oxidized pits. The presence of iron, vanadium and silicon in the pits has been confirmed by analysis. The catalytic effect of impurities was demonstrated in the laboratory. In dry air at 600 C the rate of oxidation of graphite samples soaked overnight in 0.001 M ferric chloride and vanadium sulfate was three times that of untreated control samples. The oxidized treated sample showed development of pitted areas while the control

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sample oxidized evenly. Borescoping of a tube channel near to and slightly above channel 1960-C is scheduled for April in an effort to determine the extent of the pitting oxidation in the reactor.

Advanced Reactor Technology

KER Tubes

Three KER tubes received from Harvey Aluminum have been completely tested. Overall, the tubes are of excellent quality and one has been released to the Coolant Testing Unit for installation in KER-1.

NPR Graphite - Test Irradiations

The GEH-19-3 graphite test irradiation capsule which was discharged from the MTR on December 14, 1959 after four cycles of irradiation has been dismantled and the irradiated graphite samples returned to Hanford. (The delay in dismantling the capsule was occasioned by necessary maintenance work on the MTR discharge channel.) Severe damage to part of the graphite samples and containers was observed after disassembly. No explanation is yet available and investigation into the cause is continuing.

RADIOLOGICAL ENGINEERING

Radiation Control Experience

The following table summarizes the radiation exposure experience of critical IPD classifications for the first 12 weeks of the 1960 badge year:

<u>Classification</u>	<u>Total Dose</u>	<u>No. of Employees</u>	<u>Average Dose/Employee</u>	<u>Extrapolated Year End Average</u>	<u>No. of Employees over 3r Extrapolation Exposure</u>
Radiation Monitors	54843 mr	79	694 mr	3008 mr	44
Processing Operators	137426 mr	253	543 mr	2354 mr	36
Pipefitters	45020 mr	93	484 mr	2098 mr	19
Millwrights	34760 mr	77	451 mr	1955 mr	15

Lapse of Control

	<u>Lapse of Radiation Control</u> <u>Distributed by Reactor and Component</u>								<u>IPD Total</u>
	<u>B</u>	<u>C</u>	<u>D</u>	<u>DR</u>	<u>F</u>	<u>H</u>	<u>KE</u>	<u>KW</u>	
Processing	3	0	0	0	2	0	0	1	6
Maintenance	0	0	0	0	1	0	0	0	1
Supplemental Crews	1	0	0	0	1	0	0	0	2
Research and Engineering	1	0	0	0	0	0	0	0	1
Facilities Engineering	0	0	0	0	0	0	0	0	0
Central Maintenance	0	0	0	0	0	0	0	0	0
Reactor Areas	0	1	0	0	0	0	0	0	1
Assigned totals	5	1	0	0	4	0	0	1	11
IPD General	1								1

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

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Average Reactor Effluent Activity Output

	<u>March 1960</u>	<u>February 1960</u>	<u>March 1959</u>
107-B	26,000 uc/sec.	19,000 uc/sec.	31,000 uc/sec.
107-C	38,000 "	10,000 "	46,000 "
107-KW	66,000 "	38,000 "	66,000 "
107-KE	33,000 "	36,000 "	58,000 "
107-D	31,000 "	23,000 "	36,000 "
107-DR	18,000 "	22,000 "	21,000 "
107-H	22,000 "	32,000 "	27,000 "
107-F	28,000 "	15,000 "	26,000 "
Total	<u>262,000 uc/sec</u>	<u>195,000 uc/sec.</u>	<u>311,000 uc/sec.</u>

Extremely low river flow rates were experienced during the filling of the Priest Rapids reservoir which occurred during the period March 15-25, 1960. The lowest river flow rate past the plant was about 37,000 cubic feet per second. Results of special sampling had not been evaluated at the time of this writing.

Instrumentation

The fabrication of a prototype remote monitoring device is in progress. It is a portable battery operated dose rate equivalent monitor with scintillation detector weighing about 10 pounds. The instrument contains a meter relay and alarm circuit to alert personnel to a change in radiation conditions. It can be mounted on brackets just over the work site in the charge and discharge areas, thus allowing the radiation monitor to observe the work from a location of low radiation level without endangering the radiation safety of personnel.

Investigation continued to develop a device which will trip the fog spray system in the event of a reactor release incident. Principle difficulty has been a contaminant in the normal exhaust air which masks the Iodine ¹³¹ being detected and results in low instrument sensitivity. Efforts are directed at eliminating the offending response and secondly at concentrating ¹³¹I to overpower the offender. (A⁴¹ from pile gas.)

SECRET

PROCESS TECHNOLOGY OPERATION

REACTOR POWER LEVEL LIMITATIONS

Except at D and DR Reactors, the primary limit to all reactor power levels at the end of the report period was based on fuel element failure control at the goal exposure currently in effect. D and DR Reactors' power levels were restricted by bulk outlet temperature limitations.

WATER TREATMENT

Raw Water Conditions

The first appreciable increase in turbidity of the year occurred on March 23, 1960. No difficulties were encountered treating this water.

Bauxite Feeder

The test reaction box at 183-B was placed in operation February 5, 1960, and is still operating satisfactorily.

Liquid Alum Feeder

Liquid alum feeding was started at 183-D on March 1, 1960. No difficulties have been encountered thus far.

PROCESS STANDARDS

HW-46000 B, Process Standards - Reactor

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

Process Standard C-120 - "Poison Splines"

A revision was made to the Standard to authorize the use of splines at C Reactor.

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

Two new equipment requirements added to the Standard require a routine preventive maintenance program and testing of the equipment to be assured of a high degree of reliability of seismoscope response to an earthquake.

Another addition to the Standard specifies a critical inspection by a team of experts and consultation with Research and Engineering Operation prior to reactor startup following a severe earthquake.

A new section has been added that formalizes the dissemination of information concerning possible earthquake damage to CPD and IPD management.

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

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

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

The revisions made to this Standard were identical to those made for HW-46000 B, above.

HW-46000 K, Process Standards - Reactor

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

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

A V-72 valve at each reactor in the high pressure cross-tie line was sensed to close upon low pressure in the cross-tie line. This would minimize the amount of water loss from each reactor in the event of a ruptured cross-tie line.

During a recent pump trip-out test the V-72 valve closed automatically from a low pressure surge during the period reactor water supply was through the cross-tie. This left the down reactor with only service water for a short time interval while the process pump motors in that area attained operating speed. The automatic closing requirement of the V-72 valve has been deleted from the Standard because its doubtful value in protecting against line rupture weighed against the risk of the valve closing during emergency flow conditions indicated removal.

HW-27155 Rev1, Process Standards - Water Plant

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

Process Standard 190-B-070 - "Emergency Water Requirements, B, C, D, DR, F, and H Water Plants"

Previous requirements of the Standard specified that steam driven pumps be used as a backup facility for the electrically driven pumps during reactor shutdown. The revision permits the steam driven pumps to be used for automatic pressure regulation of the reactor water supply immediately after reactor shutdown. This system of pump operation provides more stable process water flow conditions to the reactor during outages.

PROCESS CHANGE AUTHORIZATIONS

Fifteen Process Change Authorizations were issued during the month to permit temporary deviation from Process Standards - Reactor, HW-46000, and one was issued to permit temporary deviation from Process Standards - Water Plant, HW-27155 Rev1. These were:

PCA #0-13 - "Front Face Leak - B Reactor"

Process Standard A-010 requires that the reactor be shut down under certain conditions of front face process tube fitting leaks.

Authorization was given to operate the reactor with a leaking pipe plug in a venturi housing since calculations demonstrated that sufficient water

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would be provided to the process tube if the plug was completely ejected.

Precautionary measures stipulated constant monitoring of the tube's exit water temperature with an alarm set 5°C above the normal temperature, shut down if tube temperature increased to within 10° of the TAI limit and hourly monitoring of the tube's Panellit pressure.

PCA #0-14 - "Thermal Shield Cooling - DR Reactor"

Process Standard A-070 specifies reactor shutdown if the shield water flow on two adjacent cooling tubes is stopped. A recent inspection of rotating vane flow indicators showed two adjacent indicators to be stopped.

Continued operation was authorized since: nearly all cases, to date, of rotating vane failure have shown ample flow existed on the shield cooling tube; preliminary production test data has indicated that the thermal shield cooling requirements of the Standard are too conservative; fringe tube power restrictions were imposed on process tubes adjacent to the shield area with non-rotating vanes, to minimize the possibility of shield damage.

PCA #0-15 - "Graphite Thermocouple Stringers - DR Reactor"

Process Standard C-040 limits the number of non-serviceable graphite thermocouple stringers.

Authorization to continue operation with one less stringer than required was given since provisions to replace all stringers with new Geminol thermocouples is in progress. Graphite temperatures in the un-monitored regions must be calculated as specified in Standard C-040.

PCA #0-16 - "Installation of Special Raw Water Screens, D-DR Reactors"

Finer mesh raw water screens are scheduled for installation under Production Test IP-301-I.

The PCA authorizes installation of the screens during operation, 24 hours prior to the scheduled outage.

Emergency flow will be adequate through the screens due to the thorough flushing of the export water line prior to the installation. The fine mesh screens will be replaced with the screen size specified in Process Standards on completion of IP-301-I.

PCA #0-17 - "Flux Monitor Range Switch Settings - F Reactor"

Process Standard C-030 requires flux monitor operation with 40 per cent scale deflection and the amplifier operated on the least sensitive shunt range. The least sensitive shunt range resistor was changed on #1 Beckman on Design Change No. 306-F, to make possible operation within this specification. Neutron signal strength was still insufficient after the change for compliance to the Standards specification. A new chamber will be required for #1 Beckman in addition to the design change, to meet the requirements of the Standard.

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Operation was permitted in the interim period provided stop pegs are used on the vernier range switch, to prevent an inadvertent insensitive switch setting.

PCA #0-18 - "Hot Startup-Rear Pigtail Failure, B, D, DR, F, and H Reactors"

Process Standard A-010 specifies the conditions under which a reactor may be operated upon failure of a rear pigtail. The Standard does not authorize recoveries from a scram following a rear pigtail failure.

Hot startups were authorized under the provisions of the PCA provided the conditions of the Standard were met before the scram and can be met following the rise to power.

PCA #0-19 - "Ball 3X Functional Testing, C-Reactor"

Functional testing of the ball 3X system was resumed in November 1959, after a postponement of nearly two years for equipment renovation. During the recent testing, approximately 20 pounds of balls per hopper were lost in fissures of the graphite stack causing reactivity peaking which may have contributed to recent ruptured fuel elements.

Cessation of the ball 3X testing program was approved until July 1960, since recent experience with functional tests of the equipment has exhibited a high degree of reliability of performance for those ball hoppers tested.

During the interim period of no ball hopper testing, attempts will be made to devise other means of functional testing, without introducing 3X balls to the graphite stack. If this cannot be accomplished, testing will be resumed at the required frequency beginning in July, 1960.

PCA #0-20 - "Graphite Thermocouple Stringers, C-Reactor"

Process Standard C-040, for C-Reactor, specifies the number of graphite stringers that must be in operation for correlation of filler block graphite temperature with TC stringer temperatures. Two stringers must be installed at C Reactor to meet this requirement.

Extension of the time of operation without the required number of stringers was authorized until May 27, 1960, to permit sufficient time for procurement of Geminol temperature monitoring equipment.

PCA #0-21 - "Critical Pressure, No. 5 Orifice Zone - D Reactor"

Panellit low trip pressures are specified by Process Standards. The value of the low trip pressure is a function of the orifice size in certain zones. Changes have been made in the orifice size which resulted in low trip pressure settings not covered by Process Standards.

Equations were provided in the PCA to permit establishing low trip pressure settings not presently covered by Standards.

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PCA #O-22 - "Pork Irradiation in Front-To-Rear Test Holes, KE Reactor"

Irradiations in test hole facilities are normally authorized under production or development tests.

Authorization to use the tube-in-tube test hole facility at 105-KE for production irradiation of Pork material was provided by the PCA. The operating limitations were determined by the Testing Operation and furnished to KE Processing Operation by the assigned Process Engineer.

PCA #O-23 - "Low Graphite Temperature - DR Reactor"

Maximum and minimum graphite temperatures are specified in Process Standard C-040. Reactivity effects associated with the block discharge authorized by PITTA 294-C produced graphite temperatures lower than permitted in the Standard.

Authorization was provided to operate for 48 hours at not less than 15°C below the temperature limits specified by Standards. Relatively short exposures at low temperatures, do not significantly effect the rate of graphite growth.

PCA #O-24 - "Automatic Scram Feature of the Temperature Monitor - K Reactors"

Startup without process tube temperature trips actuating the #1 safety circuit was authorized due to the number of spurious scrams that have been experienced with this system. In its place, Design Change No. 258 now provides low temperature annunciator trips on 50 selected tubes. Early warning of poor temperature distribution is thus provided. As a further safeguard, mandatory trip of the #1 safety circuit is required when more than two trips are experienced in any 10 X 10 block of tubes.

PCA #O-25 - "Thermal Shield Cooling - DR Reactor"

Process Standard A-070 specifies the provisions for thermal shield cooling water. Recent inspections showed three non-adjacent rotating vane flow indicators to be without rotation and the adjacent tube powers over prescribed limits.

Continued operation was authorized until the next outage, with fringe tube powers adjacent to the fronzee vanes, not in excess of 125 per cent of the limit specified in the Standard. Experience has shown that nearly all non-rotating flow indicators are a result of mechanical malfunction rather than any flow stoppage. In addition, preliminary data from a production test indicates that the provisions of the current Standard may be overly conservative.

PCA #O-26 - "Raw Water Screens, H Reactor"

Raw water screen mesh size does not presently conform to Process Standards requirements. Authorization was given to operate with the present screens until April 29, 1960, or until the current screens are replaced, whichever

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is sooner. The present screens are not considered optimum size, however they are not subject to severe plugging under credible circumstances, and operation for a short period with the present screens will not significantly affect reactor safety.

PCA #O-27 - "Water Leak, DR Reactor"

Water collection rate increased slightly over the daily collection rate specified in Process Standards. All evidence showed that the process tube leak must be near the rear of the reactor.

Continued operation was permitted for two days until efficient shutdown scheduling could be affected. Limitations were set on inlet reactor gas dew points and on the quantity of water introduced to the graphite stack.

PCA #O-28 - "Use of Cast Uncanned Tubular Aluminum-Silicon-Cadmium Dummies - B Reactor"

The PCA authorized the use of 2600 aluminum-silicon-cadmium poison pieces remaining from Production Test IP-174-IE. This poison material was tested and proven a satisfactory substitute for the canned lead-cadmium alloy normally used. Due to manufacturing difficulties associated with the Al-Si-Cd alloy, further production of this material will be discontinued.

PROCESS ASSISTANCE

Auditing

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

Graphics

Graphics services prepared 78 charts, graphs, and visual aids for various IPD and HLO components.

RUPTURE EXPERIENCE

<u>Failure Date</u>	<u>Tube Number</u>	<u>Lot Number</u>	<u>Type of Metal</u>	<u>Exposure</u>	<u>Type of Failure</u>
3/1/60	2369-F	KL-364-C ⁽¹⁾	8" I&E Natural	376	Side Hot Spot
3/11/60	2060-KW	KR-108-D ⁽¹⁾	8" I&E Natural	661	Unknown
3/13/60	2184-B	KL-369-D	8" I&E Natural	571	Unknown
3/13/60	2562-KW	KR-140-D	8" I&E Natural	373	Unknown
3/17/60	3557-KW	KR-141-D	8" I&E Natural	387	Unknown
3/17/60	0566-C	KG-244-E	6" I&E Enriched ⁽²⁾	442	Side Hot Spot
3/21/60	3563-D	CL-892-D	8" I&E Natural	548	Side Other
3/22/60	3877-DR	KL-418-D	8" I&E Natural	212	Side Other

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<u>Failure Date</u>	<u>Tube Number</u>	<u>Lot Number</u>	<u>Type of Metal</u>	<u>Exposure</u>	<u>Type of Failure</u>
3/23/60	2044-KE	MA-279-A	8" Solid Natural	402	Split Long
3/25/60	0859-DR	SH-017-C(3)	6" I&E Enriched(2)	377	Side Hot Spot
3/25/60	1463-D	VL-009-D	8" I&E Natural	557	Uncl.
3/28/60	3873-F	KL-378-C	8" I&E Natural	553	Side Other
3/29/60	2567-C	KJ-197-C	8" I&E Natural	429	Side Hot Spot
3/31/60	1464-H	CL-891-D	8" I&E Natural	659	Unknown

- (1) Multiple Failure Lot
- (2) .94 per cent U-235
- (3) Parent lot KH-134-C

Legend:

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

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

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

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

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

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OPERATIONAL PHYSICS OPERATION

PILE PHYSICS ASSISTANCE

The average flattening efficiency at the eight reactors as measured by the total ECT was maintained above 77 per cent of all reactor tubes. The number of outages occurring during the month was higher than usual, largely because of ruptures.

All reactors now have both channels of their subcritical monitors installed and in general functioning satisfactorily.

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

Reactor	B	C	D	DR	F	H	KE	KW
ECT in March (1)	1435	1665	1490	1590	1440	1625	2500	2475
12-Month Avg. ECT	1435	1645	1480	1520	1445	1600	2465	2465
Equil. Scram Time (2)	13-17	26-30	14-18	20-30	14-20	23-25	18-22*	18-22*
No. of Scrams and Recoveries (3)	1/0	3/3	0/0	0/0	1/1	1/1	1/1	0/0
No. of Outages (4)	0/0	1/0	1/0	0/0	0/0	0/0	1/1	0/0
No. of Outages (4)	4/0	3/1	2/0	2/0	3/0	4/0	6/0	5/0
Reporting Period -								
From:	2/23	2/22	2/23	2/23	2/23	2/24	2/25	2/23
To:	3/25	3/24	3/24	3/24	3/25	3/25	3/25	3/24

* Equilibrium scram recoveries are not attempted at the K reactors.

- (1) Effective Central Tubes: This value is defined as pile power level divided by the average of the ten most productive tubes in the reactor.
- (2) This is defined as the maximum time available in minutes between scram and first indication of startup.
- (3) The first pair of numbers shows the number of brief outages from which secondary cold startups would be made and the number of successful startups. The second pair shows the number of brief outages from which hot startups would be made and the number of successful recoveries.
- (4) The first number shows the number of ordinary outages (including those initiated by scrams followed by unsuccessful recovery attempts, but not including scrams from which recoveries were made), and the second shows the number of additional outages to discharge temporary poison.

B Reactor - S. L. Stewart

Limited longitudinal flux distribution measurements have indicated increased upstream peaking over the past several months. This increase is at least partly the result of the spike enrichment charges used to provide the increased reactivity required for efficient operation. A program was initiated to monitor longitudinal flux distribution with the graphite thermocouple system; the measured graphite temperatures are being normalized to flux traverses obtained from adjacent columns. Average flattening efficiency was limited by the short operating periods.

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C Reactor - R. A. Chitwood

Flattening during the first part of the month was excellent with an ECT of 1690 tubes being attained. The severe downstream flux peaking in the central region of the pile as reported last month was improved slightly by displacement of 30 spike enrichment columns 24 inches upstream.

Following startup on March 2 the rope tying out VSR #35 broke, allowing the rod to slip into the pile undetected. Water in the stack, evident during the previous operating period in the far side graphite, masked the reactivity loss due to the rod; however, the distributional effect was subsequently observed from low near side tube temperatures at near equilibrium conditions. As a result of the unfavorable reactivity condition the VSR's were checked, the one vertical rod was found to be in the reactor, and the reactor was shut down.

Two additional outages occurred as a result of ruptures.

D Reactor - W. L. Stiede and D. I. Monnie

A rupture occurred in a tube into which a spline had been inserted during the preceeding shift; however, preliminary examination showed no evidence that the rupture was due to the spline.

Installation of both the subcritical monitors and the power rate meter has been completed.

Operation has been reasonably continuous and at above average flattening efficiency; continuity was interrupted by two unscheduled outages, one due to a Panellit trip of unknown cause and one for a rupture.

DR Reactor - D. G. Montague

The uniform low exposure following the block discharge resulted in a new high ECT of 1600; the previous twelve-month average ECT was 1520. As a result of the increased PCCF coverage outside the rod banks a new high turn-around level of 1475 MW was attained on March 24. A second PCCF charging machine has permitted startup efficiency increases following minimum time startups. A subcritical monitor failure was repaired, and the P.C. chamber was relocated to increase its sensitivity.

Operation has been interrupted by a water leak and a rupture subsequent to the full central discharge in February.

F Reactor - G. F. Bailey

High inventories of air channels (15 at the end of the report period) have been necessitated by tube corrosion and the requirement of replacing tubes on an efficient schedule; lower than average ECT's have resulted, and increased enrichment has been required. Operation during the first half of the report period was interrupted by two shutdowns for ruptures and one for a water leak; since March 11 operation has been continuous.

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H Reactor - A. R. Kosmata

Following the startup on March 12 seven top HCR's became inoperable due to number six HCR sticking, causing an electrical circuit break which cut power to the two top rod banks. Control was maintained by operating at a lower level and by charging poison in PCCF tubes to compensate for the reactivity transient in the top of the reactor. Number six HCR has remained out of service; however, no decrease in efficiency has resulted since this rod is not normally used for equilibrium control.

Two near-side columns were added to the PCCF system in conjunction with an over-all program to improve the flattening capability of the PCCF system. The PCCF system now contains 24 columns.

Three shutdowns occurred during the report period, two due to water leaks and one due to electrical power failure. An attempted scram recovery after 40 minutes down following the electrical power interruption was unsuccessful due to insufficient reactivity.

KE Reactor - F. C. Franklin

Despite six shutdowns during the report period, four from equilibrium condition, the average ECT was maintained 35 tubes above the past 12-month average. Non-equilibrium losses per startup continued to be equivalent to only 0.4 day of full level operation except for a startup complicated by water in the lattice and a rupture. Use of approximately 160 poison splines for equilibrium and non-equilibrium control was responsible for this excellent operating efficiency performance; previously startup losses had been averaging slightly over an effective day per startup. Replacement of all solid metal charges with I & E material in the number two orifice zone, necessitated by increased peripheral tube powers, has been completed. A high residual exposure phase having maximum distributional flux cycling potential was passed with little trouble; a contributing factor in this absence of noticeable cycling was the ten per cent reduction in maximum tube powers at this time because of temporary five-pump operation.

KW Reactor - A. D. Vaughn

The new subcritical startup instruments have been installed and have performed satisfactorily during the last two startups. Full utilization of the spline system, using the new reel roll-up device to remove splines, has become standard operating procedure. Excellent performance has been experienced with the system during the last three startups.

Five outages, caused by ruptures, reduced the flattening efficiency; however, the average ECT was maintained slightly above the average for the previous twelve months. Two flux traverses taken during the month indicated approximately a nine per cent flux peak above a cosine in the center of the pile, little change since the outboard rod configuration was adopted.

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PROCESS PHYSICS STUDIES

Safety Control Studies

The operational experience test on the subcritical monitor system was successfully carried out at KE Reactor on March 12.

A fast recorder was connected to the No. 1 Galvanometer during DR's March, 1960, bulk temperature surge test in order to obtain some possibly useful metal temperature coefficient data. The indicated 100 MW total increase is in good agreement with previous predictions but the lag time of the galvanometer must be taken into account in evaluating rates of rise and the metal coefficient value.

The document recommending the use of the "square pile" method of total control evaluation as a basis for process standards has been issued under the appropriate signatures.

Pile Reactivity Studies

Checks are being made on the constants used in the IBM 709 Program for calculating product yields and burn-out. Because of the mating feature of the I & E elements their effective length is one-tenth inch less than their actual length. Adjustments for metal temperature are also being explored for sensitivity of results.

NPR startup transients have been further analyzed using the Giant Program to normalize analogue results for the 21-pound per foot fuel elements. In view of the large transient expected in the freshly loaded reactor it has been suggested that the feasibility of splines in graphite cooling tubes be considered for the preliminary startup heating period.

Control Efficiency Studies

Consumption of splines at the KE and KW Reactors has recently been nearly double the rate anticipated last fall. The higher rate is due partly to the larger number of outages recently and partly to the success of the spline coiler and "snake" (whole spline) removal methods. Because of recent chopper difficulties spline use during startups at the D Pile is limited to those in which temporary poison discharge outages would otherwise be required. The C Pile used six splines during a startup late in the month; the "snake" removal method was employed.

The poison displacement column facility now appears to be working well in out-of-pile tests and ready for in-pile trial of at least one column.

Two PCCF columns were added to the H Reactor system for improving equilibrium flattening. Relocation of some of the outer channels for improving startup control is still pending.

Operation of the central zone under the Unit Flattened Zone Discharging in DR Reactor, PITA 294-C, is even flatter than was expected. Two ruptures to date, one an I & E², plus a water leak have required shutdowns which have

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marred an otherwise good performance.

Shielding Studies

Strap-on thermocouples and Potter flow meters have been installed in selected thermal shield cooling tubes and the second thermocouple stringer for the uncooled channel is nearly completed. Under a supplement to PT-285-C flow and temperature data in the neighborhood of an uncooled thermal shield tube will be obtained.

Observations with flow meter vanes purposely stopped have alleviated fears of flow meter failure interfering with thermal shield coolant flow.

Reactor Fundamentals Training

Other members of the Operational Physics Sub-Section are assisting in giving talks for the Reactor Specialists classes on new startup instrumentation bases and use, total control, and supplementary control incentives and application.

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TESTING OPERATION

IRRADIATION TESTING OPERATION

DR-1 Loop

The DR-1 Loop was not operated during the report period, being shut down for maintenance work in preparation for the next test run of a semi-homogeneous fuel element.

The number 1 recirculation compressor was disassembled for inspection after a total running time of 3900 hours. No visible evidence of wear was found except at the contact of the shaft rub pick-up on the shaft end cap bolt. The compressor was re-installed in the loop after replacing these items.

Diaphragm heads for the number 1 and 2 Lapp compressors were relocated on the X-0 level. During a routine inspection, the reduction gears in the Varidrive for the number 3 Lapp compressor were found to be seriously worn. The gears were replaced, and the drive shaft end-play adjusted to prevent further wear. Attempts to charge a dimensional mock-up of the heterogeneous fuel element into the in-reactor tube were not successful due to curvature in the in-reactor tube. The edges of the piston ring were rounded off, and the mock-up moved past the restriction with only a slight increase in pushing force required. The restriction, located 10'7" from the outer flange, would not pass a 0.025" undersize gauge plug.

Heavier bases were installed on the number 1 and 2 motor-generator sets to reduce vibration during operation.

H-1 Loop

The empty in-reactor loop was on recirculation cooling for one-fourth of the report period and on process water cooling the remainder of the time.

On March 3, 1960, an attempt was made to charge the NRM fuel assemblies (BAPL-120-8B test). It was discovered that the transition heads on the flow tubes were too large and that an interference fit existed between these parts. The assemblies were discharged and returned to Bettis for thermocouple examination, repair or replacement.

The following work was accomplished in preparation for inserting the BAPL-120-8B test: (1) the transition heads on the flow tube were machined to the proper dimensions, and (2) extensions were installed on the thermocouple seals to provide cooling so that Teflon Conax seals may be used in place of the lava seals that are more difficult to assemble.

Messrs. B. O. Grable, W. R. DeBoskey, R. T. Esper and E. R. Smith, Bettis Atomic Power Laboratory, Westinghouse Electric Corporation, visited the facility March 2 through March 8 to observe the insertion of the BAPL-120-8B test assemblies.

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Physics Studies

Neutron Leakage Through "T" Seams - 105-C - Neutron leakage through a "T" seam at the C Reactor was measured using gold foils in a stack of plexiglas plates. The leakage rate at the point of measurement was approximately 3×10^4 n/cm²-sec. From the distribution in the plexiglas it was concluded that a six-inch radius semi-cylinder of borated hydrogenous material would reduce the "T" seam leakage to background level.

Production of Cobalt-60 - Curves were developed for the production of cobalt-60 as a function of exposure time and flux level, taking into account both the burnout of cobalt-59 and cobalt-60. Accuracy of estimating the activity of an irradiated cobalt sample is limited by the accuracy with which a rise factor can be obtained for the sample and in-reactor location.

Quickie Spectrum-E Test Hole - 105-F - Aluminum, iron, magnesium, nickel, phosphorous and sulfur were irradiated in the Quickie Facility in an attempt to determine the fast neutron flux spectrum. Data from two of the samples were lost because of laboratory delays that allowed the activities to decay away; one sample is yet to be counted. The results obtained indicate that reaction cross sections will have to be known with greater precision before an accurate neutron spectrum can be obtained.

Irradiation Experiments

The first of a series of capsules designed to provide specimens of uranium irradiated at constant temperature was charged into test hole 3674 at KW Reactor on February 26. The irradiation is part of the uranium swelling program sponsored by Hanford Laboratories Operation's Physical Metallurgy Operation.

Borescoping Activities

Process Tubes 1278, 2382 and 3691 - 105-KE - All three tubes were nearly worn through as a result of chattering of upstream dummy charges inadvertently left in the tubes.

Vertical Bowing Measurements

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

<u>Date</u>	<u>Area</u>	<u>Tube Number</u>	<u>Distance</u>	<u>Results</u>
3-5-60	105-C	4674-C	36'	Up .05" at 8'8" since 12-16-59 Down .03" at 21' since 12-16-59
3-23-60	105-DR	CTH-DR	20	No previous data

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Sample Irradiations

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

<u>Reactor</u>	<u>Test Hole</u>	<u>Facility</u>	<u>Request Number</u>	<u>No. of Samples</u>	<u>Material - Purpose</u>
KW	2B	Magazine	HAPO-119	6	Graphite (damage studies)
KE	2C	Hot Graphite	HAPO-177	6	Graphite (damage studies)
D, DR, H		PCCF	HAPO-184	12	Washington-Designated Program
B, DR, D		PCCF	HAPO-218	6	Natural uranium (fission product release studies)
F	E	Quickie	HAPO-219	2	Strontium (isotope production)
F	E	Quickie	HAPO-229	4	UO ₂ (thin films for damage studies)
C	D	Hot Graphite	HAPO-230	3	Inconel, Hasteloy, etc. (PRTR gas loop components)
KW	3674	General Purpose	HAPO-222	1	Uranium in NaK (swelling tests)
KW	2D	Magazine	ORNL-186	1	Fe (isotope production)
KW	2D	Magazine	ORNL-187	2	CaCO ₃ (isotope production)
KW	2D	Magazine	ORNL-193	24	KCl (isotope production)
KW	2D	Magazine	ORNL-195	2	Ta (isotope production)
KW	2D	Magazine	ORNL-198	2	Sb (isotope production)
KW	2D	Magazine	ORNL-200	1	W (isotope production)
KW	2D	Magazine	ORNL-202	2	Fe (isotope production)
F		Process Tube	ORNL-183	16	Co (isotope production)
F		Process Tube	ORNL-184	19	Be ₃ N ₂ (isotope production)
KE		Gamma	HAPO-148	6	Plastics, rubbers
KE		Gamma	HAPO-171	9	pH cells (gamma radiation damage studies)

COOLANT TESTING OPERATION

During March, 1960, activities of the Coolant Testing Operation included operation of the 1706-KE in-reactor and out-of-reactor equipment; operation of the 1706-KER in-reactor loops, and pre-start-up preparation of new and revised facilities.

A summary record of activities involving each facility follows, including significant items of performance, changes and improvements:

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

Six central zone tubes in KE Reactor, which are supplied by 1706-KE pumps, were operated during the month under the following specified production test conditions:

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<u>Tube</u>	<u>pH</u>	<u>Water</u>	<u>Dichromate</u>
4355	7.0	Filtered	1 ppm
4456	7.0	Filtered	1 ppm
4557) Control	7.0	Process	2 ppm
4863) Tubes	7.0	Process	2 ppm
4963	6.5	Process	2 ppm
5063	6.5	Process	2 ppm

On March 10, 1960, the FW-1 pump, supplying control tubes 4557 and 4863, dropped off the line, causing a reactor scram from a Panellit pressure surge. It was determined that the control circuit to the pump had opened and the pump was returned to service during the March 19 outage, after replacing all control circuit components. The tubes were supplied with normal reactor process water while the pump control circuit was being repaired.

1706-KE Mock-up Tubes

The steam-heated mock-up tubes were operated during the month for a continuing test on corrosion evaluation of sample lots of nickel-plated I&E slugs corresponding to lots of slugs which have recently been charged into one of the old reactors. These tests are being run in 120 C and 165 C process water. A test using 80 C process water was completed during the month.

Other tests completed during the month were: (1) evaluation of sprayed silicate coating for protection of fuel elements during shipping and charging, (2) hydriding effect of 110 C process water on etched and unetched Zircaloy-2 coupons, and (3) NPR control rod galvanic couple between titanium and aluminum in 80 C process water.

A test of aluminum Cermet coupons in 120 C process water was started during the month. These Cermets are being evaluated for possible use as reactor process tube material.

Out-of-Reactor Loops

ELMO-1 - The loop continued operation during the month on a raw water corrosion test of A-212 carbon steel with the primary side at 200 F and the secondary (raw water) at 175 F.

ELMO-4 - Installation of the loop was completed during the month and "shake-down" runs were started. The recirculating pump failed during a "shakedown" run and further loop operation is awaiting pump repair.

ELMO-5 - The loop continued operation at 290 C and pH 10.0 for uniform corrosion tests of coupons of:

Zircaloy-2
Zircaloy-4
Stellite-6
Stellite-12
Hasteloy-C
Monel

Nickel
D-979 Nickel Alloy
J&L Steel #313472
Hasteloy-X
Inconel

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ELMO-6 - The test using CO₂ gas addition for pH control in a 300 C system was completed during the month. All coupons were discharged and loop operation resumed on a clean-up and conditioning run.

ELMO-7 and ELMO-8 - Major loop revisions were completed during the month and pre-start-up checks and "shakedown" runs are being completed.

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

CEP-1 - The study of the effect of repeated decontaminations using alkaline permanganate-Turco 4518, followed by high temperature loop operation, was continued during the month. Two decontamination cycles were completed and loop operation resumed at 300 C, pH 10.0 with LiOH. Cumulative effects of repeated decontaminations on coupons of carbon steel, stainless steel, Zircaloy-2, and Stellite are being studied.

CEP-2 - Conditioning of the loop at 305 C and pH 10.0 was completed during the month. A test was initiated on fretting corrosion of Zircaloy-2 components, primarily in support of PRTR fuel element evaluation.

CEP-4 - The loop remained shut down during the month for replacement of primary loop piping. Analysis of pitting corrosion following previous decontamination testing revealed that the loop was unsafe to operate further with the previous piping.

REP - The loop has operated at 270 C and pH 10.5 on a conditioning run during the latter part of the month, in preparation for a decontamination test.

In-Reactor Loops

KER-1 - The loop remained shut down during the month awaiting further examination and analysis of the Zircaloy-2 in-reactor tube. During the March 23 outage, an unsuccessful attempt was made to obtain physical impressions of the questionable areas of the tube. A replacement tube is now available and will be ready for installation when pressure tests are completed.

KER-2 - The loop continued operation at 269 C and pH 10.0 during the month with fuel elements authorized by PT-IP-292-A.

KER-3 - The loop operated at 275 C, pH 10.0 with LiOH, during the month, with fuel elements authorized by PT-IP-288-A.

KER-4 - The loop continued operation at 285 C and pH 10.0 during the month with two fuel elements, as authorized by PT-IP-292-A and one fuel element as authorized by PT-IP-250-A, Supplement C.

Outage Performance

One unscheduled outage was caused by Coolant Testing Operation activities during the month. This was caused by the failure of the single-pass pump control circuit.

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A total of 11.2 hours of reactor outage time was charged to the operation and is broken down as follows:

<u>Date</u>	<u>Item</u>	<u>PT</u>	<u>Hours</u>
3-10-60	Lost production time from FW-1 pump failure	IP-197-A Suppl. B	7.2
3-10-60	Install new rear thermocouple in KER-2	IP-288-A	0.7
3-19-60	Repair leak on rear face piping - KER-4	IP-292-A & IP-250-A Suppl. C	0.6
3-23-60	KER-1 tube examination	None	2.7
	TOTAL		11.2

COMPONENT TESTING OPERATION

Irradiated Material Examination

Examinations were completed on the fuel elements from the following 32 tubes at the 105-C Metal Examination Facility during the month of March:

<u>PT No.</u>	<u>Tube No.</u>	<u>PT No.</u>	<u>Tube No.</u>
85A	2084-C	216A	2379-DR
95A	3089-D		2364-DR
178A	1863-KE	227A	0581-D
	2275-KE	255A	0168-H
197A	4557-KE		0268-H
	4963-KE		0368-H
	5063-KE		0468-H
216A	2054-KE		0768-H
	2072-KE		0668-H
	3153-KE		4172-H
	3174-D		4173-H
	3176-D		4174-H
	3264-D	280A	2667-D
	3274-D		2679-D
	3284-D		2680-D
	2464-D		2774-D

Machine Processing of Post-Irradiation Fuel Element Data

The new data sheets to be used in conjunction with the IBM processing of post-irradiation fuel element data have been received. The data from seven charges of PT-IP-216-A fuel elements were transferred to these forms. These data will be used in a trial run of the program, and the results will be compared with results now calculated. Post-irradiation fuel element data are being recorded on the new data sheets starting March 31, 1960.

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Process Tube Corrosion Monitoring Program

In-reactor measurements of 248 process tubes were completed during the month. Listed below are the number of tubes measured per reactor and the document numbers of the reports issued.

<u>Reactor</u>	<u>No. of Tubes Probologged</u>	<u>Report No.</u>	<u>HW Number</u>
B	36	8	64101
C	10	9	64153
F	69	10	64192
C	13	11	64256
F	16	12	64313
B	12	13	64320
D	59	14	64482
B	33	15	64484

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

Reactor	B	C	DR	H
Number of tubes	1	7	4	5

Tube 1265-B, which operated six months in the reactor, was removed because it was a leaker. The leak was found on the top wall, 9' from the rear van stone flange.

The seven tubes removed from C Reactor were examined to determine the current wall thickness and nature of the corrosion. From the data a more nearly accurate time can be established for the large scale replacement of C Reactor process tubes.

Tubes 2470, 3363 and 3486 were removed from DR Reactor for further investigation of rate-of-corrosion and to verify the accuracy of the Probolog on second generation tubes. Actual wall thickness of these tubes showed the Probolog to be accurate within ± 2 mils. Tube 3873-DR, which operated eight months in the reactor, was removed because it was a leaker. The leak was found on the top wall, 9-1/2' from the rear van stone flange.

Tubes 2979-H, 3661-H and 3673-H were removed because each contained a ruptured slug. Tubes 1879-H and 1763-H were removed because they were leakers. The leak in tube 1879-H was found 9-1/2' from the rear van stone flange. This leak was located in one of the many severe scratches on the outside surface of the tube. In leaker tube 1763-H, a transverse crack was found approximately 10-1/2' from the rear van stone flange.

Panellit Programs

Gauges processed by Maintenance personnel during the month totaled 307. Component Testing Operation inspection of these gauges resulted in detection of 31 gauges which did not meet inspection criteria, for a rejection rate of 10.1 per cent.

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In-board reliability examinations were performed on 1791 gauges, an amount 2-1/2 times greater than required per month to implement our program requirements. Of this number, 213 gauges were determined to be defective and were removed from service. This is a percentage defective of 11.9 and is compared to last month and yearly removal rates as follows:

Last month	15.4%
Last year, avg/mo	12.8%

In-board Bourdon coil leak examinations on 875 gauges, resulted in detection of no confirmed leaking coils. This particular group of gauges had been examined less than 30 days prior to subject examination and consequently, these results are to be expected.

Response times were determined on a total of 1791 gauges during the month. Of this number, 48 per cent, or 88 gauges, showed slow response and received corrective action. Slow response for each of the past six months is as follows:

This month	4.8%
February	7.4%
January	12.5%
December	9.5%
November	12.0%
October	6.9%

The trend for slow responses strongly indicates an improved response condition. This is attributed to large scale sensing line flushing activities. For example, detection of 27 slow response gauges out of 128 gauges tested at a particular reactor--21 per cent--prompted a decision to flush each of the 2000 sensing lines.

During the month, 96 gauges required comprehensive failure analysis examination.

Critical component inspection of Panellit components to be warehoused by the Spare Parts Records Operation, Warehousing Operation, was as follows:

DT-100-T Switches

Inspected - 205
Rejected - 94
Per cent Rejection - 45.8

Bourdon Coils

Inspected - 25
Rejected - 0
Per cent Rejection - 0

Design Change No. 353, Form 2B Switches, was approved and issued during the month.

Panellit systems improvement program accomplishments during the month were: (1) preliminary - for engineering studies and evaluation - cost quotations were obtained from Panellit Incorporated, (2) rough draft procurement specifications, HWS-7803, for new gauge procurement, was completed, and (3) form 2B switch, inspection, scope and procedure specifications, HWS-7802, was documented.

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MANUFACTURING OPERATIONPRODUCTION OPERATIONPRODUCTION PLANNING & SCHEDULING OPERATIONPlanning

Assumptions and production data for the eighteen month forecast were completed and forwarded to FPD and CPD Production Planning Units for use in their forecasts. Considerable effort was devoted to the production portion of the Plant Improvement Program study. A document was prepared and issued setting forth the proposed projection slug usage requirements.

Production SchedulingDischarge Concentrations

There were no discharge goal exposure plan adjustments effected during March. The recent trend toward lower discharge exposures was reversed to a small degree in March as indicated by the table below.

Comparison of March Discharge Exposure (MWD/T)

	<u>Solid Regular U</u>		<u>I&E Regular U</u>		<u>I&E Enriched U</u>	
	<u>6 Old</u>	<u>2 K's</u>	<u>6 Old</u>	<u>2 K's</u>	<u>6 Old</u>	<u>2 K's</u>
January	696	666	656	661	770	715
February	693	541	615	642	846	678
March	694	637	618	659	787	694

A resume of discharges outside the established goal exposure plan is given in the table following:

<u>Reactor</u>	<u>Tons Discharged</u>	<u>Tons Excess Usage</u>	<u>Material Type</u>	<u>Reason</u>
B	0.6	0.2	Reg.	Discharged tubes running hot.
	0.5	0.4	Enr.	To adjust enrichment.
C	11.9	3.2	Reg.	Rupture prone lots KJ186C and SJ084C.
	4.5	2.2	Reg.	Rupture prone lots KJ186C, KJ179C and SJ085C.
	0.4	0.3	Reg.	Discharge of tubes where maintenance work required removing water flow.
D	3.8	1.0	Reg.	Rupture prone lot SL102D.

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Continued:

<u>Reactor</u>	<u>Tons Discharged</u>	<u>Tons Excess Usage</u>	<u>Material Type</u>	<u>Reason</u>
DR	1.2	0.4	Enr.	To adjust enrichment.
F	10.2	6.3	Reg.	Rupture prone lot KL364C.
H	3.5	1.1	Reg.	Rupture prone lot S1111C.
	16.5	4.1	Reg.	Rupture prone lot KL388C.
KE	7.4	2.4	Reg.	Discharge of solid charges remaining in flow zone 2.
	6.1	1.2	Reg.	Discharge of remaining KIIN charges in preparation for five-pump operation.
KW	14.5	1.6	Reg.	Material discharged to utilize available outage time (goal exposure reduction under consideration).
	6.9	3.0	Reg.	Discharged tubes running hot.
	1.2	0.5	Enr.	To adjust enrichment.
	1.4	0.5	Reg.	Rupture prone lots KRL08D and KRL19D.
	87.7	27.2		Totals for Regular.
	2.9	1.3		Totals for Enriched.

Operations Analysis

Tube corrosion analysis continued and data for use in preparation of a revised tube replacement forecast were compiled. Documents were issued summarizing studies of the C Reactor and H Reactor central tube corrosion status.

PRODUCTION COMPUTING OPERATION

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

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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.

Over the past year there has been a steady growth in the complexity and volume of our computing and reporting functions. The IBM machines are now loaded to the point where routine processing can not be completed during regular working hours. In order to maintain normal standards of service it was necessary to operate the machines on two Saturdays during the month.

ESSENTIAL MATERIALS

Rail and truck shipments received in March were as follows:

Carload shipments for IPD	175
Carload shipments to other Depts.	134
Truck shipments for IPD	<u>165</u>
Total	474

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

100-B	433,300 cu. ft.
100-C	650,000 " "
100-D	298,300 " "
100-DR	233,900 " "
100-F	326,900 " "
100-H	474,900 " "
100-KE	382,300 " "
100-KW	<u>414,100 " "</u>

Total 3,213,700 cu. ft.

In addition to the routine duties involved in the procurement and delivery of essential materials, an appropriation request was prepared to cover installation of liquid aluminum sulphate feeding facilities at D, DR, F and H Areas and shipments of aluminum boron splines were expedited throughout the month from the Sintercast Corporation at Yonkers, N.Y. Samples for testing were also obtained from two other vendors who have shown interest in manufacturing these splines.

PRODUCTION REPORTS AND STATISTICS

Routine processing of the Daily Production and Daily Operations Reports and the Monthly Manufacturing Operation Record Report was continued. Significant time was spent in preparation for issuing the April IPD

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monthly record report which will subsequently be compiled and issued by Production Operation.

Data involving reactor operation and associated equipment were collected and tabulated in historical record books. Chart Books were maintained for the HAPO and IPD General Managers and the Manufacturing Operation Manager. A "Produc-trol" board was procured and set up to show certain up-to-date reactor data. A large volume of both routine and non-routine data were supplied to IPD personnel. Some routine data were also supplied to FPD, CPD and HLO.

MISCELLANEOUS ACTIVITIES

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

IPD's new training course "Fundamentals of Manufacturing" was started on schedule, with the first class of 16 participants holding its first session on March 14. The group represents an excellent mix of experience, functions, and organizational components. Other integrative staff work on Manufacturing personnel training continued in connection with union relations, radiation protection, and reactor fundamentals.

On March 9, two G.E. Mfg. Services representatives (R. J. Watkins and W. H. Coleman) met with IPD Manufacturing management, to discuss HAPO participation in the Company's "Manufacturing Training Program". Departmental liaison with the central Relations Operation was continued in connection with the consideration being given to this participation.

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MONTH		REACTOR OPERATIONS STATISTICS - PROCESSING														TOTAL	
March, 1960																	
		B		C		D		DR		F		H		KE		KW	
		NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.
INPUT PROD. - PU (S OF FORECAST)		100.2		100.0		103.3		117.7		94.2		103.1		110.8		109.7	1
TIME OP.R. EFF. (S OVERALL)		80.1		81.6		79.2		84.6		74.8		79.2		85.2		82.5	
NO. OF REACTOR OUTAGES & HOURS		NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.	NO.	HRS.
SCHEDULED		0	49.3	0	88.3	0	88.4	0	42.0	0	91.4	0	61.8	0	51.6	0	33.1
UNSCHEDULED - SCRAMS		1	8.3	1	0.5	1	6.5	0	-	1	3.6	2	9.9	2	32.0	0	-
- OTHER		2	90.3	4	48.4	2	59.9	3	72.7	3	92.6	3	83.3	1	26.4	3	98.3
TOTAL		3	147.9	5	137.2	3	154.8	3	114.7	4	187.6	5	155.0	3	110.0	3	131.4
BREAK'DN OF REACTOR OTSGE HRS.																TOTAL HRS. TIME	
PLANNED																	
CHARGE-DISCHARGE		26.9		41.4		32.2		26.5		36.5		23.5		37.4		32.8	
TUBE REPLACEMENT						18.4				42.7							
PROJECT WORK																	
PRODUCTION TEST				15.8		2.5		0.8		1.0		2.7		5.4			
MAINTENANCE		22.4		31.1		35.3		14.7		11.2		35.6		6.4		0.3	
MISCELLANEOUS																	
SUB - TOTAL		49.3		88.3		88.4		42.0		91.4		61.8		51.6		33.1	
UNPLANNED																	
CHARGE - DISCHARGE						1.6		0.3		4.3		0.4					
PRODUCTION TEST						2.0								(4)	7.9		
RUPTURE REMOVAL		23.2		21.3		55.9		40.0		39.6		3.6		25.7		79.4	
WATER LEAK		64.7		3.0				26.5		34.8		66.1					
MAINTENANCE		(1)	10.0	(2)	4.1	0.4		5.9		(3)	13.9	(3)	15.3			(6)	15.4
INSTRUMENTATION																	
PANEL LIT				0.5		6.5				3.6							
MISCELLANEOUS																	
SUB - TOTAL		98.6		48.9		66.4		72.7		96.2		7.8		(5)	24.8	3.5	
TOTAL		147.9		137.2		154.8		114.7		187.6		155.0		110.0		131.4	
NO. SLUG RUPT. (ALL TYPES)		1		2		2		2		2		1		1		3	
NO. NEW TUBES INSTALLED		2		0		11		2		35		2		0		3	
TYPE OF WATER LEAK - TUBE		1		0		0		1		1		2		0		0	
VAN STONE		1		0		0		0		4		0		0		0	

REMARKS:

- (1) Broken pigtail - 8.3 hrs.
- (2) VSR #35 dropping - 12.5 hrs.
- (3) Misc. rear and front face leaks repaired.
- (4) Failure of KER pump servicing KER tubes.
- (5) Faulty contact on the incoming 13.8 Kw line causing power loss to #4 & 5 pump motors.
- (6) Faulty Rheostat.

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MONTH March 1960		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.	9652		4390		2286	2974			19302			
TO FILTER PLANT (BLDG. 183)	GPM AVG.	62909		82235		69377	74700	161600	164800	615621			
TO FILTER PLANT (CSDR)	GPM AVG.	97290		61570						158860			
TO R & E (KER) & FEO	GPM AVG.			203				529		732			
TOTAL	GPM AVG.	169851		148398		71663	77674	162129	164800	794515			
TOTAL	M GAL.	7582.1		6624.4		3199.0	3467.4	7237.4	7356.7	35467.1			
RESERVOIR WATER (BLDG. 182)													
TO POWER HOUSE (BLDG. 184)	GPM AVG.	30		75		41	46			192			
TO COND. SYSTEM (BLDG. 190)	GPM AVG.			1620		1787	2928			6335			
TO COND. SYSTEM (190DR & 183F)	GPM AVG.			2700		450				3150			
TO EXPORT SYSTEM	GPM AVG.	9622								9622			
TOTAL	M GAL.	430.8		196.1		101.7	132.8			851.5			
FILTER WATER (BLDG. 183)													
TO POWER HOUSE (BLDG. 184)	GPM AVG.	180		184		139	155			658			
TO PROCESS (BLDG. 190)	GPM AVG.	71070	78335	67932	70554	66810	68600	156011	159453	738765			
TO 108	GPM AVG.	2500	4500	1075		1096	1210			10381			
TO 108DR	GPM AVG.			1076						1076			
TO FILTER PLANT (BLDG. 183DR)	GPM AVG.		12249	10063						(22252)			
TO F & S SYSTEM	GPM AVG.	171		235		189	127			722			
TO R & E (KER) & FEO	GPM AVG.			153						153			
BACKWASH	GPM AVG.	1237	2206	1577	1019	1143	4608	5589	5347	22726			
TOTAL	M GAL.	3901.8	4343.0	3671.0	3596.0	3097.0	3334.6	7213.8	7356.7	36513.9			
PROCESS WATER (BLDG. 190)													
TO REACTOR	GPM AVG.	70670	77935	67532	70154	66410	68100	152800	157700	731301			
TO REACTOR	GPM NOR.	80600	95000	79000	80000	81800	81400	172600	178900	849300			
POWER HOUSE (K AREA)	GPM AVG.							44	13	57			
108 (KE - KW)	GPM AVG.							2591	1340	3931			
TO R & E (KER)	GPM AVG.							176		176			
BUILDING USAGE	GPM AVG.	400	400	400	400	400	500	400	400	3300			
TOTAL	M GAL.	3172.5	3496.8	3032.4	3149.5	2982.4	3062.3	6964.3	7118.0	32978.5			
RIVER DATA													
ELEVATION (M/L.F.T.)	(MAX.)	390.8		383.3		370.2	374.6		385.0				
	(MIN.)	385.7		378.0		365.2	369.8		379.0				
	(AVG.)	387.8		379.8		366.7	371.8		381.2				
TEMPERATURE	AVG. °F	40.4		42.0		42.6	42.3		40.8				

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MONTH
1960

REACTOR OPERATIONS STATISTICS - POWER

SHEET 2

WATER TREATMENT DATA

AT BLDG. 102
BLDG. 103

MM GALS
MM GALS

CHEMICAL CONSUMPTION

CHLORINE (BLDG. 102)
(BLDG. 103)

LBS.
LBS
AVG PPM

Alumina
ALUM

LBS
AVG PPM

SEPARAN

LBS
AVG PPM

SULPHURIC ACID
(AS 100%)

LBS
AVG PPM

DICHROMATE

LBS

WASTE MATERIAL CONSUMPTION

SOLIDS

LBS

Alumina and Alum combined for average ppm in alum column.

100-B	100-C	100-D	100-DR	100-F	100-H	100-KE	100-KW	TOTAL
2808.2	4343.0	3671.0	2748.5	102 3097.0	3334.6	7213.8	7356.7	102 34572.8
11470	19632	17890	13590	13010	16254	31700	33000	156546
.5	.5	.6	.6	.5	.6	.5	.5	.5
25267	208311	215022	155630	167475	165675	397500	393600	25267 1782669
* 7.7	5.7	7.0	6.8	6.4	6.0	6.6	6.4	6.2
50	50	204	150	318	100	500	450	1822
.002	.001	.006	.006	.012	.004	.008	.007	.006
181850	225458	266922	171648	238358	222619	552800	581800	2441455
7.7	6.2	8.7	7.5	9.2	8.0	9.2	9.5	8.5
46800	52500	42900	44600	43800	47887	102400	105800	486687

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MONTH	REACTOR OPERATIONS STATISTICS — POWER										SHEET 3
March 1960											
ANALYTICAL DATA											
RAW WATER											
PH	PH AVG	100-B	100-C	100-D	100-DR	100-F	100-H	100-KE	100-KW		
TURBIDITY	PPM AVG	16	15	26	26	24	22	27	27	7.5	
FINISHED WATER											
PH	PH AVG	7.10	7.10	7.05	7.06	7.06	7.06	7.08	7.06	7.06	
TURBIDITY	PPM AVG	.005	.005	.006	.005	.007	.006	.007	.005	.005	
CL ₂ RESIDUAL	PPM AVG	.05	.05	.10	.10	.05	.06	.05	.06	.06	
DICHROMATE	PPM AVG	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	
TEAM DATA											
GENERATED MAX)	LBS/HR	127000	220000	122000	82000	551000	65000	70000	135000		
(NOR)	LBS/HR	81000	90000	65000	59000	295000	-	-	-		
(AVG)	LBS/HR	90400	96379	66495	59000	312274	41726	35855	77581		
TOTAL	M LBS	67256	71706	49472	43925	232359	31044	26676	57720		
TO PLANT	M LBS	57033	60806	43535	37248	198622	27939	24008	51947		
COAL RECEIVED	TONS	2292	2278	2347	2096	9013					
CONSUMED	TONS	3869	4000	2782	2331	12982					
IN STORAGE	TONS	25452	28263	18377	20142	92234					
GEN-STEAM/LB.OF COAL		8.69	8.96	8.89	9.42	8.94					
OIL RECEIVED	GALLONS						362030		362030		
CONSUMED	GALLONS						275216		275216		
IN STORAGE	GALLONS						745248		745248		
GEN-STEAM/GAL.OF OIL							112.8	110.3	111.6		
ELECTRICAL DATA											
TOTAL GENERATED KW MRS.							1635200	1736000	3371200		
Excess KWH							147200	248000	395200		

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B-C REACTOR OPERATIONGENERAL

Administrative Activities - Review of N Reactor criteria, specifications and prints continued. Considerable progress was made toward eliminating bus unloading and reloading at Main Gates. Efforts were continued to obtain pocket dosimeters for on-the-job monitoring of radiation doses. A new Non-Exempt Non-Unit Salary Plan was presented and explained to appropriate people.

Personnel Development - Four B-C Managers are participating in the "Business Operations In Our Changing Environment" course. B-C Supervisory Training in Basic Principles was started in March for first level supervision and specialists. Three B-C exempt personnel are participating in IPD Fundamentals of Manufacturing Training. 31 exempt personnel attended information sessions in NPR design and progress. 17 non-exempt personnel participated in eighteen on-the-job skill improvement training programs.

Cost Control Activities - B/C-submitted portions of the proposed FY 1961-1962 IPD Operating Expense Budgets were reviewed and finalized by collaborating representatives of B-C and Financial Operations.

Landlord Activities - A program was started for improving office lighting. A study was started on the advisability of varied office colors.

Suggestions - On hand beginning of the month - 57; received - 20; completed - 22; end-of-month backlog - 55.

B PROCESSING OPERATION

Production - Input production was 100.2% of forecast, and TOE was 80.1%. Limiting factors were tube powers and graphite temperatures.

Operating Experience - There were three unscheduled outages:

<u>Day</u>	<u>Hours</u>	<u>Cause</u>
3	74.2	Water leak - tube 1265 (internal) and tube 3089 (VanStone flange).
13	37.7	Panellit scram from rupture in 2184; removed with 6400 pounds force.
22	36.0	Panellit scram caused by a sudden failure of a rear pig-tail 3667.

Equipment Experience - The leak in tube 1265 was caused by internal corrosion at the top; the tube had been in the reactor only seven months. The rear pigtail that failed was an original type equipped with a Zone Temperature Wye fitting and was installed (new) in October, 1956. 119 venturis (0.310") were installed. The PCCF wiring failed on two occasions; a new trail cable was installed.

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Improvement Experience - Production Test IP-287-E, "Installation of Prototype Analog to Digital Converter (Flexowriter)" Preparations were completed for installation in April.

Radiation Monitoring Experience - Three exempt employees received planned doses in excess of the weekly control limit during discharge area decontamination work. Two Maintenance employees received doses of approximately 680 mrad and 625 mrad, respectively, which were greater than planned, during removal of a ruptured slug (investigated and reported in HW-64400, IPD Unusual Radiation Exposure Report).

An Operator's hair was contaminated to 40,000 c/m during discharge area work.

Rear-face decontamination work reduced maximum contamination levels from 20 rads/hr to 1 rad/hr.

Events Influencing Costs - Gas leak repairs reduced helium loss by about one-third.

C PROCESSING OPERATION

Production - Input production was 100.0 percent of forecast, and TOE was 81.6%. Power level was controlled by an Operating Severity Index rupture control limit.

Operating Experience - There were 5 unscheduled outages:

<u>Day</u>	<u>Hours</u>	<u>Cause</u>
1	34.8	Outage initiated 2-29 for rupture in tube 3087 (regular I&E slug).
2	0.5	Panellit scram - Gauge 2057, suspected oscillation.
4	30.5	Discovered VSR No. 35 had dropped into the reactor.
17	35.5	Rupture - tube 0566 (enriched I&E slug).
19	2.5	Repair of two faulty thermocouples.
29	33.4	Rupture - tube 2567 (regular I&E slug).

Equipment Experience - The details of VSR No. 35 dropping into the reactor during operation were reported in HW-64268. Ball valves were removed from 2771, 2772, 2774, 2775, and replaced with standard nozzles.

Improvement Experience - PT-IP-272-A - Pilot Test of Self-Supported Fuel Elements in Ribless Zirconium Process Tubes - Thermocouple trains were installed in 1069, 1076, 2264, 2289, 3467, 3773, and 3774. Six poison splines were used successfully for reactor startup. The nitric acid storage facility and dummy decontamination tank installation was completed and placed in use. A sprinkler system was installed at the 107-C West basin for contamination control during basin repair.

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Radiation Monitoring Experience - A maximum personnel dose rate of 3,500 mr/hr was encountered during removal of VSR No. 35. The D hole facility was charged and discharged with a maximum personnel dose rate of 1 r/hr.

Events Influencing Costs - 474 overtime hours were required.

B-C POWER OPERATION

Operating Experience - The raw water turbidity increased due to seasonal run-off. Bauxite feeders were in service 23 days with satisfactory results. No. 2 boiler at 184-B was inspected by Travelers Insurance Company and reported in good condition.

Equipment Experience - At 190-BA, pump modifications were completed, and No. 3 motor stator wedging and repair was started. The last of the four old process motors in 183-B Pumproom was sent off-plant for straightening the shaft and balancing the rotor. A third-generation impeller has been installed in No. 11 pump in 190-C; the old impeller was a welded-vane type installed in November, 1959.

Improvement Experience - Work was continued on converting to use of liquid dichromate at 183-B.

Events Influencing Costs - Chemical costs were higher due to seasonal high turbidity.

B-C MAINTENANCE OPERATION

Equipment Experience - 344 tubes were pressure tested at B. To test the OCD removal tools, four discharge ball valves were removed at C.

At 105-B, preliminary work was started for the replacement of gamma monitor sensing lines; 4 of the required 21 access holes were core-drilled into the discharge area.

The following major equipment was overhauled: No. 1 and 6 motors (4500 HP) in 190-BA; No. 5 motor (700 HP) at 183-B (done by a shop in Spokane); No. 4 pump at 183-B; No. 11B pump at 181-B. New impeller assemblies were installed in No. 1 and 6 pumps at 190-BA. At 190-C, No. 8, 10, and 11 pump impellers were inspected; No. 8 did not require replacement but No. 10 and 11 had cracks in the vane castings; No. 11 was replaced and No. 10 is awaiting a new impeller.

Maintenance Engineering - A multipoint temperature indicator has been modified to read both iron constantan or geminol thermocouples at 105-C. Specifications were drawn for a small, sensitive helium detector and a test unit was ordered. A study was completed on the status of the Zirconium tube pilot program at C, and another study was started on full-pile installation. A recommendation was made for the replacement of incoming power lines at 183-B; after concurrence from B-C Power, Project Engineering and Electrical Design, it was decided to replace the lines.

Productive Maintenance - 9,434 manhours of Productive Maintenance work was scheduled and 90% was completed.

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D-DR REACTOR OPERATION

GENERAL

Administration Activities

The Specialist, Manufacturing Administration, was assigned to assist the Manager, Production Operation in bringing the IPD Organization and Policy Guides involving the Manufacturing Section up-to-date. The Manager, D-DR Reactor Operation held a meeting with all nonexempt, non-bargaining unit employees of the Operation on March 29 to explain the new wage plan applying to these employees.

Personnel Development

Sixteen D-DR Reactor Operation exempt employees attended an information meeting conducted by the Manager, Manufacturing on March 2 in 100-D Area. One of the series of five information meetings on NPR Design, conducted by NPR Project Section representatives was held in 100-D Area on March 4. Approximately forty exempt employees attended this meeting.

Cost Control Activities

The study of operating costs for the balance of FY-1960, started in February, was completed and a summary showing potential means of reduction was forwarded to the Manager, Manufacturing. The requirements of the D-DR Reactor Operation, for the balance of FY-1960 in the category of Capital Work Orders, were assembled and forwarded to the Manager, Manufacturing. This was done in connection with the imminent depletion of funds in this budget. An analysis of Applied Material costs in FY-1960 was begun in order to predict future costs and to isolate items of unusual expense. Purpose of the study is to permit future extrapolation of the trend line for miscellaneous applied materials and actual prediction for the major items.

Landlord Activities

Routine.

D PROCESSING OPERATION

Production

Input production was 103.3 percent of official forecast. Operating levels were limited by a rupture control tube power limit and at one period in the month by bulk outlet limits. Time operated efficiency for March was 96.2 percent of official forecast.

Operating Experience

There were three unscheduled shutdowns for a total downtime of 154.8 hours.

<u>Date</u>	<u>Hours</u>	<u>Reason</u>
3-3-60	34.3	Panellit trip, unexplained, non-recovery
3-21-60	85.6	Rupture 3563-D, shutdown
3-25-60	34.9	Rupture 1463-D, scram

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Operating Experience (Con't.)

Outage time was used for charge-discharge, gas and fitting leaks, pigtail and tube replacement, rupture removal and venturi inspection for plugging.

Equipment Experience

Eleven tubes were replaced of which seven were scheduled and four found thin on probologging. The two ruptures, both I&E regular, were of the "Side Other" and "unclassified" type. A poison spline was in tube 3563-D at the time of the rupture. Since the spline could not be removed in the normal manner it was necessary to push tube, metal and spline together using force up to 8000 pounds. Force of 15000 pounds was required to discharge the rupture in 1463-D. The tube was removed and the channel left blank for retubing at a future outage. Five front face pigtails with broken braids and eighty-five rear face pigtails were replaced. Because of decreased Panellit pressure an inspection of five front venturis was made with one found 50 percent plugged. During two outages 187 orifices were replaced with .310 venturis to allow increased flow for reduction of bulk outlet temperature. A flow gain of 1000 gpm was thus realized. An additional 2300 gpm gain in process water flow was made when the eighth 190 pump was put in service on 3-31-60.

Improvement Experience

CG-706 - "Improved Gas Instrumentation" - Rod water Panellit gauges were moved to make room for new gas panel. A new instrument voltage circuit was installed from Electrical Equipment Room to Control Room in 105-D. Pre-installation calibration of all gas instruments was completed. CG-707 - "Sub-Critical Flux Monitor" - The flux monitors have been accepted with exceptions. Materials are being assembled to remove these exceptions. The monitors were used for all start-ups during the month. CG-791 - "Confinement Project" - Excavations were completed for the 117-D Building and the first concrete pour to the foundation slab was made. CG-865 - "Continuous Monitoring" - Monitoring lines have been installed on the wash pad and C Elevator.

Radiation Monitoring Experience

Significant dose rates received during the month were 2r/hr in rupture removal and 3r/hr in spline removal. Contamination to skin of 3000 c/m and to personal shoes of 40,000 c/m was easily removed. A radioactive particle in a laundry cart gave an uncorrected dose rate of 20 rads/hr. The source was not determined.

Event Influencing Costs

A total of 332.2 hours of overtime was used during the month.

Nonexempt Shift Overlap	20.5 hours
Shutdown Coverage	259.2
Exempt Overtime	<u>52.5</u>

Total 332.2 hours

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DR PROCESSING OPERATION

Production

Input production was 117.7 percent of official forecast. Time operated efficiency was 105.4 percent of forecast. Production was significantly higher than forecast due to higher than predicted TOE and ECT. Limitations were divided between graphite and bulk outlet temperatures.

Operating Experience

Operation was interrupted by three unscheduled outages for a total of 114.7 hours.

<u>Date</u>	<u>Hours</u>	<u>Reason</u>
3-9-60	38.5	Water leak, 3873-DR
3-22-60	44.2	Rupture, 3877-DR, shutdown
3-25-60	32.0	Rupture, 0859-DR, shutdown

The ruptures were a "side-other" failure in an I and E regular piece in 3877-DR and a "hot-spot" type in an I and E² piece in 0859-DR. Forces of 12000 and 5000 pounds respectively were required to discharge 3877 and 0859.

Equipment Experience

Two tubes were replaced, one an in-reactor leak, the other a stuck rupture tube. Five front face pigtails were replaced because of leaks through the braid, indicating an increase in this type of failure. The gas loss reduction program this month included inspection of the rear neoprene seal, replacement of leaking gland seals on No. 5 and No. 8 horizontal control rods and foaming of fifteen front face bellows. Changes were made to larger venturis and from orifices to venturis to increase flow to I and E metal in fringe tubes. Five rear thermocouples and three zone temperature thermohms were repaired. The thermal shield far outlet thermohm was replaced. Two batches of oxalic acid were run through the thermal shield to free flow indicators and clear sight glasses. A program was begun to change out O-rings on Panellit toggle valves to correct this leakage problem at DR. A second drill, lost in channel 3666-DR last month, was retrieved.

Improvement Experience

CG-706 - Improved Gas Instrumentation - The purge vent valve on top of the unit was installed during the month. A temporary control has been installed in the Control Room so that the purge valve can be used in case it is required. Rear Crossheader Gauges - Seven pressure gauges were installed on the rear at various locations to measure rear crossheader pressure during reactor operation. These gauges show a higher rear header pressure drop than was calculated, resulting in some adjustment to the TAI limit.

Radiation Monitoring Experience

Contamination up to 80,000 c/m was spread to building corridors from the storage area during a reactor outage. Disturbance of the building ventilation balance carried contaminants from newly-dried surfaces of the storage basin to other building locations. A quantity of personal clothing was held

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Radiation Monitoring Experience (Con't.)

for decontamination. The incident is reported separately by letter "Spread of Radioactive Contamination, 105-DR, March 25, 1960", D. S. Lewis to W. D. Richmond, dated March 30, 1960. Significant dose rates received were 1 r/hr installing a purge valve on the top of the reactor, 2r/hr in rupture removal and 2.5r/hr at 8' removing a twist drill from a problem channel. One case of hand contamination, 10,000 cm, was easily decontaminated.

Events Influencing Costs

A total of 361.7 hours of overtime was used during the month.

Nonexempt Shift Overlap	13.5 hours
Shutdown Coverage	340.2
Exempt Overtime	<u>8.0</u>

Total 361.7 hours

D-DR POWER OPERATION

Operating Experience

A power failure in 100-H, opening surge suppressors in B, D, and F Areas, caused a surge in the export system March 11. Water treatment was satisfactory at each of the water plants though changes in raw water turbidity and ph presented some difficulties. Liquid alum feed was started at 183-D filter plant on March 2. The base steam load on each boiler in service was decreased from 32000 to 27000 pound per hour.

Equipment Experience

181-D - It was necessary to replace 45 percent of the wedges in No. 1 pump motor and 100 percent in No. 10 pump motor. 184-D - The SK automatic steam valve on the emergency generator was replaced. 190-D - Impellers and wear rings on No. 2, 6, and 8 annex process pumps were inspected and found in good condition. 190-DR - No. 1 annex process pump was released for grinding of pump case, replacement of impellers and wear rings, installation of straightening vanes in the suction header.

Events Influencing Costs

Liquid alum feed at 183-D saved approximately \$1500 in March. Overtime during March was 94.6 nonexempt manhours.

D-DR MAINTENANCE OPERATION

Equipment Experience

Incoming power lines to 183-D were inspected for insulation deterioration and found in fair condition. Wooden supports and spacers were installed to prevent these sixteen year old lines from shorting out. Removal of the D elevator cab in 105-D is 80 percent complete. Maintenance of spline choppers in 105-D continued to present major problems both exposure-wise and mechanically.

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Maintenance Engineering

Modification of Control Room VSR Switch Panels - New VSR switches were installed in 105-D. At 105-DR the Beckman switches were modified slightly to meet processing requirements. "Deadman" Switch on HSR's - Detailed working prints based upon elementary circuitry provided by Plant Engineering will be prepared to cover installation of a deadman switch on the HSR's and an interlock on the PCCF system. Installation at 105-DR is anticipated by May 1 and at 105-D by May 15, 1960. Gamma Monitor Heat Exchangers - Heat exchangers and associated piping are being designed to cool the gamma monitor sample water. Such cooling should provide for better long term control of sample line flows and thereby give earlier, more accurate indication of ruptures. Gas Loss Reduction - Tests will be conducted in cooperation with 105-D-DR Processing to determine leak locations and methods of repair for the 100-D Area gas system. Approximately fifteen rear face bellows and eighteen front bellows were foamed at 105-DR using techniques developed by 105-B Maintenance Engineering. This has resulted in a 50 percent decrease in gas loss at that reactor. Eight bellow's bases where boots were installed were foamed at 105-D. The foaming work was accomplished at a rate of ten minutes per bellow. Discharge Chute Conveyor - An Appropriation Request is being prepared to provide a prototype ram for the 105-D chutes. Transfer Area Splash Tray to Control Contamination - An Appropriation Request is being prepared for submission in July of 1960 to provide splash trays for 105-D-DR and B. Improved Spline Disposal 105-D - An Appropriation Request covering procurement and installation of the spline wrapper system at 105-D has been routed to the manager of Manufacturing for approval. Thermal Loop Flow Indicator Sight Glass Cleaning - The sticking of sight flow impellers is the result of softening and straightening with resulting binding against the impeller's case. The original vendor will be contacted in the hopes that a more suitable material can be found for this application. Liquid Alum Feed System - The 183-D liquid alum system is giving satisfactory operation and approval to proceed with a similar system for 183-DR has been received. Pigtail Inspection - Continued inspections at 105-DR have shown that the J1 type adapter will vibrate loose and these are therefore being replaced with J2 adapters and pigtails as leaks are found. A detailed inspection at 105-D resulted in the tagging of some 100 spiral pigtails. Approximately 75 of these pigtails have been replaced with J2 assemblies.

Event Influencing Costs

The overtime usage for the month is as follows:

Nonexempt	-	666.8	manhours
Exempt	-	<u>225.0</u>	

Total 891.8 manhours

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F REACTOR OPERATION

GENERAL

Administration Activities

A review was made to determine what information could best serve our requirements if reflected in graph or chart form. A program has been initiated to achieve this on a "minimum requirement" basis.

A review was made of bus arrival times at the area and arrival times of shuttle buses at work locations outside the perimeter. Observations have revealed that our practices meet legal requirements.

Requests were submitted to Transportation Maintenance to improve the existing roadbed leading from the southwest corner of the old F Area perimeter and joining the existing highway. Improvement of this road for regular travel will appreciably expedite traffic between F Area and the other 100 areas.

The new salary plan for non-unit, nonexempt employees was reviewed with employees in a meeting conducted by the F Area Manager on March 29. The plan was also reviewed with supervision in other meetings.

Personnel Development

Exempt: Two employees enrolled in the "Fundamentals of Manufacturing" course.

One employee enrolled in the "Practical Politics" course.

Three employees enrolled in the new "Business Operations in our Changing Environment" course.

Our Instrument Maintenance Engineer attended four orientation sessions dealing with the following subjects: 1) gas instrumentation, discussed by Dr. Boyle of the Linde Company, 2) graphite stringer instrumentation (task force meeting), 3) panel wiring standards and specifications, and 4) elimination of pressure monitor row relays and inclusion of static switching.

Nonexempt: Six Maintenance employees attended tube replacement and rupture removal training courses.

Seven Maintenance employees attended copper tubing training courses.

Cost Control Activities

Funds were approved for proceeding with work on alum feed facilities in the 183-F Building; however, approval is still pending for the tank car chlorine handling facilities at this location. Annual estimated savings on these two improvements is \$21,300. Cost of work on the two jobs is estimated to run \$20,800.

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Landlord Activities

Plant and Industrial Engineering personnel moved into recently remodeled quarters in the 1713-F Building on March 7.

A program was outlined and submitted for installing new blacktop walks, re-surfacing existing walks, painting crosswalks where required and re-painting existing crosswalks.

F PROCESSING OPERATION

Production

Input production was 94.2 percent of forecast with a TOE of 74.8 percent. Equilibrium operation was limited by rupture control tube power limits.

Operating Experience

There were four unscheduled outages:

<u>Outage Date</u>	<u>Hours</u>	<u>Reason</u>
3-1-60	48.4	Rupture 2369-F.
3-3-60	3.6	Panellit trip - 2184-F.
3-9-60	52.1	Water leak.
3-28-60	83.5	Rupture 3873-F, charge-discharge, and tube replacement.

Equipment Experience

Process Tube Replacement

During the month, 69 tubes were probologged and 22 tubes were removed due to probolog results. In addition, ten previous air channels were retubed, two tubes were replaced because of leaks, and one was replaced because it had contained a stuck charge. A total of 35 tubes was installed.

Panellit Scram

A scram occurred on March 3. Investigation revealed a tubular dummy out of sequence in the rear dummy column of tube 2184-F.

Ruptured Fuel Element

<u>Tube No.</u>	<u>Date</u>	<u>Max. Removal Force</u>	<u>Tube Action</u>
2369-F	3-1-60	6500 psi	Tube removed and channel blanked.
3873-F	3-28-60	7000 psi	Tube removed and channel blanked.

Stuck Charges

<u>Tube No.</u>	<u>Date</u>	<u>Max. Removal Force</u>	<u>Tube Action</u>
4261-F	3-9-60	2800 psi	Leak tested and charged SA.
4285-F	3-28-60	2500 psi	Leak tested and charged.

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Process Tube Probing - Traverse - Borescope - Graphite Curvature

Tube 4189 passed a 9" probe, 4277 passed a 13" probe, and 4278 passed a 10" probe.

VSR 27

VSR 27 was clamped out on March 31 until a portion of the knuckle rod can be replaced.

Leak Experience

All headers were helium leak tested, indicating leaks on 4, 8, 9, 13, 14, and 40 headers. Stinger testing of these six headers resulted in locating 35 rear gasket leaks, 2 rear vanstone leaks, 2 front vanstone leaks, and one tube leak.

Rear Face - Process Water System

Twenty-five process tube outlet temperature thermocouples were repaired, and 12 rear pigtails were replaced.

Front Face

One front leaking pigtail was replaced.

Gas Conservation

Three sphincter seal lines were repaired. Number 27 VSR sphincter seal was replaced.

Rupture-Prone Metal

Eighty tubes of Lot KL-364-C were discharged below goal as rupture-prone material.

Improvement Experience

OGI-706 - Gas Instrumentation

Installation is 84 percent complete.

PT-IP-286-I

The second sliding sleeve adapter was installed on the rear of tube 0887-F for evaluation.

Radiation Monitoring Experience

Dose rates of up to 20 rads/hour, including 3 r/hour at the discharge elevator rail, were detected in a vertical column below channel 2369 immediately following discharge of a ruptured fuel element. Dose rates were reduced to near normal levels of 150 to 350 mr/hour following steam cleaning with Turco 4306B compound. One case of personal skin contamination was readily reduced.

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F POWER OPERATION

Operating Experience

The minimum steam loads per boiler were reduced from 32,000 pounds to 27,000 pounds per hour, effective March 15.

The controlled reduction in Columbia River flow by up-river dams on March 22 had no noticeable effects on F Area. The seasonable raw water turbidity reached a high of 152 ppm on March 27.

Three stator windings for 4500 hp process water pump motors in the 190-A building failed during reactor start-ups. The No. 2A failed at 9:56 a.m. on March 11, and No. 6A and 3A failed on March 31 at 6:15 a.m. and 6:25 a.m. respectively.

Equipment Experience

The repair work performed on No. 5 turbine in 190 building was completed on March 3.

The speed increaser gear for No. 7A process water pump drive in 190-A building was opened for inspection on March 9. Wear marks on unloaded face of teeth on drive gear were noted and photographed.

Replacement of stator for No. 2A process water pump motor was completed on March 18.

Improvement Experience

Design Change No. 351-F - Low Pressure Steam Annunciation, 184 Building

Work is approximately 75% complete.

Events Influencing Costs

Repairs to steam turbines, air compressor and forced draft fan. Replacement of stators in pump motors and replacement of 425 grate segments in #2 boiler.

F MAINTENANCE OPERATION

Equipment Experience

Instruments

One thousand four hundred and eighty gages were adjusted on the pressure monitor system and 28 were replaced.

Electrical

The original power receptacles provided in the storage area were replaced with a twist-lock type in an effort to eliminate operating problems.

Additional communication system speakers were installed on each end of the "C" elevator to facilitate valving operations.

A relay was installed at each of the emergency lighting panels at the 190 annex building to cause the tunnel lights to flash whenever the ringing circuit to the building telephone is energized.

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Mechanical

The second Russell sliding gunbarrel was installed on channel 0887. Gunbarrel measuring devices were installed on each of the Russell sleeves (0887 and 2088).

Two pressure gages were installed in the cushion corridor to record crossheader pressures. The 3/16" impulse lines were installed through the riser room to the middle of crossheaders 24 and 11.

A gas regulating valve was installed in the gas line to the inlet drip leg to provide a constant pressure source of gas.

As a result of radiographic tests in 184, nine sections of various soot boiler lines were removed and new sections installed.

Safety chains were installed on the overhead crane in the 190 annex pump room.

Maintenance Engineering

Mechanical Engineering

Building 183-F Liquid Alum Feed Facilities

Work Review #IP-60-58 was approved for plant forces. Capital work order #B22224 was issued and approved for performance of the work.

Building 105-F Acid and Rinse Tanks

The acid (H-1-11754) and rinse (H-1-11761) tanks fabricated by an outside vendor were received. These replacement tanks were capital items not included in Project CGI-871, "Improvement to Dummy Decontamination Facilities."

Instrument Engineering

105-F Control Beckman Chambers

Removed electrical grounds on three Beckman chambers. This change increased stability of the control Beckman instruments.

183-F Simplex Valve Controls - Loss of Air

Completed further study and recommended modification of the 183 simplex controls so that loss of instrument air will not shut off flow to the clearwells.

Electrical Engineering

4500 HP Annex Pump Failures

The nature of three motor failures during the month is as follows:

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- #2 - This machine developed "A" phase to ground fault during routine starting. The stator was replaced with improved ~~insulation~~ spare (rewound stator by G.E. with class "B" insulation).
- #6 - "B" phase to ground fault during starting. The faulted coil was located when the end bells were removed. A meggar check after isolating the bad coil showed an "infinite" resistance to ground. However, a high pot test broke "A" phase to ground at about 10,000 volts.
- #3 - "B" phase to ground fault during start (immediately following #6 failure above). Stator removed and replaced with a Seattle G.E. Service Shop modified unit.

Ball 3X ELP (Extra Low Pressure) Trip

Started design change which will provide automatic trip of the Ball 3X system upon a TORP of 30 psi as now required by Process Standards. This is in addition to other existing system trips.

Events Influencing Costs

Three motor failures at the 190 annex building and an assessment of \$3300 over that planned for replacement of bourdon tubes in the reactor Panellit gages.

A total of 862.6 nonexempt overtime hours and 211 exempt overtime hours were required. The outstanding material costs are reflected in bourdon coils, capital items such as recorder, cabinets, ultrasonic cleaner and turbine parts.

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H REACTOR OPERATION

GENERAL

Administration Activities

Studies were started aimed at revision of the bus pickup procedure for leaving the area. Coordination was provided for submittal of appropriate H Reactor Operation Management Personnel Inventories.

Personnel Development

Exempt: Three personnel were enrolled in the "Business in our Changing Environment" course. Training activities during the month consisted of courses in "Tube Removal," Flow Measurement, Rescue Training and Fundamentals of Temperature Measurement. Approximately 66 people attended.

Cost Control Activities

A draft of the Equipment budget for FY 1961 revisions and FY 1962 was received from the Financial Operation and commented upon. During the monthly cost meeting the FY 1960 budget was compared against actual to-date expenditures, with emphasis upon overrun items.

Landlord Activities

Studies of office space allocations were continued. A report outlining recommendations for obtaining additional space on a short range basis was presented to the Plant Manager. Work orders were issued for installation of exhaust fans in Level 3 Managers offices in the 1704-H Building.

H PROCESSING OPERATION

Production

Input production was 3.1 percent above forecast. Equilibrium power levels reached 1855 MW, a slight reduction due to rising river temperatures. The tube power operating limit was accordingly reduced from 1150 to 1135.

Operating Experience

The following outages occurred:

<u>Day</u>	<u>Hours</u>	<u>Reason</u>
2	67.1	Water Leak --- 1879
11	34.1	Power Failure --- F Area Pump Grounding
12	2.1	Panellit Scram --- 4257 - closed hoke valve
15	41.6	Water Leak --- 1763
31	10.1	Rupture --- I & E - natural in 1464

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Equipment Experience

Process Tubes

Two new process tubes were installed. The first replaced tube showed signs of external galling.

Panellit System

Twenty additional gages were converted to the 1C-90 gages at month's end.

Rear Pigtails

An additional twenty-three J-2 pigtails were installed.

Crossheader Screens

Eight front crossheader screens were examined and cleaned. One screen had two pieces of stainless steel scrap, the largest was 2" x 15". One other welding rod was also found.

Tube Orifice Pattern

Individual flow increases were made on individual tubes by the installation of one modified orifice, five venturi, and thirty-four reamed venturis.

Front Pigtails

Replaced 0462 which had some frayed strands.

HCR #6

The rod was removed from service because it was binding in the rod guide seal at approximately 160 inches.

Improvement Experience

Power Valve Turners

These units have been installed on the front elevator and will be tested in use during the next outage.

PT-255 - E-N - Demonstration Test

The remaining twenty tubes were discharged.

PCCF System

Two additional tubes were converted to PCCF use as a start for updating the pattern. The new short rear ball valves were used on the rear to eliminate the need for tip-off during discharge.

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Events Influencing Costs

Overtime for the month amounted to 247 hours.

H POWER OPERATION

Operating Experience

A complete area electrical power outage occurred at 9:56 A.M. on March 11. A critical power condition "Grade W" had deactivated the H-D Section of the 230 KV loop as requested for maintenance work, and the F-H active 230 KV tie relayed out. Details of the failure will be documented in a separate report. All emergency power equipment in the 100-H Area responded in a satisfactory manner.

The average steam generating rate was 59,000 pounds per hour. An evaporation rate of 9.42 pounds of steam per pound of coal was attained. The minimum steam generating rate was reduced from 32,000 to 27,000 pounds per hour on March 15, as recommended by Facilities Engineering Operation.

Standard quality water was produced throughout the month with an average alum and Separan feed of 6 and 0.004 ppm, respectively. During the last week of the month, the raw water turbidity increased from approximately 15 ppm to 164 ppm.

The 181-H forebay sandbar deposit was surveyed on March 9 by Construction Engineering and Utilities Operation. An estimated deposit of 5263 cubic yards was observed. The current deposition is approximately 17 percent greater than the survey of 8/2/57, but is 12.3 percent less than the survey of 10/29/52. No plans are being made for removal since it will be observed closely and the build-up rate plotted.

Equipment Experience

Radiographics Operation re-X-rayed and re-evaluated their recommendations on replacement of thin walled steam supply headers to the boiler soot blowers in the 184 Building. Those requiring replacement have been reduced to approximately one-third the initial estimate. A. J. Cronin, third party representative, inspected #1 Boiler on March 22.

In the 190 Building cone valve leak tests were run on #1 and #4 annex units on March 3. Extrapolated data indicates that #1 unit is leaking approximately 400 gpm. Rewedging of #6 annex motor was completed and #4 motor is currently under inspection. During the March 15 outage, straightening vanes were installed in the suction line of the #6 annex unit. This completes the vane installation in all eight units.

Improvement Experience

The installation of liquid alum facilities for 183 Building has been approved and plant forces are currently procuring materials. It is estimated that this facility will be in service by June 1, 1960.

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The area electrical consumption instrumentation was placed in service March 15.

H MAINTENANCE OPERATION

Equipment Experience

Forty-three Panellit gages were converted to 10-90 trip range, twenty-three were installed to replace defective gages and twenty to replace 25-75 range units. To date, 1021 25 to 75 range gages have been replaced with 10-90 range gages.

Twenty-two rear face thermocouples were repaired and six leaking wells replaced. A rear face inspection of rear thermocouples is scheduled each month to correct defective thermocouples and to survey for future problems.

The PM Class "A" overhaul of horizontal control rod reels #10 and #11 was completed. Malfunction of #6 rod was caused by binding in the channel step-plug graphite bearings. The bearings were relieved to allow clearance for the rod.

A six-inch hole was core-drilled through the near downcomer concrete encasement to remove and replace the thermopot sample line. The new sample line was installed from the downcomer to the sample room, but is not connected to the thermopot. This work was scheduled during operation of the reactor, but was rescheduled during outages to conform to the Safety Specialist's recommendations to reduce hazardous working conditions.

The #6 4500HP motor in the 190 annex was removed from service for inspection and replacement of stator coil wedges. The outboard brace ring was treated with Mylar insulation and retied with Permafil tape. The stator was subjected to an A-C high-potential test and a polarity index measurement. The unit is back in service and #4 motor has been removed for inspection and similar repair.

The 105 Building discharge area elevator UP and DOWN travel limit switch replacement with geared units and a circuit continuity (troubleshooting) panel has been installed and is complete except for final circuit tie-in connections.

Maintenance Engineering

During the month, a miniature potentiometer for the 12-tube average temperature indicator was received from the vendor and is being installed at the 105 Building main control console in place of a large Brown indicator.

Installation of the 8-point deviation recorder was completed after a number of minor problems were solved. The selector switch permitting continuous monitoring of any one point has not performed satisfactorily and may have to be returned to the vendor for corrective action.

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All materials necessary for fabrication of Geminol stringers have been received. It is planned to commence assembly of the stringers early in April.

A design has been developed for the installation of three 1/2 inch stainless steel thermocouple wells on the #3 tray of the 105 Building near downcomer. These units will be used on an experimental basis to determine correlation of temperature measured by RTD units to the temperatures measured by the present methods. It is anticipated that the RTD units will provide more accurate temperature measurement of the effluent water. A feature of this design will permit removal or installation of RTD units while the downcomer is in use.

Installation of the geared limit switches and control panels in the 105 Building D Elevator Machinery Room is nearing completion. The problem concerning compliance with elevator codes has not been finally resolved. A request has been made to the Manager of Manufacturing for approval of the code deviation. Following approval, the old limit switches will be taken out of service and the new system will be connected and tested.

A revised design change was prepared in final form for installation of open pressure electrical connectors at 190-B, F, and H annex motors. This design change will be circulated for approvals of concerned personnel. It will then be issued and the installation will be made as motors are scheduled for maintenance work.

Preparation of a general design change for the Horizontal Control Rod "Deadman" switch will be made by Facilities Engineering Operation and each area will be required to furnish detailed instructions. Materials for this work have been ordered and it is planned to commence installation as soon as they are received.

Replacement parts have been ordered for the defective Groves pressure reducing regulator located inside the Process Gas Storage Building. The Groves automatic dome loader for the outside reducing valves has been received and when the replacement parts on order are received, work will be resumed. It is estimated that approximately ten mandays will be required to finish this work.

Additional protective shielding for the 105 rear face pad has been installed and it is felt the pad trays are now reasonably well protected. Routine checks of the tray will be made at approximately three-month intervals to verify its operability.

During March, a design was prepared for installation of liquid alum water treatment facility at 183 Building. A work review has been submitted and approved for plant forces. The material has been ordered and when received installation will be made.

CENTRAL MAINTENANCE OPERATION

Engineering and Planning

Contacts were made for preliminary discussions regarding performing work on

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Project CG-871, "Improvements to Dummy Decontamination."

The potential for shop air being supplied from 190 Building was evaluated with negative results. The possibility of surfacing broaches with tungsten carbide was evaluated and appears feasible.

A master control chart for the heat treating of tool steels in the Central Maintenance controlled atmosphere furnaces was prepared. The design of tube cutter for F and H Areas was improved. Research and Development was assisted in planning for method of performing special core drilling work at 105-DR. A design problem in connection with vendor-supplied equipment for Project CG-707 was evaluated and resolved. Mechanical Development was assisted in a problem concerning a pigtail cutter. A nozzle seal for use with a push pole was designed. The study for a program concerning maintenance of roofs and flashing and replacement of rotted timber was continued.

Hot Shop work included the repair work to 1760 caps, 125 venturis, 9 splitters, and 9 broaches.

Knuckles were machined on two flow tubes for the KAPL loop. Project fabrication work included projects: MJA-8, CG-865, CG-839, CG-817, CG-707, and CG-706. The high pressure test cabinet was revised for the 1706 KE facility, two shipping casks were fabricated. A 190 KE high lift pump, charging machines for 105 KE and KW, and a turbine overspeed trip valve were repaired.

Metallizing included 15 K pump shaft sections, 2 D flocculator shafts, a D sanitary pump shaft, a multistage pump shaft from KE, 7 river pump shafts for B, and two pump shaft assemblies for B and D. A prototype NFR process tube and nozzle closure assemblies, an alpha chamber assembly, and an assortment of tools for zirconium tube work were fabricated.

Project and Special Services

Project activity during the month included:

CG-706 - B, D, DR, & F; CG-707 - D, DR, F, & H; CG-806 - KE & KW; CG-817 - B, C, KE, & KW; CG-839 - KE; CG-865 - D, DR, & F; MJA-8 - B.

Painting consisted of cyclical painting in B, D, and F, as well as special work of painting the 105-B work area curtain with a fire retardant and sand blasting and painting two K Area river pump casings with carboline.

Crossheader valve operators were installed in all reactors but 105-F. Installed high pressure test loop at 200-E Area. Sheetmetal installations and repairs included work at: 105-C, 105-D, 115-D, 105-DR, 108-F, 1716-F, 1717-F, 1719-F, 105-H, and 105-KW. Delivered two spare 4500HP stators to F Area and one was shipped offsite for repairs. Completed the revisions to the fire alarm system in K. It was decided to delete the special heads at this time.

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KE-KW REACTOR OPERATIONGENERALAdministration Activities

A list of planned trips for FY-1961 to attend Professional and Trade Society meetings was compiled. The initial listing of deferred vacation requests, (15 days in 1961) was submitted. A general information meeting conducted by the Reactor Operation Manager and separate meetings conducted by component managers and specialists were held to provide full information to non-unit, non-exempt personnel on the change over to the revised Non-Unit Salary Plan. Personnel requirements for the period through FY-1962 were compiled and submitted.

Suggestion Plan Statistics for the month were as follows: Start of Month-49, Received-13, Completed-27, End of Month-35.

Personnel Development

Exempt - Two personnel participated in the MTP Information Meeting conducted by R. J. Walkins and W. H. Coleman of Manufacturing Services. Participation in other development activities was as shown below:

<u>Meeting</u>	<u>Number</u>
NPR Design Information Meeting	32
Fundamentals of Manufacturing	6 (6 sessions)
PMS & L	1 (5 sessions)
Section Manager's Information Meeting	22

Non-Exempt - Twenty-three Maintenance craftsmen attended On-The-Job Training sessions. Sixteen Processing utility operators participated in Reactor Fundamentals Training sessions. Seven Processing personnel attended a session on Charge-Discharge Engineered Methods.

Cost Control Activities

A study was completed to determine what additional capital and expense type costs would be incurred within the Operation under a program of lower metal discharge exposures. The FY-1961 operating budget, as compiled by the Financial Operation, was reviewed and approved. Approval was obtained on the following Maintenance Job Authorizations:

Noise Abatement Program for 165-190 KE and KW and 190-C
Pressure Monitor System Repairs and Modifications, 105-KE and KW

At the Monthly Cost Meeting, the Cost Reduction Programs of the Operation's components were reviewed.

Landlord Activities

Routine.

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KE PROCESSING OPERATION

Production

Input production was 110.8 per cent of forecast. Power level was limited by graphite temperature and rupture control tube power limits.

Operating Experience

On March 10 the Number 1 process pump was taken out of service for a pump impeller change. A period of five-pump operation was maintained to permit class A overhauls of two additional pumps. Six-pump operation was resumed on March 24 with a rupture control limit of 1450.

Reactor outages totaled 110 hours for this month. Operating continuity was effected by the following:

<u>Day</u>	<u>Hours</u>	<u>Remarks</u>
10	49.0	Scram due to pump failure on 1706 single pass tubes 4557 and 4863.
19	30.0	Scram due to loss of two process water pumps caused by a breaker incident on Number 6 pump.
23	31.0	Reactor shut down due to rupture in tube 2044. (Solid, regular)

The one rupture experienced was discharged with the charging machine.

Equipment Experience

The reactor scrambled on March 19 due to loss of process water pumps. The cause of the pump loss was a power distribution incident on the breaker of Number 6 high lift pump.

Improvement Experience

The reactor contained 27 tubes charged with production test material at month end. Installation of equipment for the Power Rate of Rise (CG-806) was completed.

Radiation Experience

Dose rates over 1 r/hr were required 13 times. Six of these were associated with spline removal work.

Fabrication of a metal radiation shield with a lead glass viewing window was begun for installation on the end of the discharge elevator. It will be large enough to shield two persons engaged in waiting or observing.

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KW PROCESSING OPERATION

Production

Input production was 109.8 per cent of forecast. The maximum power level achieved was 25 units below the previous high. Maximum tube power limits were reduced after the reactor experienced three stuck ruptures. Nonequilibrium losses were reduced through the effective use of poison splines for start-up reactivity control.

Operating Experience

Reactor outages totaled 131.4 hours. Operating continuity was affected by the following events:

<u>Day</u>	<u>Hours</u>	<u>Remarks</u>
11	66.1	Panellit scram due to ruptured fuel element in tube 2060, (I&E Regular).
13	27.3	Reactor shut down to discharge ruptured fuel element in tube 2562, (I&E Regular).
17	38.0	Reactor shut down to discharge ruptured fuel element in tube 3557, (I&E Regular).

All three fuel element failures were stuck and required removal of the tube and metal column. High radiation exposure rates on the rear face hindered removal operations of tube 2060. A new tube could not be readily inserted, and the channel was converted to an air channel.

Equipment Experience

A total of 10 high trips were reported on the temperature monitor but no tube outlet temperature limits were exceeded. Two defective RTD's were repaired and returned to service. Defective condensers in the B-1 power supply failed on March 30, and automatic transfer to B-2 supply permitted repair of the system without interrupting reactor operation.

The fog spray system was used on four occasions to reduce the rear face contamination that was encountered during the removal of the tube and the ruptured metal column from channel 2060.

Improvement Experience

The four air powered portable valve turners were received and put into service during valving operations for the three outages. Operation was satisfactory and, except for minor safety and control considerations, the equipment was well accepted by the charging crews.

A spline in tube 1370 could not be removed from the tube. The tube, spline, and metal column were removed on March 13 without incident, requiring 3.5 outage hours. Following successful operation of the spline coiler, the spline chopper, hose reel and tank equipment were removed from the C Elevator pit.

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Radiation Experience

Of four radiation occurrences recorded, one was classified as a Lapse of Radiation Control with an assigned severity of 13 and involved the spread of contamination during removal of the rupture in tube 2060. Contamination to 22.5 rads was measured on rear nozzles, caps and the rear elevator during rupture removal work. Personnel dose rates up to 5 r/hr were required. Subsequent decontamination reduced the levels to normal. Levels of contamination up to 10.5 rads were measured on the exhaust tunnel floor.

KE-KW POWER OPERATION

Operating Experience

In order to accomplish class A overhauls of high lift and river pumps and install new type impellers in river pumps, pump operation was decreased from six pumps (all available units) to five for the period from March 14 to March 23.

Filling of the Priest Rapids reservoir, with attendant increase in floating debris in the river, has resulted in abnormal accumulations of this debris in the intake forebays. Twice during the month the services of a heavy tug were used to clear the trashracks and forebays.

On March 14 during a routine startup of the process pumps following a KW Reactor outage, the Number 3 high lift motor failed to start. Investigation revealed a failure in the center cell of the liquid rheostat. The rheostat was repaired and the pump unit was ready for service after a nine hour delay of reactor startup.

On March 19 while in the process of starting Number 6 high lift motor, a fault occurred in the 13.8 kv circuit breaker cubicle of the motor. This caused all switches connected to the Number 2 13.8 kv busbar to relay out and a scram of KE Reactor. All emergency equipment functioned properly. Parts were borrowed from Number 2 cubicle to get Number 6 unit back in service. The incident is covered in detail in a separate report.

Equipment Experience

Two flywheel cooling coils developed leaks and required replacement.

Third party boiler inspector, John Cronin, examined Number 2 boiler at 165-KW and Number 1 boiler at 165-KE, and pronounced both boilers in good condition.

Improvement Experience

Under CG-775, a new prototype impeller for Number 1 high lift pump, 190-KE, was installed and tested on March 11. Following satisfactory test performance, the test piping was disconnected and the unit was placed in normal operation the following day. Operation of the pump was satisfactory to month end.

Improvement Experience (Cont'd)

Larger capacity impellers were installed on river pumps Numbers 3 and 4 at KE when they were given class A overhauls. The change provides more water and assists in relieving the raw water shortage at 183-KE which periodically occurs.

KE-KW MAINTENANCE OPERATIONEquipment Experience

A total of 10,764 range changes and checks were made. A large portion of these were made to accommodate the transition from six to five pumps and back to six.

The following design changes were completed:

- Number 358, C Elevator Photocell Bypass, (105-KE)
- Number 339, Bulk Outlet Water Temperature Alarm, (105-KW)
- Number 346, Temperature Monitor Power Supply Modifications (105-KW)
- Number 250, Safety Circuit Revision Number 3 (1706-KE-KER)

Class A overhauls were completed on 254 items of equipment, Class B on 181 items, inspections on 70 and lubrication checks on 49 items.. The class A overhauls included high lift pumps Number 2 and 6 and associated equipment in 190-KE and Number 3 and 4 river pumps at 181-KE. The class B overhauls included generators Number 1 and 2 in 165-KE and 2 and 3 in 165-KW.

Maintenance Engineering

Dye was released into the effluent overflows of 107-KE-KW to check the leak pattern of the outfall line in the river. Photographs indicated no significant change since October, 1958.

The following design changes were approved and issued:

Design Change 362 - Raw Water Pump Number 3 and 4 Trip Circuit Revision-165-KE KW - The change provides for tripping the two pumps during loss of BPA power. This will reduce generator loading to achieve better generator stability in case of BPA failure.

Design Change 319 - HCR Withdrawal Upon Loss of Cooling Water-105-KE-KW - The change provides for automatic HCR withdrawal upon loss of cooling water after a number one scram.

Design Change 363 - Removal of V-72 Guard Valve Meletron-105-KE-KW - The Change provides instructions for removal of the guard valve.

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SUPPLEMENTAL CREWS OPERATION

Communications

A Round Table Meeting was held by the Manager of Supplemental Crews for the Supervisor and Supplemental Coverage Specialists of B and C shifts. Problem areas and general policy concepts were discussed.

The time distribution of the Crews from February 29 through April 3 was as follows:

<u>Area</u>	<u>Percent</u>	<u>Hours</u>	<u>Area</u>	<u>Percent</u>	<u>Hours</u>
100-B	9.6	931	100-F	15.3	1485
100-C	17.1	1655	100-H	14.9	1438
100-D	9.7	940	100-KE	10.7	1036
100-DR	11.5	1117	100-KW	11.2	1088

R L Dickman
R. L. Dickman, Manager
Manufacturing Operation
IRRADIATION PROCESSING DEPARTMENT

RLD:bam

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FACILITIES ENGINEERING OPERATION

REACTOR MODIFICATION DESIGN

RESEARCH AND DEVELOPMENT

The downcomer model testing program being conducted at Washington State University continued under Contract DDR-95. Testing at boiling conditions has been delayed to permit verification of the similarity between the test model and the prototype installation.

Results of the network analyzer study of the export water system were received from Washington State University. The analyzer study included 48 cases with different combinations of pumps and loads. The study results agree closely with available field test data and indicate the need for additional export system pumping capacity under some emergency flow conditions.

A new order for ceramic sleeves for the 105-K Reactor Building horizontal control rods has been placed with the Coors Manufacturing Company. Steps are being taken to cancel the previous order for these sleeves which had been placed with a foreign vendor.

DESIGN PROJECTS

CG-775 - 100-K Water Plant Expansion

A revised design impeller was installed in the prototype pump at the 190-KE Area Main Pump House for cavitation testing. Preservice testing indicated that the impeller met with specifications and that improved cavitation performance could be expected. Following three months service, the impeller will be inspected for cavitation damage.

CGI-791 - Reactor Confinement

Overall detail design completion for this project is 90 percent. All supporting design testing has been completed with the exception of DT-1050, Environmental Component Testing.

The fog spray systems have not been placed on automatic operation due to the erratic radiation background of the reactor buildings exhaust air. A gamma scintillation monitor has been set to read the Iodine-131 channel and provide a signal to actuate the fog spray system when the concentration of Iodine-131 in the exhaust air exceeds a preset level. Preliminary data indicates the interference with this system is caused by Argon-41. Field tests are in progress to determine the instrument changes required to provide a satisfactory signal for the fog spray system.

Phase III scoping is 96 percent complete. All significant scope items have been approved by the Design Council. Detail design for this phase is 78 percent complete. Thirty two detail design drawings were approved and 20 drawings were issued for comment during the month.

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The supporting design test program is approximately 97 percent complete. All tests have been completed except DT-1048, Environmental Component Testing, which is scheduled for completion in January 1961. This test is being performed to determine the effects of normal reactor exhaust air upon the individual air filters and halogen collectors. Test units, which were installed in the 105-B and F Reactor Building exhaust tunnels, have been in service for approximately five months. Pressure readings across the filters have increased 0.15" w.g. at 105-B and 0.30" w.g. at 105-F. Visual inspection of the filters at 105-F on March 28, 1960 failed to reveal any surface dirt that would account for the increased pressure drop. The color of the filter media was black rather than brown. A radiation survey gave readings of 15 mr/hour on the filters compared to background readings of 2-4 mr/hour.

CGI-839 - Modification of Fuel Element Test Facilities

A scope change in this project, relocating the 165 K Control Building KER power switchgear from the C-F emergency bus to the B-E bus, was approved by the Design Council and HOO-AEC. This relocation was necessary in order to equalize the bus loadings. To prevent overloading the emergency generator system, the 275 horsepower pump in Cell No. 3 supplied from 165-KE and the 275 horsepower pump in Cell No. 4 supplied from 165-KW will be dropped by electrical relay following a BPA failure.

The cell piping drawings are approximately 75 percent complete. Drawings of the building addition have been reviewed and returned to the architect-engineer for correction prior to final approval. Vendor drawings of the loop heat exchanger have been reviewed and comments returned to the vendor.

Prototype process tube nozzle assemblies have been assembled in the 189-D Building Test Laboratory mock-up for coolant pressure drop tests.

Work is continuing in the preparation of acceptance test procedures for this project. The ATP for instrument modification has been issued for comment.

CGI-844 - 100-K Coolant Backup System

A revised project proposal requesting total project funds of \$2,100,000 has been prepared. Issuance of Project Representative Meeting Minutes No. 2 and four scope drawings has been delayed pending HOO-AEC approval.

An interim report was received from Mr. Weller Reed, Consultant, which recommended that only commercially tested and proven power units be used for emergency pump drives. Since there are no gas turbines, except for test installations, in general use at this time, these units have been dropped from further consideration as alternate pump drive units.

The Department of the Navy has indicated that inventory levels will permit them to release two of the three 1000 horsepower diesel engines originally requested; however, a third used unit of unknown condition is available. The renovation costs of the third unit and conversion

costs for the three units is being investigated and will dictate final recommendations.

CGI-883 - K Water Plant Expansion

Project CGI-883 was initiated by approval of the interim project proposal which requested funds of \$279,000 to provide for the installation of one modified pumping unit at the 190-KW Main Pump House and the initiation of detail design for the complete project. Requisitions have been issued for all engineered items required for the one pump installation.

Scope design for the total project is approximately 90 percent complete. Ten scope drawings have been approved and four additional drawings have been issued for comment. A rough draft of the design criteria has been completed. The preparation of detail design for the total project was initiated by a Design Work Release issued March 25, 1960.

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EQUIPMENT DEVELOPMENT OPERATION

EXISTING REACTOR WORK

It was demonstrated that the addition of a moderate quantity of soluble oil in the charging of self supported fuel elements through the indexing device markedly reduced fuel element scratching. This supports the conclusion that this charging machine modification is suitable as an interim device for the charging of self supported fuel elements. It further supports the conclusion that the same type of device will handle bumper fuel elements, but this has to be demonstrated in view of the greater fragility of the bumpers.

Mechanical tests of reamed Parker fitting assemblies have all been favorable and laboratory tests indicate that reaming will permit a six to eight percent flow increase in B, D, F, type reactors. This will be complete on the development, now in progress, of a tool for doing this work.

Stamping heads have been procured to mark serial numbers on I&E fuel elements which can be photographed in the charging pallets. Application of these devices would provide a means to identify the tube, and location in the tube, for any slugs randomly selected from the discharge basin.

Daily operation of the cap remover has demonstrated its operability. Only one minor, and correctable, difficulty in the mechanism has appeared. The project proposal for procurement and installation of the cap remover carriage has been delivered to the AEC.

Laboratory test on a model flapper valve aimed at inexpensive remote operation of the rear face indicated satisfactory design except for the need of minor strengthening of the toggle linkage. Manufacturing Services in Schenectady has been requested to study the design with a view to minimizing the unit manufacturing cost.

NEW REACTOR WORK

Model studies show that the chain link net arrangement can be made feasible for a mattress pad for NPR fuel elements. A half scale model is being fabricated for further testing.

Thermal and bend cycle tests of a seal welded mechanical joint for the connector-to-nozzle and other joints of the NPR have been successfully completed. This device is regarded as a back up for similar mechanically sealed joints in the event leakage problems in such joints become more severe than the maintenance problem of breaking and remaking the seal weld.

A review of flow monitor tests to date show that the Daystrom-Barton-Luther prototype system meets existing NPR technical requirements insofar as this can be determined on the performance of the two channel prototype.

The third fuel element rupture test was conducted at ETR on March 1. Unlike the previous two tests, this fuel element produced a definite rupture, an apparent uranium emission of four to five grams, and a high loop contamination. Again the gross gamma-count rate rupture monitor prototype gave clear indication of the failure and went completely off scale as the loop contamination increased.

The test program on an NPR ball hopper actuating solenoid was complete.

PLANT AND INDUSTRIAL ENGINEERING OPERATIONDRAFTING OPERATION

The summary of services provided by the Drafting Operation is as follows:

New, revised, as-built drawings	250
Sketches, layouts and charts	230
Microfilm drawings added or retired	2845
Film prints produced	297
Check prints produced	715
Catalogs Added	221
Customers serviced print files	41
Customers serviced catalog files	95

INDUSTRIAL ENGINEERINGRear Face Improvements, 105-K Reactors

Operating crews at KE and KW reactors are now routinely using the new engineered system for handling nozzle caps during charge-discharge. Work performance using the new engineered methods and equipment is greater than the performance predicted at the beginning of the study.

Reactor Building Work Area Metal Handling, All Old Areas

The design-development of a suitable magazine container for storage and shipping of fuel elements is in progress. An economic report (HW-64164) on fuel clips was issued for the general information of those responsible for shipment, handling, and use of fuel elements. Tests of prototypic fuel clips in shipping service have been continued. The flow of fuel elements within the clip is also being studied.

Reactor Outage Management

A graphic means of presenting plans, schedules and progress of outage work has been devised, tested and is now being used routinely at the 105-F reactor. The graphic chart employs visual components which have become standard within the field of plant layout; a special printing machine is used to prepare templates rapidly and accurately. The use of this type of chart is being developed simultaneously with fuller use of "bogey" and standard times for controllable outage tasks.

Program of Charge-Discharge Improvement

The procedure for premarking the rear face tubes has been rechecked and rewritten for issuance as an approved procedure.

A requisition for 4,000 front face special marking tags has been issued. The tags will be used to indicate process tubes that are to be charged with special materials. These tags will be hexagonal in shape, three inches across the flats, green on one side and yellow on the other side. The use of premarking tags shortens the outage time for charge-discharge operation and helps to reduce charging errors.

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Portable Power Operator for Valve Turning

To reduce time and effort required to adjust crossheader valves, a powered tool is being provided at the near and far ends of front and rear face elevators. Installation of four portable powered valve operators was completed on the front face of the KE and KW reactors. Initial valving with the powered tools disclosed that this equipment will save about 40 minutes of outage time per outage for each K reactor. This savings correlates closely with that predicted in the justification for the tools.

Metal Unloading Ramp

An engineered system of unloading fuel elements and other material from delivery trucks at the reactor buildings is being provided at B, D, DR, and F. One ramp unit, purchased from Magline Inc. of Pinconning, Michigan, has been delivered to the 105-F reactor. Testing of this prototypic unit was completed and the unit was found to be satisfactory after minor alterations. Standard operating procedures have been prepared. A purchase order for three additional units for B, D, and DR was issued.

REACTOR, PLANT ENGINEERING

Improved Material Handling Budget Study

Document HW-63546 has been issued covering the above subject. A material handling system for both charge and discharge area was recommended on a lead reactor basis for FY-1962. Amortization period of the material handling project for eight reactors estimated at approximately two years.

Charge Seaters - All Areas

Equipment has been fabricated to take the place of the charging machines during the seating portion of the charging cycle. Nine seaters have been delivered to the areas for use to shorten the charge-discharge period. An additional safety feature was installed and tested at the 105-KE reactor during a recent outage.

Noise Abatement, C and K Main Pump House, K Control Building

A Maintenance Job Authorization for noise abatement work in 190-C and K and 165-K has been approved and steps have been taken to initiate detail design work.

Poison Splines

Efforts have continued to establish additional qualified vendors for poison splines. Three vendors who had indicated interest in fabricating poison splines have been contacted. Reactor Materials, Incorporated, Peekskill, New York, has submitted a 17-foot sample for testing.

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Safety Circuit Trip Identification System

The scope of a system to identify the cause of scrams more positively has been routed for approval. The preliminary total cost estimate was \$130,400 for equipment patterned after a prototype presently installed and operating at 105-DR reactor.

STANDARDS ENGINEERING

Spare Parts

New Line Items Added to Spare Parts and Items Increasing Stock Levels	112	\$17,950
Line Items Deleted from Spare Parts and Items Decreasing Stock Levels	4	12,300
Line Items Changed, i.e., Description, Etc.	34	
Spare Parts Items Authorized by Letter to Project Engineering	10	18,100
Spare Equipment Authorized by Letter to Project Engineering	1	1,700
Spare Part Items for Projects by SARs	31	690
Spare Equipment Items for Projects by SARs	0	0
Spare Part Items for 100-K	10	2,473
Engineered Items Reviewed	57	
Drawings Ordered Revised	0	
Stock Adjustment Requests (SARs) Processed	49	
Stores Stock Requests Processed	11	

To date a total of 115 uniform wall process tubes procured from the Reynolds Aluminum Company have been installed in the five old reactors.

Engineering Standards

Revisions to the Specification for Hose Couplings, HW-4587-S to include standardized air and water couplings were approved on March 17 and sent to the Standards Council.

The proposed guide for inspection and maintenance of water tanks has been revised to reflect IPD comments and sent to the Standards Council.

Craft Training and Testing

Seven instrument trainees completed a thirty-five hour course on the Fundamentals of Temperature Measurement. Methods of thermocouple fabrication, the two- and 3-wire resistance thermohm, and their associated bridge circuits were covered in this course.

The Instrument Specialist Selection Program for this period started on March 7. Testing was completed on March 22. Thirty-one Instrument Technicians participated in this program. Test results have been made available to supervisors involved.

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Productive Maintenance

Mr. J. A. Cronin, Inspector for the Travelers Insurance Company, conducted Third Party Inspections in B, H, and K Areas. His work included four steam boilers and a number of unfired pressure vessels.

WATER PLANT AND UTILITIES ENGINEERING

Engineering in Support of Power Forecasting

A comprehensive review of power use was started for the annual two year and five year power forecasts. Contacts were made with numerous technical and operating groups to acquaint them with the power problem and allow them to comment on proposed changes in power use. A preliminary forecast was given to Financial Operation for budget purposes.

Recording River Temperature and Flow Instrument

Design was completed on the temperature and flow recorder to be located below Priest Rapids, and the transmitting devices and receiving equipment for location at 183-B Filter plant, and material was ordered. The Atomic Energy Commission has received preliminary approval of a working agreement with the Grant County Public Utility District and the United States Geological Survey.

Continuity of River Flow at Priest Rapids

The problem of continuity of Columbia River flow at Priest Rapids Dam was reviewed with the Grant County Public Utility District. At present there is no sure way to insure river flow continuity under all conditions of dam operation. Consideration is being given by the P.U.D. to installation of a standby electric generator at the dam to automatically start and operate one gate in an emergency.

Area Tripout Tests

Analysis of data from charts and pictures obtained from tripout tests at 100-H, F and D areas continued. The data tabulated from high speed motion picture records have disclosed that regular power house records or skilled observations are not adequate enough to indicate the fine distinctions among the many events occurring simultaneously during trip tests.

4500 HP Motors

Activities in support of 4500 HP motor continuity continued as planned. The failure of three motors in March provided an opportunity for extensive measurement of electrical characteristics of individual stator coils. Valuable data related to possible corona damage were developed. Additional tests were conducted at the Seattle Service Shop of the General Electric Company, and restoration of the motors is moving forward.

Minimum Steam Loads as a Facility in the Secondary System Reliability

During the month an interim report was received from Weller Reed and Associates outlining preliminary conclusions related to this topic. Based on the report and on the continuing good quality of coal currently being received, a reduction of load to 27,000 pounds/hour/boiler was recommended. Indication was given that further reductions were feasible pending development of an organized program and integrated technique for evaluating the various facilities involved in setting safe minimum loads. Involved are such items as maintenance standards, instrument calibration, steam pressure, coal segregation, and safety philosophy.

Expansion Study

Data necessary for budget proposals and task force recommendations in the expansion study have been previously submitted in rough draft form. During the month extensive efforts were directed to completion of the final report.

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PROJECT ENGINEERING OPERATION

PROJECTS

CG-558 - Reactor Plant Modifications for Increased Production

Process Pump Impeller Improvement Program

Previously reported all pumps had been modified except for DR-1. On March 21, DR-1 pump was shut down and modification work to the pump case was started under the supervision of Mr. E. Budde, DeLaval field representative. The inspection program, intended to examine each rotating assembly after approximately one year's service, has been continued and the impellers observed to date show distinct improvement over any previously supplied impeller.

CG-600 - 100-C Alterations

During this period 190-C process pumps No. 8, 10 and 11 were examined as a part of the current program to examine each process pump as promptly as possible. Pump No. 8 was found to be in reasonably good condition although cavitated to a degree. Pump No. 10 was opened for examination on March 30, and after dye checking, two cracks were observed in impeller vanes. This impeller was one of the original integrally cast and had been repaired by the Byron Jackson plant. It had been placed back into service last fall and now will be removed due to the hazard of operating with a cracked vane. In its place a new style 18-8 stainless steel impeller will be installed. Pump No. 11 was examined on the 9th of March and the chrome fabricated impeller was found to be seriously cracked. This impeller was replaced with a brand new 18-8 stainless steel unit.

A meeting was held with the HOO-AEC and Byron Jackson on March 10 to discuss the present condition of the Byron Jackson pumps at 190-C. Byron Jackson agreed to repair dangerously worn impellers prior to the summer high water demand season.

CGI-791 - Reactor Confinement

Phase I - Fog Spray

Drawings for the installation of the thermocouple duct shields have been issued to Plant Forces. In attempting to put the modified sampling system into operation, we have found that the Compton effect arising from the Argon 41 in the reactor exhaust gas partially blankets the Iodine 131 channel. Further studies are now underway to determine the additional modifications required before the sampling system can be used as an automatic control for the Fog Spray System.

Phase II-A - Site Preparation

The J. A. Jones Company forces completed the work scoped in this phase of the project. They have been assigned additional work consisting of the

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installation of the modifications required to provide the permanent 440 volt power for the filter buildings in 100-DR, H, KE, and KW Areas. They are proceeding with this work as equipment is received on site.

Phase II-B - Filter Buildings

The R. B. Miles Company is approximately 22 per cent complete with their contract. Three concrete pours have been completed in F and H Areas, two in C Area, one in D Area and one in B Area. Excavation for the filter buildings has been completed in KW Area.

Phase III - Ventilation Modifications and Tie-ins

Revision 4 of the Project Proposal, which covers the remaining work on the project, was transmitted to the AEC on March 24, 1960.

General

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

The fabrication of the filter frames by Commercial Steel Fabricators of Seattle, Washington has stopped. The vendor has had the order since December 28, 1959, and is still unable to make satisfactory welds. A Project Engineering representative visited their plant on March 28, 1960, to determine just what had been accomplished to date and found that there has been no acceptable fabrication completed. GE Purchasing Operation was contacted on March 29 and efforts are being made at this time to get the fabricator in a position to complete his contract or, if this proves to be not feasible, to move the order to another fabricator.

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

Design work required for the moving and modification of a dormitory from Richland to 100-D Area was accomplished by the Commission with Doudna, Williams and Phipps, Yakima Architect-Engineers. The bid package was mailed out by the Commission March 31.

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

During this period a negotiated purchase agreement was signed between the Commission and Byron Jackson Pump Company for the procurement of twelve canned rotor process pumps. The signing of this order was accomplished after approximately two months of negotiation. All other major engineered equipment has been ordered. Central Maintenance is installing the rupture detection system in connection with this project.

CGI-845 - Increased Pumping Capacity - 181-C

The construction work on this project is in process with J. A. Jones forces. The General Electric Company modified switchgear arrived from Seattle shops

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March 10. It is being installed in the 181-B River Pump House. Concrete pads were poured to support the new 3000/4000 KVA transformers on March 11. The new concrete beam floor supports, which had been pre-fabricated, were placed under the No. 1 pump position on March 14. A lump sum bid package was prepared for the construction of the new 13.8 KV line and sent to the Commission to be incorporated with the dormitory moving project and should be mailed out on March 31.

PROJECT PROPOSALS

Project Proposals Submitted to AEC

CGI-791 Reactor Confinement
Rev. 4

CGI-824 Remotely Operated Cap Remover, KE Reactor
Rev. 1

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

CAI-890 Ventilation Improvements, 1704-K

Other Projects Awaiting AEC Approval

CAI-868 Columbia River Scale Model
Rev. 1

CGI-869 Operational Charge-Discharge, C Reactor

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

CGI-837 Critical Mass Monitoring, All Hanford 105 Buildings
(NCO-AEC disapproved March 10, 1960. To be sent to Washington-AEC for review.)

Requests Received for Project Preparation

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

CGI-883 Increased Process Water Flow, 100-K Area
Rev. 2

R-20931 Improvement of Gamma Monitor Systems for 105-B, C, D, DR, F, and H

R-20932 Project Fuel Elements - Lead Reactor

CPFF CONSTRUCTION SERVICE CONTRACT - LIAISON

We have issued four new work orders and supplemented four work orders for a total of \$22,008 to J. A. Jones Company in the month of March. All four new orders are classified as Davis-Bacon.

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PLANT FORCE WORK REVIEW

The HOO-AEC Labor Standards Board approved five jobs for assignment to Plant Forces which are estimated to cost \$21,690.

MANAGER
FACILITIES ENGINEERING

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RELATIONS PRACTICES OPERATION

PERSONNEL PLACEMENT

Twenty-three experienced BS/MS candidates were interviewed with four offers extended. Five PhD candidates were interviewed with no offers made. Six exempt men transferred into the Department from other HAPO and GE Components. Offers have been accepted by 12 Summer Program candidates: 4 professors, 4 graduate students and 4 college juniors. There were two transfers out of the Department.

OFFICE SERVICE AND PROGRAM ADMINISTRATION

Three new 1960 sedan delivery trucks were assigned to IPD's mail function as replacement vehicles.

IPD paid a total of \$326 in suggestion awards to 29 suggesters. The highest award was \$106.

COMMUNICATION

Mass communication activities included the publication of nine Management News Bulletins, one Round Table Guide, and three IPD Employee Headliners. Five IPD-OPGs and four HAPO-OPGs were issued during March. GE NEWS coverage included fourteen items about IPD activities totaling 170 column inches. Two Management Information Meetings were held during the month.

SALARY ADMINISTRATION

A two-day audit of our Salary Administration records was made by AEC auditors.

WAGE AND BENEFITS

Two employees retired during March. There were no deaths during this report period. The new nonexempt, non-unit wage plan was presented to IPD management on March 16, and to employees on March 29, 1960.

HEALTH & SAFETY

Three security violations occurred in March. No disabling injuries were reported but 79 medical treatment injury cases were treated. IPD completed its first disabling injury-free year on March 17, 1960, and accumulated nearly $4\frac{1}{2}$ million hours of exposure.

W. A. Shanker

FINANCIAL OPERATION

GENERAL ACCOUNTING OPERATION

During March, five IPD employees attended meetings of Professional and Trade Societies. Societies represented were: (1) the American Institute of Electrical Engineers, (2) American Welding Society, (3) American Society of Metals, and (4) American Institute of Mining Metallurgical and Petroleum Engineers. Expenses incurred for this purpose totaled \$1,146.

Attendance at Off-Site Courses and Seminars for March consisted of participation by one employee in a two-day Executive Study Group in Philadelphia, Pennsylvania. Expenses were \$277.

Two Assistance to Hanford authorizations were approved in March, ATH-IP-11-60 Study of IPD Optimization Methods (GEL) for \$3,000 and ATH-IP-12-60 Mark IV Reactor Discharge Valve Evaluation (Manufacturing Services Laboratory) for \$5,000.

The quarterly custodial inventory of Precious Metals was taken on March 31, 1960.

The annual physical inventory of Property of Others (POO) was taken on March 28, 1960. The count was made jointly by Custodial personnel and Financial personnel. Of the 112 items of record only one could not be located. A Missing Plant & Equipment Report has been issued for the item. One item was added to record as a result of inventory pick up.

The FY 1961 and FY 1962 forecast of Reactor and Other Special Materials was transmitted to Contract Accounting this month.

PRODUCT COST & BUDGET OPERATION

Planning, scheduling and preparing details for the budget has been a major effort. AEC schedules were submitted to Contract Accounting April 1.

Estimates of incremental power costs (water treatment chemicals) was prepared on three case studies of Reactor Plant Expansion for the Measurement Specialist.

Three meetings were conducted for the shift supervisors in B-C Power Operation to promote a better understanding of financial reports and answer questions.

Assistance was given F Plant Administration personnel in developing material to be used in periodic business meetings with the Manager Manufacturing.

D Power Operation has just completed conversion of facilities to liquid aluminum sulphate, at a cost below \$3,000. DR, F and H plan to follow suit with target date of April 15. The conversion will pay for itself in two months normal operation. With the turbid water season immediately ahead, it is possible IPD can save \$15,000 by June 30.

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Plans were made to revise the monthly operating report forms to book Rotational Trainee cost as a direct service. Formerly this was considered an indirect service. The change will be made effective with the July report.

Essential material inventories in B and C Processing Operations were observed.

PERSONNEL ACCOUNTING OPERATION

Suggestion awards paid calendar year to date amounted to \$2,036.

A total of 15,072 overtime hours were worked by the Department during the month. Hours worked during February were 12,782.

AUDITING

Revisions to thirteen AEC Manual Chapters were reviewed to determine their effect on IPD operations.

Observation was made of a physical inventory of Property of Others which in IPD consists of KAPL-120 Loop and its associated equipment located in 100-H.

Revisions of two Organization and Policy Guides were made.

Assistance was given to CA&O auditors in connection with a purchasing audit. Approvals and propriety of purchases were reviewed for a selected group of purchase requisitions.

PROCEDURES

Analyses were made of the current and expected usage of electronic data processing services by each component in the Department. This review was made in connection with the budget preparation for Supporting Service Liquidations for FY 1961 and FY 1962.

Certain additional evaluations were made of the adequacies of services received on the 709 computer in support of a plant-wide review of these activities. Assistance was also given C. A. Bennett of Operations Research and Synthesis Operation, HLO in his review of our Department's computing needs in connection with this same question.

A procedures review was made of the work of two general clerks in Central Maintenance Operation as a followup of recommendations made by the traveling auditors.

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Manager-Finance
IRRADIATION PROCESSING DEPARTMENT

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NPR PROJECT OPERATION

PROCESS DESIGN

Research and Development

The steady state IBM-709 heat transfer analysis program has been rewritten for the Monitor data processing system which provides improved solution acceleration and extrapolation procedures.

The IBM-709 piping flexibility program was completed and successfully used during the month. Several piping problems reported in the literature were run as test cases. Our results were in very close agreement with those reported for the reference cases. Data are now being prepared for the calculation of stresses in the NPR inlet and outlet moderator cooling system piping.

Project CAI-816

During the month, the Advisory Committee on Reactor Safeguards again considered the adequacy of the NPR confinement system design approach. Although their conclusions have not been formally transmitted to General Electric, it is understood that they accepted the basic approach as adequate for the isolated Hanford location with the stipulation that critical openings in the primary confiner should be equipped with backup provisions to increase assurance of confiner integrity in event of a major accident. Such provisions are being incorporated as part of the design effort, initiated during the month, to integrate the 105 and 109 Building steam release systems. A meeting was held with Architect-Engineer representatives at which agreement was reached regarding design bases for an integrated system. Continued close cooperation will be required to gain the improvements in venting efficiency and reduction in total system cost that are potentially available from this approach. It should be noted that the additional cost of vent back-up provisions probably will outweigh the savings possible from integrating the 105 and 109 systems.

In support of the engineering audit being performed by APED, a programming meeting was held during the month at which procedures were established for interchange of information. Agreement also was reached as to areas of initial effort and the first package of NPR design information was transmitted to them. At month end, the Hanford contact on this program was at APED to provide assistance and to answer questions in the assimilation of this basic design information.

Reactor Plant Design over-all progress stands at about 54 percent complete at month end. The final scope item, that of fuel element criteria, was approved by Project Representatives and Design Council during the month. Also approved were the changes in graphite criteria necessary to permit design to proceed on the program to provide maximum channel flexibility to accommodate long range contraction effects. The criteria document on code deviations, requested by the Design Council, was gotten underway. One of the major items for inclusion will be the primary loop over-pressure protection system, the bases for which were approved by Project Representatives and Design Council during the month.

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Project CAI-816 (Continued)

To assist in meeting project schedules, additional manpower was made available direct to Reactor Plant Design on a loan basis from Field and Operations Engineering as well as Facilities Engineering Section of IPD. The approximate numbers of people currently contributing to the reactor plant design effort is as follows:

Process Design	28
Equipment Development	22
CE&UO (Engineering)	28
Drafting	70

The latest heat dissipation system design progress schedule, dated March 19, 1960, reports Title II work as 43 percent complete, as scheduled. Scope design on this portion of the plant is calculated to be 83 percent complete. During the month the A-E submitted a number of potential cost reduction items for consideration including the integrated venting system mentioned above. Significant items approved from this list, in addition to the venting proposal, included elimination of one graphite cooling system heat exchanger and pump as well as certain 109 Building valving. Other items not involving relaxation in plant safety are still under consideration.

DEVELOPMENT AND TESTING

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

Engineering proposals were received from twenty-four vendors on or before March 22, 1960, presenting suggested designs for inlet butterfly valves and exit diversion valves to be considered in the prototype fabrication and testing program. Approximately eighty organizations submitted "no bids" after reviewing the engineering requirements and the requirements for proposal preparation; this procedure is believed to have eliminated more than three-fourths of the unqualified vendors. Most of the twenty-four vendors submitting proposals included designs for both types of valves and many included alternate designs for each valve. Most of the proposals were high in quality and many included unique design features that will be investigated. A review team composed of General Electric engineers and Kaiser engineers and procurement personnel is reviewing the proposals to classify and grade them in preparation to visiting several companies. To date, the prototype approach to procurement of critical items appears to be justified based on the quality of the proposals, the unique ideas suggested, and the elimination of numerous unqualified but interested vendors. A second prototype procurement item, bellows for the process tube-to-nozzle joint, has been forwarded to Kaiser Engineers.

Prototypic rupture detection equipment was operated during the third rupture test in the Engineering Test Reactor at Arco, Idaho, on March 1, 1960. The time interval between slug defection and a manual reactor scram at a

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high radiation level (40 R/hr) was thirty-three minutes. Instrument signals indicated a relatively slow rupture reaction for the first thirty minutes and a rapid reaction for the last three minutes. During the slow reaction period, rupture signals were obtained with the multichannel gamma energy analyzer and the GM tube detector. During the fast reaction, all rupture detection signals went "off-scale". The 3 ± 1 minute fast reaction time emphasizes the need for speed in rupture handling operations, i.e., sample decay time, detection, identification, diversion, power setback and/or reactor scram, cooling and discharge.

Nuclear Metals, Inc. has proposed a program to develop co-extruded zircalloy-carbon steel joint for potential use in joining process tubing to cooling water manifolds. Such a joint has application in future tube replacement operations, to back up existing mechanical joints (rolled or threaded), and for future reactor programs. The zirconium-carbon steel joining development program is an extension of a zirconium-stainless steel joining program that Nuclear Metals, Inc. is performing for duPont. Internal approvals, authorizing expenditures of \$10,000 in FY-1960 and \$15,000 in FY-1961, have been made and the contract is being processed through Research and Engineering, Purchasing, and the Atomic Energy Commission.

Connector-to-nozzle and connector-to-connector coupling tests have been accelerated to meet a specification target date of May 1, 1960, and a requisition issue date of June 1, 1960. In contention are couplings from Grayloc, Tube Turns, Marman, and Futurecraft. Attempts are being made to have tests on couplings exactly as they would be furnished in a bulk order. To date gasket rippling and space limitations place the Marman Conoseal in a doubtful status. It is hoped to qualify more than one coupling so that competitive bidding can be utilized.

A three-groove 11 percent rolled zirconium-to-steel joint was sectioned after six hundred thermal cycles at 1800 psi from 480 to 600 F and revealed no leakage past the first groove (first success in this area). White deposits, presumably lithium from the water treatment process, were observed on the first land and into the first groove, indicating water penetration to this depth. Two three-groove rolled joints, 11 percent and 14 percent, separated under pull-apart testing at 86,200 pounds and 97,000 pounds, respectively.

The leakage rate of a bell-ring sealed closure with a grooved seat has not increased through more than 1100 thermal cycles at 1800 psi from 480 to 600 F.

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FIELD AND OPERATIONS ENGINEERING

Construction

Jensen-Rasmussen poured the base slab for the 181 Building March 3 and 4, 1960. This was made in one continuous pour in a period of 34-1/4 hours and consisted of a total of 2278 cubic yards. Six of the seven pours necessary to bring all the walls on this building to a point ten feet above the base slab have been completed.

George A. Grant Construction Company has completed the pouring of concrete on the area septic tank and is installing tile in the tile field. This contractor has also installed the drain lines for the 1704-N Building and is working on the completion of the 1101 TC Administration Building.

Work was started on March 23 by Sound Construction Company on the excavation for the 105-N and 109-N Buildings.

Graphite

Grinding of the 2101 base cast iron has continued during the past month and it is now expected that the entire base will be brought within reasonable flatness tolerances within the next two weeks. Although the over-all base has assumed a general concavity of approximately .030", it is not anticipated that this will adversely affect the mock-up operation.

Over-all cleaning of the fabrication areas is nearly completed and it is planned to start movement of the existing "K" graphite inventory from the mock-up room into a better location with respect to the machining program. Actual machining of this material for use as filler blocks in the NPR top and bottom reflectors is scheduled to start early in April. Approved detail drawings for these blocks have recently been issued.

An over-all check of the building ventilation system is now underway to verify that air flows and static pressures are adjusted to meet the new requirements. The objective of this check is to assure a positive pressure within the fabrication and mock-up areas for contamination control.

The 305 test pile has now been calibrated for testing of NPR graphite samples, the first of which are due at HAPO about April 1. First bulk shipments will follow by about two weeks. Since machining of this material will not be initiated until after June 1, this will allow for an adequate build-up of stock.

The inquiry for the core grade graphite was sent to potential bidders on March 18 with a presently scheduled bid opening of April 11. However, it is expected to extend this latter date by one week since revised specifications are being issued in connection with certain details of the sampling procedures.

Design is 100% complete on pre-shop inspection stations and approximately 30% complete on fabrication shop stations.

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Quotations have been received and a purchase order placed on the air gaging equipment required to dimensionally check the notched graphite blocks.

Zirconium Procurement

Progress on the pilot tube orders is as follows:

Chase Brass and Copper Company

Eleven tubes were shipped on February 8. Thirteen tubes remaining from the first lot are now being welded. Some tubes will have up to four welds, utilizing short length extrusions. Metal for the remaining tubes for the pilot order, 53 tubes, is now being melted and forged. Chase has been working on improvements to the welding and inside surface conditioning processes.

Allegheny-Ludlum Steel Corporation

Eleven tubes were shipped on February 15, 1960. Fourteen additional tubes have been welded and are scheduled for tube reducing prior to April 1, 1960. Metal and billets for the remainder of the order, Lot B - 43 tubes, is now in process with some billets being canned.

Harvey Aluminum, Incorporated

One tube has been received with nine additional accepted at the vendor's plant awaiting results of corrosion tests. Metal for Lot B - 82 tubes, is now being melted with extruding scheduled approximately May 1, 1960.

Bid openings for the production lot of tubing was originally scheduled for March 14, 1960. This was extended one week due to a change in terms and conditions directed by the Commission. Results of on-site fluorescent dye penetrant testing showed Allegheny tubes incapable of passing this test without a modified surface conditioning process. Allegheny asked for a week's delay to investigate this. This was granted, extending the bid opening to March 28, 1960.

Bids for the 3/4" diameter zirconium tubes for graphite cooling were opened March 21, 1960. Wolverine Tube was the apparent low bidder at \$285/tube.

Zirconium On-Site Testing

On-site testing, including fluorescent dye penetrant and ultrasonic testing, has been completed on the 23 process tubes received to date. This testing furnished the opportunity of demonstrating the equipment requirements for this and other tube handling problems. A considerable number of items have been placed on a punch list for Kaiser's inclusion in the shop modification. Sub-contract work on the building modification is continuing. The contract for the mechanical modification has been let and work started March 28, 1960.

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Following is the present status of procurement:

Reactor PlantGeneral Electric Originated - Kaiser Engineers Purchase (49 Requisitions - 26 Alterations)

34 Open Requisitions - Estimated Cost	\$ 4,950,950
10 Open Purchase Orders - Actual Cost	211,317
5 Completed Purchase Orders - Actual Cost	<u>10,846</u>
	\$ 5,173,113

General Electric Originated - General Electric Purchase (5 Requisitions - Zirconium and Graphite)

3 Open Requisitions - Estimated Cost	\$ 9,795,000
5 Open Purchase Orders - Actual Cost	<u>3,487,040</u>
	\$13,282,040

Heat Dissipation PlantBurns and Roe, Inc. Originated - Kaiser Engineers Purchase (62 Requisitions - 96 Alterations)

44 Open Requisitions - Estimated Cost	\$19,679,600
8 Open Purchase Orders - Actual Cost	<u>5,390,076</u>
	\$25,069,676

NPR RelatedGeneral Electric Originated - Kaiser Engineers Purchase (5 Requisitions)

1 Open Requisition - Estimated Cost	\$ 17,500
1 Open Purchase Order - Actual Cost	33,160
3 Complete Purchase Orders - Actual Cost	<u>55,475</u>
	\$ 106,135

Grand Total all orders

\$43,630,964

Administration

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

Routine work processed this month:

Drawings	526
Criteria	26
Specifications	42
Requisitions	48
Other	<u>64</u>
Total:	706

Design Review and Consultation:

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

On Detail Drawing	133
On Specifications	41
On Scope Drawings	<u>15</u>
Total:	189

Operations Planning

A reliability study of the K Reactors using the same bases employed in a similar study recently completed for N-Reactor has been started. Results will be useful in evaluating the validity of the N study.

An outline of proposed training for each position in the 100-N Operation, giving a skeleton training schedule and time required, was prepared for Manufacturing as a basis for more detailed program development and for determining the timing of the training activities.

A schedule of construction activity dates that are of significance to Operations planning was prepared for use by Manufacturing.

The first list of personnel, selected by Manufacturing as acceptable for N-Operations assignments, was received by Field and Operations Engineering and Construction Engineering and Utilities Operation Inspection for assignment of individuals for off-site inspection and field inspection work as a part of their training.

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The detailed training program planning and development work for N-Reactor Operation has been re-assigned to NPR Field and Operations Engineering. Manufacturing will make available the personnel required to carry on this activity. A position guide covering these assignments has been prepared and submitted for approvals.

Communications

E. W. Wilson, D. C. Keck, H. G. DeVoss, and W. R. Conley conducted a series of informational meetings for exempt employees of the 100 Areas on February 29 and March 2, 4, and 17, 1960. Six meetings were conducted with an average of thirty personnel attending each meeting.

E. T. Tausch and A. C. Whiteside conducted an informational meeting for "D" Shift Power employees of "B" and "C" Area on March 3, 1960.

Briefing and written material was provided toward up-dating Kaiser Engineers' supervision on optical control techniques, equipment and personnel training for tolerance control on reactor construction.

CONSULTING ENGINEERS

W. J. Dowis assisted R. W. Beck and Associates with the interpretation of information supplied by the General Electric Company for the Federal Power Commission report.

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PROGRAM EVALUATION

Design Status

Reactor Plant as of 3-31-60

	<u>Wt'd Total</u>	<u>Certified Schedule</u>	<u>Actual % Complete</u>
<u>Title I</u>		100	99.7
Scope			
<u>Title II</u>			
Drawings	70	52	54.4
Specifications	8	60	40.8
Requisitions*	8	9	8.7*
ATP's	4	6	0.0
Development and Testing	<u>10</u>	<u>66.5</u>	<u>60.0</u>
Total	100	47	47.4

*Requisition percentage completion is now based on 400 engineering requisitions.

Heat Dissipation Plant as of 3-31-60

<u>Title I</u>		100	83
Scope Criteria			
<u>Title II as of 3-19-60</u>		44	43
Detail Design			
	<u>No. Req'd</u>	<u>No. Issued to 3-19-60</u>	
		<u>Scheduled</u>	<u>Actual</u>
Criteria	26	15	15
Preliminary Drawings (bid)	701	178	188
Detail Drawings (for const.)	738	68	67
Specifications (bid)	160	53	53
Requisitions	170	60	60
ATP's (no. being developed)	-	0	0

Composite Design Completion
(Reactor and Heat Dissipation Combined)

	<u>Certified Schedule</u>	<u>Actual % Complete</u>
Total	52.5	51.3

Cost Estimate

A new NPR cost estimate is being prepared and will be issued by Kaiser Engineers about mid-April, 1960. See last month's report for previously issued cost estimate data.

Schedules

Kaiser Engineers issued a revised subcontract schedule on March 24, 1960 and Burns and Roe issued a revised schedule on March 18, 1960. No revisions have been made to the over-all project schedule during this reporting period.

MANAGER
NPR PROJECT

JS McMahon:mf

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SIGNIFICANT REPORTS ISSUED

HW-64140 Operating Incident, Pump Failure 190-D-7, January 15, 1960, W. D. Richmond, Secret.

HW-64178 100-H Reactor Central Tube Corrosion, March 3, 1960, J. R. Young, Confidential Undocumented.

HW-64268 Operation with VSR in 105-C Reactor Following Start-up of March 2, 1960, March 8, 1960, A. R. Maguire, Secret.

HW-64372 Projection Fuel Element Requirement, March 18, 1960, R. L. Dickeman, Secret.

HW-64395 An Assessment of the Zirconium Tube Program C Reactor Pilot Demonstration Installation, March 18, 1960, G. O. Amy, Secret.

HW-64459 100-C Reactor Central Tube Status, March 25, 1960, J. R. Young, Confidential Undocumented.

Unclassified Electrical System Failure at 165-KE, March 19, 1960, R. S. Bell. X

HW-64475 Report of Preliminary Testing-Production Test IP-234-AE, Sup.1 Project CG-775 - Prototype Testing of the 190-K Process Pumping Units, March 25, 1960, M. H. Schack, Unclassified.

Unclassified Chemical Decontamination of the Hanford Production Reactors, March 1, 1960, H. F. Jensen, Unclassified.

Unclassified Interim Report #3, Van Stone Seal Insert Test IP-279-AE, March 15, 1960, H. F. Jensen, Unclassified.

Unclassified Application of Silicone Foam, March 1, 1960, H. F. Jensen, Unclassified.

HW-64272 Development Program for Reduction of Rear Crossheader Vibratory Motion, March 9, 1960, R. L. Loundagin, Unclassified.

HW-64310 Reamed Rear Parker Fittings for B, D, F Reactors, March 17, 1960, P. B. McCarthy, Unclassified.

HW-64325 Interim Status and Recommendation Report, Flow Monitor, March 11, 1960, A. J. Lindsay, Unclassified.

HW-64363 Safety Circuit Trip Identification System Interim Report, March 23, 1960, R. L. Richardson, Unclassified.

HW-57015 Primary Coolant System - Addendum 1 - Relocation of High Pressure
ADDL RD Emergency Dump Line, March 19, 1960, N. O. Strand. X

HW-62476 NPR Project Section - Monthly Design Test and Development Program Status Report - CAI-816, February, 1960, W. J. Morris.

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HW-63277 NPR Process Design Monthly Report - February, 1960, March 11, 1960, A. B. Carson.

HW-63608 REV A Note on the Material of Construction for the NPR Venturi-Connectors, March 2, 1960, M. C. Fraser.

HW-63923RD Proposed Relocation of the High Pressure Emergency Dump Line and Energy Dissipator, February 24, 1960, N. O. Strand.

HW-64093 Definition of NPR Water Terms, March 1, 1960, W. D. Bainard.

HW-64154 100-N Decontamination Facility Design Guide, March 8, 1960, W. D. Bainard.

HW-64354 Reactor Core Thermal and Nuclear Parameters for Use in NPR Primary Loop System Study, March 18, 1960, D. L. Condotta.

HW-64387 Pu-240 Concentration as a Function of Power Level, March 17, 1960, E. R. Astley.

HW-64442 Sample Shielding Casks for Non-Production Fuels Reprocessing Program, March 25, 1960, C. A. Mansius.

HW-64501 NPR Three Group Flux Distribution, March 31, 1960, D. E. Simpson.

HW-64269 Critical Pressure Ratio for a Nozzle with Two-Phase Fog Flow, March 8, 1960, W. J. Love.

HW-64255 RD Design Considerations and Equations for a Fuel Discharge Recovery System, March 8, 1960, W. J. Love.

TRIPS

O. H. Greager attended a meeting of the Advisory Committee on Reactor Safeguards in Washington D. C., 3/8-11/60.

D. H. Curtiss visited Harvey Aluminum Co., Torrance, Calif., to discuss fabrication of zirconium sleeves, 3/9-11/60.

G. C. Fullmer visited the Dresden Atomic Power Station, Morris, Illinois, to observe physics startup tests. He also observed the Experimental Boiling Water Reactor, Lemont, Ill., and visited the Flight Propulsion Division, Cincinnati, O., to conduct recruiting interviews, 3/10-18/60.

W. L. Stiede attended the Institute of Radio Engineers Meeting in New York, N.Y., and also visited the Argonne National Laboratory, Lemont, Ill., and the Dresden Reactor, Morris, Ill., to discuss reactor control problems, 3/19-28/60.

W. R. Conley visited Burns & Roe Co., New York, N.Y., to discuss NPR design, 3/20-4/2/60.

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S. S. Jones visited the Albrook Hydraulic Laboratory, Pullman, Wn., to discuss the DR Downcomer Model Program, 3/23/60.

M. H. Schack visited Washington State University March 23 to discuss testing of a downcomer model.

D. F. Watson attended an ASME Conference, Houston, Texas, March 7 -9 to discuss gas turbine applications.

J. W. McLaughlin visited Aerojet-General Corp., Azusa, Calif., to witness testing of Contract DDR-91, and several companys in Portland, Ore., and Seattle, Wash. to locate possible NPR tooling, March 20 - 25.

J. W. Green and R. W. Gilmore visited Arco, Idaho, February 25 to March 3 to run a series of tests on instrumentation response to NPR fuel element ruptures.

C. W. Botsford visited Joy Machinery Co., Lebanon, N.H. March 7 - 9 and Peters Engineering Co., Portland, Ore., March 15 - 16 to discuss overboring problems.

E. C. Wood visited General Electric Co., New York, N.Y., and G.E. Flight Propulsion, Evandale, Ohio and ANP, Cincinnati, Ohio, March 20 - 25 to interview prospective employees.

R. D. Gilbert visited the Bureau of Yards & Docks, Bremerton and Seattle, Wash., March 10 to confer on engineered performance standards for maintenance work.

H. A. Kramer made several visits to Priest Rapids Dam, Washington, to discuss installation of a new river gauge station.

A. McDonald visited G. E., Seattle, Wash. to develop a course of action appropriate to restoration of the failed 4500 HP stator.

D. E. Newby visited Commercial Steel Fabricators, Seattle, Wash. March 28 to determine progress on an order placed December 28, 1959.

R. T. Jessen, F. J. Mollerus and A. McDonald visited G. E., LM&G Dept., Schenectady, N.Y. March 30 - April 1 to discuss 4500 HP motors.

E. M. Kratz attended a Seminar on Pump Application and Operation sponsored by the Worthington Pump Company at Seattle on March 24, 1960. On March 25, 1960, a visit was made to the University of Washington at Seattle. Their nuclear program and research projects were discussed with Professors D. E. McFeron and W. Moulton.

M. H. Russ visited Burns and Roe, Inc., from March 18 - 31, 1960, to expedite design progress. Also visited Sheppard T. Powell Associates in Baltimore, Md., on March 25 to discuss NPR water treatment facilities.

E. R. Astley attended a Work Simplification Seminar sponsored by Manufacturing Services, General Electric Company, in Schenectady, New York on March 20-25, 1960.

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D. L. Condotta visited Burns and Roe, Inc., on March 20 - 24, 1960, for discussions concerning coordination of confinement vent design on 105 and 109 Buildings of NPR.

D. E. Simpson visited APED, San Jose, California, on March 30 - April 1, 1960, for consultation concerning NPR design engineering audit being performed by them.

J. F. Nesbitt visited the Western Gear Company in Los Angeles, California and the American Machine and Foundry in New York City on March 15 - 19, 1960, for discussion regarding metal handling equipment requirements and proposals.

G. E. Wade and J. R. Carrell visited Burns and Roe, Inc., on March 22 - 23, 1960, to discuss confinement system changes and resolve differences in the Graphite Cooling System.

L. G. Henke visited Burns and Roe, Inc., on March 23 - 25, 1960, to discuss primary piping specifications common to 105-N and 109-N.

F. C. Fisher visited the Pacific Car and Foundry in Seattle, Washington; Willamette Iron and Steel Foundry in Portland, Oregon, and Pacific Coast Engineering Foundry in Alameda, California, March 28, 29, and 30, 1960, to evaluate their capacity for fabrication of primary shield crates.

C. E. Love visited Harvey Aluminum, Inc., Los Angeles, California, March 7, 8, and 9, 1960, to participate in negotiation of price redetermination on the NPR pilot tube order.

C. D. Shadinger attended the Curtiss-Wright ultrasonic testing school at Princeton, New Jersey, from March 14 to 18, 1960. He visited Allegheny-Ludlum Steel Corporation, March 21, Chase Brass and Copper Company, March 22, and Tube Reducing Corporation, March 23 in connection with NPR zirconium process tubes.

E. W. Wilson spent the period from March 21 to April 2, 1960, at Burns and Roe, Inc., in Hempstead, New York, as a Heat Dissipation Plant Project Representative engaged in design consultation and scope review and approval.

W. J. Love attended a manufacturer's pump seminar, Worthington Pump Company, in Seattle, Washington on March 24, 1960.

W. J. Love visited the University of Washington Departments of Chemical and Mechanical Engineering in Seattle on March 24, 1960. He met with Professors W. Moulton and D. E. McFeron to discuss two-phase flow information.

F. P. Britson attended the American Power Conference in Chicago, Illinois on March 29, 1960.

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VISITORS

W. R. DeBoskey and R. T. Esper of Westinghouse Electric Corp., Bettis Plant, Pittsburgh, Pa., and B. O. Grable and E. R. Smith of Westinghouse Electric Corp., MTR Site Operation, Idaho Falls, Idaho, visited HAPO to observe installation of the BAPL-120-8B experiment, 3/2-8/60.

K. W. Newman, Turco Products, Inc., Wilmington, Calif., visited HAPO to discuss NPR decontamination problems, 3/8/60.

H. A. Andersen, Carborundum Metals Co., Akron, N.Y., visited HAPO to discuss zirconium and zirconium alloys, 3/9/60.

P. Loewenstein of Nuclear Metals, Inc., Concord, Mass., visited HAPO to discuss the NPR fuel development program, 3/14-15/60.

D. Tuel of Wyandotte Chemical Co., Wyandotte, Michigan, visited HAPO to discuss NPR decontamination problems, 3/15/60.

P. J. Hastings of National Carbon Co., Cleveland, O., visited HAPO to discuss NPR graphite, 3/15/60.

B. L. Bailey and L. H. Juel, Great Lakes Carbon Corp., Niagara Falls, N.Y., visited HAPO to discuss NPR graphite, 3/23-24/60.

G. A. Moudry of Harvey Aluminum Co., Torrance Calif., visited HAPO for a technical meeting on NPR process tubes, 3/28-29/60.

J. R. Eliason of G.E. Apparatus Sales Div., Seattle, Wash., visited HAPO to discuss design review for 100-K electrical system alterations under CGI-883, 3/25/60.

A. L. Bunke of Byron Jackson Co., Los Angeles, Calif., visited HAPO to discuss canned motor pumps for CGI-839, 3/21/60.

J. D. Cochran and Amon Groves of General Aluminum Corp., Spokane, Wash., and W. P. Dale of United Products Corp., Tacoma, Wash., visited HAPO to discuss aluminum castings and machine shop work on prototype front and rear face fittings on 3/4/60 and 3/8/60, respectively.

J. Powers of Longyear Company visited HAPO to discuss equipment for the Octant Monitor Drilling work, 3/14/60.

D. D. Welt and C. Claridge of Stromberg-Carlson, visited HAPO to discuss nuclear instrumentation as to detailed design and performance, 2/22-24/60.

W. F. Kamsler, of Epsco-West, visited HAPO to discuss rod position presentation instrumentation and a possible 1000 point high speed scanning system for NPR monitoring, 3/9/60.

J. Kellas and A. Nelson of Western Dynamics, Inc., Seattle, Wash., visited HAPO to discuss problems of pigtail fabrication, 3/2/60.

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G. Gunnoe of General Electric Co., Schenectady, N. Y., visited HAPO to confer on application of carbon brushes and brush application, 3/8-11/60.

E. Budde, DeLaval representative, visited HAPO to supervise work being done under the process pump impeller improvement program - CG-558.

C. J. Blom and F. Drahos of Byron Jackson Div., Borg-Warner Corp., visited HAPO to inspect impeller of pump #11 in Building 190-C.

J. F. Cage, Jr., B. Wolfe, and P. M. Murphy of the General Electric Co., Atomic Power Equipment Department, San Jose, Calif., visited HAPO on 3/8-10/60 for discussions on the NPR design engineering audit to be performed by APED.

Dr. H. Poritsky of the General Engineering Laboratory visited HAPO on 2/29 - 3/3/60 to discuss the NPR flow transient problem with H. G. Johnson of Reactor and Systems Design Analysis Unit.

G. Rice of Turco Products, Inc., visited HAPO on 3/15/60 to discuss layout of the decontamination facility.

Dr. L. G. VonLossberg of Sheppard T. Powell Associates, visited System Design on 3/28/60 to discuss NPR water treatment.

Dr. J. Lichtenstein and Mr. D. E. Klion of Burns and Roe, Inc., visited System Design on 3/17/60 to discuss the testing requirements of the primary coolant pumps.

A pre-bid conference for the production order of NPR process tubes was held in Richland, 3/1/60, at which the following representatives were present:

A. H. Smith	Allegheny-Ludlum Steel Corporation
T. T. Magel	Allegheny-Ludlum Steel Corporation
F. C. Hackett	Allegheny-Ludlum Steel Corporation
H. Burchoff	Chase Brass and Copper Company
J. Doran	Chase Brass and Copper Company
J. Baker	Chase Brass and Copper Company
G. A. Moudry	Harvey Aluminum, Inc.
C. Crawford	Harvey Aluminum, Inc.

R. Paul, Allegheny-Ludlum, visited the plant 3/17-18/60 to review Zyglo testing on tubes his company has shipped.

R. J. Watkins and W. H. Coleman from G. E. Manufacturing Services, visited IPD Management on March 9 to discuss HAPO participation in the Company's "Manufacturing Training Program".

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IRRADIATION PROCESSING DEPARTMENT
MONTHLY REPORT OF INVENTIONS OR DISCOVERIES

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MARCH, 1960

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

A Z Dickman
for General Manager
IRRADIATION PROCESSING DEPARTMENT

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**DATE
FILMED
01/08/93**