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HW-75089

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IRRADIATION PROCESSING DEPARTMENT  
MONTHLY REPORT  
SEPTEMBER, 1962

HW--75089

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Compiled By  
IPD Personnel

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October 12, 1962

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RICHLAND, WASHINGTON

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SUMMARYMANUFACTURING

Reactor input production (MWD) was 0.5 per cent below forecast; 4.8 per cent below at the six old reactors and 4.5 per cent above at the K's.

Over-all time operated efficiency was 69.6 per cent (73.6 per cent forecast); 65.4 per cent at the six old reactors and 82.4 at the K's. Efficiency was low at the old reactors due largely to process tube water leaks.

There was no increase in reactor power levels.

Nine ruptured fuel elements, six I&E natural including two oversize and three I&E enriched metal, were removed from the reactors. Two of the natural metal ruptures were at B, one at C and one at H. The two oversize ruptures were at C. Two of the enriched ruptures were at DR and one at B.

On the Tube Replacement Program, 547 new process tubes were installed for a year-to-date total of 4,871.

RESEARCH AND ENGINEERING

The reactor power levels were restricted by bulk outlet temperature limits during the report period.

Three overbore fuel failures were experienced at C Reactor (one on August 29). Two were split failures requiring discharge forces of 18,500 and 11,000 pounds; both were from the same lot which was declared rupture-prone and 27 additional tubes were discharged. The third failure was due to corrosion and a large number of damaged self-supports were noted when the tube was discharged. Examination of the Zircaloy-2 tubes after discharge of the ruptures revealed only minor damage and the tubes were recharged.

A Hanford Hot Press fuel element ruptured on September 23; the tube had an average exposure of 567 MWD/T. This tube was one of 18 in PT-IP-490-A for comparison of bond qualities with Sylcor Hot Press and Hanford Al-Si fuel.

The test irradiation of 14 N-Reactor prototype fuel elements in KER-4 was discharged September 25 at an exposure of about 1240 MWD/T.

A study of the seismoscope system was completed and reported in document HW-74975 entitled, "Review of Hanford Reactor Seismoscope Systems".

A study to determine the acceptability of the N Reactor ball hopper discharge rates was completed. It concluded that they meet the control criteria established for Phases I and II operation.

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## FACILITIES ENGINEERING

The detailed design of new process tube assembly components included in the zirconium process tube replacement program at the 105-K Reactors has been completed. Prototype quantities of the new impact extruded nozzle have been received from the vendor, and are considered acceptable. The tube vendor has received billets sufficient for 500 tubes. Several tubes have been reduced; however, Vidigage inspection equipment is not yet fully installed for checking these tubes.

The remaining track blocks in the inner half of HCR Channel No. 17 at 105-KE Reactor have been removed from the reactor and cylindrical graphite HCR channel sleeves were installed.

Design, prototype fabrication, and testing of drive units, tooling and vacuum system for process tubes channel treatment have been completed. Improved efficiency of aluminum tube replacement has been demonstrated.

Off-reactor testing of equipment to permit installation of vertical safety rod channel sleeves continues in preparation for an on-reactor demonstration tentatively scheduled for late November.

Design development of charging machine concepts capable of charging self-supported fuel in smooth bore zirconium tubes is in progress. Two off-site concepts are nearing design completion. Preliminary testing of an on-site fabricated machine has been initiated.

The first of the 275 HP pumps from Loop No. 3 being repaired by the vendor on Project CGI-839, Modification of Fuel Element Test Facilities, 1706-KER, failed in their plant and will not be returned by them until the middle of October.

The last pumping unit for Project CGI-883, Increased Process Water Flow, 100-K Area, was installed and is operable.

## NFR PROJECT

The engineering problem with primary loop cone valves was resolved when 16-inch, 10-inch, and 8-inch cone valves passed the high-pressure, high-temperature seat leakage requirements.

High deceleration forces are being encountered in the testing of a number of horizontal rod drives at Rucker. Ten drives have been accepted and stamped by General Electric Inspection. The anticipated problem with erratic motion at low shim speed is not being encountered.

Final underwater system tests have been performed without incident on the segregation equipment for handling irradiated metal, at American Machine and Foundry.

Failure sequence analyses have been made of the heat dissipation plant instrumentation.

A purchase requisition was issued for 1,004 transformers to isolate the Flow Data Logger from the Flow Monitor and thereby protect the reactor from potential spurious scram signals generated in the Flow Data Logger.

Installation of the power relay panels in the 105 Building was accelerated. This now permits the major work of installation and connection of electrical cables to proceed without interruption.

Title III testing of the water treatment plant has been started. Testing of the 183-N water filter building has been completed. Testing is now in progress in the 163-N demineralization building. General Electric's Instrumentation Technicians started preparation work for calibration of instruments in the 184-N Building on September 18.

Pouring of the concrete for the top shield of the reactor was completed September 19, and installation of the top skin plate has now started.

Pipe fabrication in the HUICO shop is proceeding satisfactorily, however, field installation activities have been lessened by the reduction of Kaiser Engineers' forces assigned to pipe work. This was necessitated by late delivery of valves in the 105 Building, hangers in the 109 Building, and by inadequate work sequencing through the HUICO shop.

GENERAL

RESPONSIBILITY

Effective September 1, 1962, in the Irradiation Processing Department, the following changes in responsibility were made.

In the Manufacturing Section the functional responsibilities of the Reactor Maintenance Engineering Units were transferred to Applied Reactor Engineering Operation. Those responsibilities relating to plant maintenance and engineering support performed by engineers in Facilities Engineering were also transferred to Applied Reactor Engineering Operation.

In the Facilities Engineering Section, the Plant Engineering Sub-Section and the Reactor Modification Design Unit were discontinued and a new Sub-Section, Design Engineering, was established incorporating much of the work performed by the eliminated components.

In the Project Engineering and Equipment Development Sub-Sections some realignment of functional assignments was made.

FORCE SUMMARY

	<u>Exempt</u>	<u>Non-Exempt</u>	<u>Total</u>
General	7	2	9
Research and Engineering	99	60	159
Manufacturing	433	1453	1886
Facilities Engineering	90	35	125
NPR Project	89	23	112
Financial	18	10	28
<b>TOTAL</b>	<u>736</u>	<u>1583</u>	<u>2319</u>

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SAFETY, SECURITY AND RADIATION EXPERIENCE

There were 78 medical treatment injuries, 3 security violations, one radiation exposure exceeding operational control, and no disabling injuries.

INVENTIONS

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

<u>Name</u>	<u>Date</u>	<u>Title</u>
W. J. Love	9-17-62	Vibratory Fatigue Test Machine
W. J. Bott	9-19-62	A Positive Method to Determine That a Flushed
L. H. Munson		Reactor Process Tube Is Empty

*AB Greninger*  
 General Manager

AB Greninger:DLD:ewm

MANUFACTURING

PRODUCTION OPERATION

There were no discharge goal exposure adjustments during September. Discharge exposures at the K Reactors were allowed to drift slightly above the target exposure to compensate for underexposure due to tube replacement work at the old reactors.

Discharge Exposure Comparison (MWD/T)

	<u>Natural Uranium</u>		<u>Enriched Uranium</u>	
	<u>6 Old</u>	<u>2 K's</u>	<u>6 Old</u>	<u>2 K's</u>
July	683	650	800	775
August	647	626	884	798
September	597	692	825	860

Rail and truck shipments of Essential Materials were as follows:

Carload shipments for IPD	-	226
Carload shipments for other Depts.	-	176
Truck shipments for IPD	-	<u>174</u>
Total		576

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MONTH	REACTOR OPERATION STATISTICS - PROCESSING											TOTAL HOURS	% OF TIME
	B	C	D	DR	F	H	KE	KB	TOTAL				
SEPTEMBER, 1962													
INPUT PU (% OF FORECAST)	103.5	88.6	49.1	92.8	124.2	95.5	103.5	105.5				349.4	6.1
TIME OPER. EFF. (% OVERALL)	81.1	71.7	23.8	75.2	92.7	47.5	81.1	83.7				64.9	1.1
NEW TUBES INSTALLED	0	0	354	2	1	200	0	2				229.6	4.0
WATER LEAKS - TUBE	1	1	1	1	0	2	0	0				437.5	7.6
- VAN STONE	5	0	6	1	0	0	0	0				406.3	7.0
FUEL ELEMENT RUPTURE	3	3	0	2	0	1	0	0				12.9	0.2
HELIUM CONSUMED - M CU. FT.	605.2	720.7	352.8	499.1	215.4	219.8	186.6	283.4				130.9	2.3
UTILIZATION OF REACTOR OUTAGE HOURS													
CHARGE - DISCHARGE	46.8	53.9	56.7	35.0	19.1	42.5	54.9	40.5				12.4	0.2
RUPTURE REMOVAL	16.8			24.5		23.6						108.3	1.9
WATER LEAK	27.5	49.4	95.0	37.2		20.5						1752.2	30.4
TUBE REPLACEMENT	9.2	11.7	230.6		2.1	152.1	10.8	21.0					
MAINTENANCE	24.2	18.1	126.4	80.9	31.1	62.5	21.8	41.3					
STANDARD CHECK	4.0	1.7	4.4				2.8						
PRODUCTION TEST	6.4	68.5	10.0	1.0		9.2	34.0	1.8					
PROJECT WORK			.8					11.6					
OTHER	1.2	0.5	25.5			68.2		11.7					
TOTAL	136.1	203.8	549.4	178.6	52.3	378.6	136.0	117.4					
REACTOR OPERATION STATISTICS - POWER													
RIVER WATER PUMPED - M GALS.	9015.8		6175.0		3311.9	2982.5	8836.1	8163.7					
WATER TREATED - M GALS.	3239.8	5103.6	2980.8	3079.7	3268.7	2875.4	8807.7	8163.7				38485.0	
WATER TO REACTOR - GPM NOR.	88300	100,200	87400	86200	88900	84500	205400	201500				37519.4	
FINISHED WATER - ANALYTICAL DATA												942400	
TURBIDITY PPM AVG.	.002	.005	.005	.003	.003	.002	.004	.003					
PH AVG.	7.00	7.00	7.03	7.04	6.92	7.00	6.61	6.60					
CL <sub>2</sub> RESIDUAL PPM AVG.	.05	.05	.15	.15	.05	.14	.23	.27					
DICHROMATE PPM AVG.	.99	1.39	1.00	1.00	.99	1.06	1.83	1.69					
STEAM GENERATED M LBS.	60944		65696		31800	39544	25985	24307					
EVAPORATION RATE/LB. OF COAL	9.13		8.55		8.61	8.34	115.0	108.7					
EVAPORATION RATE/GAL. OF OIL							1585200	1635200					
TOTAL KW - HR GENERATED												3,220,400	

B-C REACTOR OPERATION

Three outages occurred at B Reactor to remove ruptured fuel elements. In addition, two scrams were experienced; one unexplained Panellit gauge trip and one due to the accidental actuation of a VSR switch.

C Reactor experienced three outages to remove ruptured fuel elements, one Panellit scram, and was shut down once for installation of shielding in the front of an air channel.

Satisfactory acceptance tests were performed on the motor controls for the supervisory control instrumentation in Building 181-B/C. Completion of this modification is contingent upon receipt of annunciator equipment.

At B Reactor, five rear Van Stone leaks were found which required the removal of four process tubes and the reforming of the flange on the fifth tube.

Due to binding of No. 38 VSR at C Reactor, it was necessary to broach the channel to remove protruding portions of graphite filler blocks. The rod is in service and operates satisfactorily.

Rear face moisture at C Reactor caused damage to the electrical control switch-gear of the discharge area work platform. Eleven additional outage hours were required to return the platform to normal operational status.

An unplanned exposure was received by a Maintenance craftsman when disconnecting a hose used on the tube replacement vacuum debris removal equipment, August 26. Final exposure evaluation results estimate the exposure received to be nine rads to the extremities which is one rad over the operational control limit.

D-DR REACTOR OPERATION

D Reactor was down until September 18 for scheduled tube replacement work. Three other outages were caused by process tube water leaks. DR Reactor was shut down five times. Two outages were caused by fuel element failures, two by process tube water leaks and one by the failure of a front nozzle injection fitting used on a Production Test for injecting material to stop process tube leaks.

Third Party inspection of the Building 184-D No. 3 boiler revealed slight pitting inside the mud-drum. As a preventive measure, the addition of disodium phosphate and sodium sulphite to boiler water was increased approximately 25 per cent.

The installation of Inconel rear face pigtails is 72 and 57 per cent complete at D and DR Reactors, respectively. Bumper nozzle installation

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on DR Reactor process tubes is 97 per cent complete. A total of 347 process tubes was replaced at D Reactor during the tube replacement outage.

The investigation, reported last month, into composition of the underground 8-inch sanitary water line near Building 183-D revealed that approximately 850 feet of this line is welded carbon steel instead of the normally used cast iron. Excessive corrosion was evident upon visual inspection at both ends. A total of 450 tons of anthrafil<sup>t</sup> was added to the Buildings 183-D and 183-DR filters in completing the annual renewal of this filter bed material.

A relay actuated camera system has been installed at DR Reactor to permit measuring vertical rod drop times under operating conditions.

### F REACTOR OPERATION

The F Reactor concluded a tube replacement outage (started on August 24) September 3 and operated without interruption the balance of the month. The production achieved in September was the third highest in the history of the F Reactor. The highest production was made during the month of April, 1961, and the second highest was in March of this year.

In addition to the tube replacement work and the major work reported last month, the following work was accomplished prior to start-up on September 3: graphite thermocouple stringer 3484 was replaced with a new type sheath Geminol wire stringer, 11 rear face thermocouples were repaired, and one tube was replaced in channel 4077 because of a pulled Van Stone flange. Also, as part of Project CG-905, the impulse lines in the 105 high tanks were raised to permit the export water system to furnish water to the reactor before using most of the water from the high tanks.

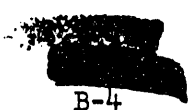
A Third Party Inspection was made of the No. 1 boiler in Building 184-F, as well as the flash tank common to all boilers. No significant unsatisfactory conditions were reported.

Design Change 556 was completed which provides an audible alarm for the HCR exit water temperature. The new equipment will permit corrective action to be taken within a prescribed time limit.

### H REACTOR OPERATION

Five unscheduled reactor outages were experienced. These were caused by a tube leak, a fuel element failure, front face pigtail leaks during start-up, and two Panellit scrams. Following the reactor outage on September 19, the reactor remained down for electrical peak control purposes until the starting of the tube replacement outage which continued through month's end.

Prior to the extended outage, the process tubes were purged with a diatomaceous earth solution during reactor operation for the purpose of



removing internal contamination-holding materials. At the beginning of the tube replacement outage, reactor rear face hardware was internally decontaminated. Average dose rates of the rear face were reduced from 61 to 26 mr/hr. Two hundred process tubes were replaced up to month's end during the first week of the extended outage.

The No. 46 vertical safety rod indicated binding during withdrawal. An inspection revealed that the Sphincter seal was deteriorated by heat, radiation and oil saturation. The seal was replaced and the rod was returned to service. A schedule was established for the inspection of the remaining rod seals.

During the extended outage, the two emergency coolant water high tanks were individually drained for interior cleaning and painting. This work was initiated as part of Project CGI-905.

A total of 23 near side and three far side front face crossheader strainer screens was checked following the admission of raw water to the reactor during shutdown condition. The raw water flow was due to the inadvertent actuation of a meletron switch associated with the raw water admission valve.

#### KE-KW REACTOR OPERATION

In addition to continuation of the planned outage initiated in August, KE Reactor experienced six outages during the month. Causes were failure of the 13.8-4.16 KV transformer, a scheduled outage for metal processing, Panellit trip (two start-up outages) and vertical safety rod maintenance (two short duration outages). Operation at KW Reactor was interrupted four times. Causes were a defective spline cap insert assembly, a scheduled outage for metal processing and two Panellit trips which occurred during the subsequent start-up.

The sleeved channel of Horizontal Control Rod No. 17 at KE Reactor was borescoped. Results indicated that the recently installed graphite sleeves were intact and no 3X system balls were in the sleeve junctures. A spring loaded transition piece was attached to the rod step plug to provide pressure to hold the sleeves together. The rod was re-assembled and returned to service.

The channels of Vertical Safety Rods Nos. 48 and 66 at KE Reactor were successfully rehabilitated during the September 25 outage. The channel renovation work permits improved rod drop times.

The wall thickness of 262 process tubes at KW Reactor was measured by the probolog method. Results indicated that 40 of the tubes have a remaining wall thickness of 38 mils or less. Two tubes were removed to provide additional probolog calibration information. In addition, two tubes were short charged in an effort to reduce operating temperature and to inhibit corrosion rate.

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A rear face intermediate level radiation alarm, (Design Change E-62K-161), was installed at KW Reactor. The modification provides an audible and visible alarm to personnel should a radiation event occur.

APPLIED REACTOR ENGINEERING

MAINTENANCE PRACTICES OPERATION

The inventory of B-D-F process tubes is about 1000 with another shipment of 700 in transit. An alternate vendor will supply an additional 1000 tubes.

PLANT EQUIPMENT ENGINEERING OPERATION

A report, HW-73106, was issued following a complete analysis of the capacity of the existing dryer systems, with conclusion that a specified inspection and maintenance program can increase the dryer system capacity by a factor of three for the six old reactors.

SPECIAL OUTAGE SERVICES OPERATION


The extremely thin condition of the old process tubes at the downstream Van Stone at F and D Reactors makes splitter starts difficult. Stuck splitter experience on the past 504 tubes was 1.8 per cent; 3.1 per cent at F Reactor and 1.2 per cent at D Reactor.

Two new guillotines were received and are in service as primary tools. At D Reactor all tubes were removed without guillotine failure.

REACTOR MAINTENANCE ENGINEERING

A test for the supervisory control which permits remote operation of all 181-B electrically driven pumps from 183-C Building was performed and the system is currently in operation.

At 105-D, 70 tubes with reduced ribs on the inlet end were installed. Some interference with the eight-inch non-bumper fuel element was encountered in approximately 20 tubes.

  
Manager, Manufacturing

OC Schroeder:DLD:bm

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RESEARCH AND ENGINEERING

PROCESS AND REACTOR DEVELOPMENT

REACTOR FUELS

Present Reactor Technology

Overbore Fuel Development

An overbore failure occurred in tube 3162-C on August 29, 1962; the average tube exposure was 640 MWD/T. The failure element had fractured transversely into two pieces with the downstream half having also two visible longitudinal cracks. A discharge force of 18,500 pounds was required to remove the charge. The tube was left empty of fuel and at the next outage was bore-scoped and found to be in suitable condition to be charged.

On September 9, 1962, a 30 psi pressure rise was noted in tube 1494-C. The reactor was shut down and the column discharged (6000 pounds pushing force). The furthest downstream element had failed as a result of corrosion attack near the female end. A large number of damaged self-supports were noted on the discharged fuel. The tube was recharged during the outage. The average tube exposure in this tube was 700 MWD/T.

Nine hours after startup, C Reactor again was shut down with a rupture. The rupture occurred in tube 2969-C; the average tube exposure was 660 MWD/T. The column discharged normally until four elements remained in the tube and then 11,000 pounds of force were required to discharge the next element. The remaining three elements were discharged with essentially no force. The stuck piece was the one in which the failure occurred and the mechanism was a split near one end of the element. The split element was from the same lot as the failure in 3162-C; this lot has been declared rupture prone and 27 tubes of overbored metal were discharged and recharged with fresh fuel.

Self-Supported Fuel

The tubes of KVNS fuel in KW Reactor were discharged and recharged during the outage of August 24, 1962. The average exposure was 700 MWD/T, and the breakaway discharge forces were found to be 1600 and 2400 pounds.

Other Fuel Programs

Post-irradiation examination of two columns of alpha-extruded dingot fuel which were discharged on September 8, 1962 from B Reactor (950 MWD/T) is underway.

A rupture occurred on September 23, 1962 in tube 3680-C, charged on May 25, 1962 with Hanford Hot Press fuel (PT-IP-490-A). This tube was part of an eighteen-column test consisting of Sylcor Hot Press, Hanford Hot Press and Hanford AlSi bonded fuel. The column in which the rupture occurred had an average exposure of 567 MWD/T and was operating at 1265 KW. The

STATUS REPORT OF PRODUCTION TESTS

<u>Test No.</u>	<u>Type Metal</u>	<u>Tubes</u>	<u>Reactor</u>	<u>Goal</u>	<u>Current</u>	<u>Remarks</u>
IP-216-A	Normal prod. natural & enriched fuel elements	80	All	Normal variable goal		Provides for monitoring the performance of a sample of all normal production material to assist in development of a Quality Index for production fuel. Test is continuous.
IP-272-A	I&E self-supported fuel	69	C	Variable +200		Provides for testing of CIVN geometry fuel in C Reactor ribless zirconium tubes.
IP-381-A & IP-431-A	I&E self-supported fuel overbore size	62	C	800 MWD/T		Provide preliminary qualitative data regarding irradiation behavior of larger fuel element designs.
IP-409-A	I&E self-supported fuel	2	KW	800 MWD/T	200 MWD/T	Provide qualitative data to confirm the fuel geometry design.
IP-423-A	Alternated oil-quenched and water-quenched natural uranium I&E fuel elements	51	F	Variable		Provide a comparison of dimensional stability of standard water-quenched uranium fuel cores and oil-quenched cores. The first part of a three-part test was discharged on 6-25-62.
IP-468-A	Alpha extruded dingot	0	B	Variable		Elements charged 4-14-62 to evaluate alpha extruded uranium fuel cores as an alternate to rolled fuel cores. Four columns were discharged on 8-7-62 at 755 MWD/T. The two remaining columns were discharged on 9-8-62 at an exposure of 950 MWD/T.
IP-477-A	Eleven 23-inch N Reactor fuel elements, KER-3	1	KE		695 MWD/T	Elements charged 6-20-62 to evaluate N fuel at N Reactor operating conditions. Discharged 9-6-62 because of loop operating difficulties.

Test No.	Type Metal	Tubes	Reactor	Goal Exposure	Current Exposure	Remarks
IP-477-A	Fourteen 23-inch N Reactor fuel elements, KER-4	1	KE	1300 MWD/T	1200 MWD/T	Elements charged 4-26-62, to evaluate N fuel at N Reactor operating conditions.
IP-490-A	Diffusion bonded natural uranium I&E fuel elements	18	C	800 MWD/T	600 MWD/T	Elements charged 5-25-62 to provide a comparison of bond qualities of AlSi bonds and solid state diffusion bonds.

Fuel Designation Codes

- OIIN Old Reactors, second I&E model, natural uranium element.
- OIIINB Old Reactors, third I&E model, natural uranium bumper rail element.
- OIIIEB Old Reactors, third I&E model, enriched uranium bumper element.
- CIIN C Reactor, second I&E model, natural uranium element.
- CIVN C Reactor, fourth I&E model, natural uranium element.
- CIVNS C Reactor, fourth I&E model, natural uranium self-support element.
- CVIN C Reactor, sixth I&E model, natural uranium element.
- CVINB C Reactor, sixth I&E model, natural uranium bumper element.
- CVINS C Reactor, sixth I&E model, natural uranium self-support element.
- KVNS K Reactor, fifth I&E model, natural uranium self-support element.
- NIEL N Reactor, inner tube, enriched uranium, first model.
- NINL N Reactor, inner tube, natural uranium, first model.
- NAEL N Reactor, concentric tube assemblies, enriched uranium, first model.

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ruptured element (fifth from the downstream end) had two separate penetrations of the cladding both occurring under the bridge of support rails. The ruptured areas were each about the size of a dime and caused no noticeable flow decrease. The rupture was detected by the gamma monitor and the discharge required 7000 pounds of force.

### Advanced Reactor Technology

#### KER Testing

Loops one and two continue out of service for loop modification under CGI-839.

KER-3: The eleven, N Reactor prototype, fuel elements were discharged on September 6, 1962. The exposure reached was 695 MWD/T. Seventy-five per cent of the attained exposure was in cold water and the information from the test is of little value. KER-3 will not be recharged until adequate pump capacity is on hand to support two tube operation.

KER-4: The fourteen, N Reactor prototype, fuel elements charged into KER-4 on April 26, 1962 have attained an exposure of 1200 MWD/T as of September 20. It is anticipated that the loop will be discharged during the September 25 outage at an estimated exposure of 1240 MWD/T.

### REACTOR ENGINEERING

#### Present Reactor Technology

##### Overbore Program

Examination of two of the Zircaloy-2 tubes in C Reactor in which ruptures occurred during the past month (3162 and 2969) revealed only minor damage to the tubes and the tubes were recharged.

##### Zircaloy-2 Process Tubes - K Reactors

A visit was made to Wolverine Tube Co. to review the status of the fabrication of the 5200 Zircaloy-2 process tubes. Wolverine has material in process to fabricate over 500 tubes. The material is in form of extrusion billets, clad and declad extrusion blooms, and first and second step reductions. The inspection facilities are being installed and are expected to be ready by October 1.

##### Hazards Summaries

Comment issues of Volume III of the hazard summaries were issued during the month. These volumes were prepared by FEO. Work continued on Volume II and Volume I.

### Advanced Reactor Technology

#### Technical Manual

No progress this report period.

Technical Bases for Standards

No additions this report period. Approximately one-third of the Technical Bases required have been completed through the rough draft stage.

N Reactor Hazards Review - Volume 2

The rough draft of Volume 2, Appendixes, is being revised and polished in preparation of the final draft.

Test Irradiation of N Reactor Graphite

The fourth and fifth capsule in the program of irradiation of NPR core graphite are under irradiation in the GETR. The third capsule was discharged on September 4, 1962. The specimens of the third capsule now have a maximum fast neutron exposure equivalent to about 2.5 years of maximum exposure in the NPR.

REACTOR PHYSICS

Present Reactor Technology

E-N Loads - Conversion Ratio

There have been no new data during the past month. Plutonium conversion data remain to be obtained from the second H Reactor loading.

Uranium Recycle

The per cent of recycled fuel in enriched fuel present in the reactors at the end of August and discharged during August are given below:

Per Cent of Recycled Fuel in Enriched Fuel

	<u>B</u>	<u>C</u>	<u>D</u>	<u>DR</u>	<u>F</u>	<u>H</u>	<u>KE</u>	<u>KW</u>
August 31 Status	94	100	100	97	93	93	100	100
August Discharge	96	100	100	99	96	85	99	100

Seismoscope Review

Conclusions of a recent review of the Hanford Seismoscope system have been transmitted to the AEC. The study is being documented in HW-74975 entitled, "Review of Hanford Reactor Seismoscope Systems", by W. S. Nechodom. The conclusions are as follows:

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1. The seismoscope trips should be retained in the LX(VSR) safety circuit at all eight reactors.
2. The Ball 3X system should become an automatic backup safety system to the VSR's at all reactors for the seismoscope trip (similar to the present K Reactor system).
3. All three seismoscope pendulums should be set at the MM5 level and all three channels should be connected in a two-out-of-three coincidence circuit to trip the LX circuit.
4. The annunciation feature of the power failure relay incorporated in the present seismoscope apparatus should be restored at those reactors where it has been removed.
5. Certain non-fail-safe features of the present electronic relays in the seismoscope apparatus should be investigated and corrected if possible. Better, the present vacuum tube relays should be replaced by more reliable solid-state equipment.
6. The pendulums should be modified by placing a flexible jumper wire around the piano wire portion of the pendulum suspension to preserve circuit continuity if the piano wire becomes detached.
7. The present procedure of bypassing the seismoscope during cold startups should be stopped except at the K Reactors where it is necessary that the Ball 3X backup portion of the trip be bypassed until a certain power level is reached. In no cases is there any need that the LX trip from the seismoscope be bypassed.

#### Advanced Reactor Technology

##### NPR Ball 3X System

Several accident conditions have been studied in order to determine the acceptability of the measured ball hopper discharge rates (7.84 lbs/sec). These were stack flooding in conjunction with cold water injection, and positive reactivity ramps caused by withdrawing the horizontal rods at the maximum possible rate. It has been concluded, at least for Phase I and II operation, that the ball hopper discharge rates are adequate to meet reactor control criteria established for the new reactor.

#### RADIOLOGICAL ENGINEERING

##### Radiation Control Experience

The following table summarizes the radiation exposure experience of critical IPD classifications through 32 weeks of the 1962 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 Extrapolated Exposure</u>
Radiation Monitors	130200 mr	77	1691 mr	2747 mr	20
Processing Operators	377406	263	1435	2331	6
Pipefitters	168119	121	1389	2256	18
Millwrights	129269	97	1333	2165	16

Lapse of Radiation Control

Lapse of Radiation Control  
Distribution by Reactor and Component

	<u>B</u>	<u>C</u>	<u>D</u>	<u>DR</u>	<u>F</u>	<u>H</u>	<u>KE</u>	<u>KW</u>	<u>IPD Totals</u>
Processing	1	3	0	1	1	0	0	1	7
Maintenance	1	0	0	0	1	1*	1	0	4
Suppl. Crews	0	0	0	0	0	0	0	0	0
Applied Reactor Engr.	0	1	0	0	1**	0	0	0	2
Research & Engr.	0	0	0	0	0	0	0	0	0
Facilities Engr.	0	0	0	0	0	0	0	0	0
Central Maintenance	0	0	0	0	0	0	0	0	0
Reactor Areas	2	0	0	0	0	0	0	0	2
Assigned Totals	4	4	0	1	3	1	1	1	15
IPD General					1**				

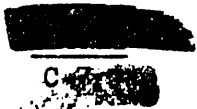
\* Occurred at 105-C  
\*\* Split responsibility

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

Effluent Activity Data

The table below shows average reported concentrations of selected radionuclides from reactor effluent samples taken during August, 1962. Units are 10<sup>-12</sup> curies/ml.

<u>Reactor</u>	<u>P32</u>	<u>As76</u>	<u>Zn65</u>	<u>Np239</u>	<u>Cr51</u>
B	6.7	52	72	300	920
C	5.7	61	13	110	450
D	5.9	55	40	130	580
DR	2.4	71	18	95	450
F	6.7	42	50	120	1600
H	6.3	58	11	75	300
KE	11.9	39	17	85	430
KW	9.5	38	12	65	480



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All reactor water plants continued on an alum feed rate of 18 ppm, except KW at 20 ppm. The higher than usual (for the season) Zn<sup>65</sup> and Cr<sup>51</sup> release rates experienced during July for B, D, and F Reactors decreased materially, although these same three reactors continued to have the highest release rates. The cause of this correlation has not been determined. River samples taken at Pasco during July did not confirm the release rates estimated from our effluent samples.

#### NPR Waste Disposal

Additional laboratory work was requested to refine design parameters required for the NPR Decontamination Wastes Crib and treatment plant. The requested work is essentially complete. Better than 90 per cent removal of Co<sup>60</sup> from ammonia release will make desirable the addition of a gas scrubber at the waste tanks. The proposed caustic addition facility design should avoid a potential problem with excess caustic addition rate. Design of the waste crib facility has begun.

PROCESS TECHNOLOGY OPERATIONREACTOR POWER LEVEL LIMITATIONS

During this report period, the primary limitation to reactor power levels for all reactors has been bulk outlet temperature limits.

PROCESS STANDARDSHW-46000 B, D, F, Process Standards, Reactor

One revised standard was issued during the month for each of these manuals. This was:

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

The standard was revised to require that only one perforated dummy, instead of three as formerly specified, be used next to the fuel charge. Greater flexibility of dummy use resulted from the change without significant difference in process tube flow characteristics.

The requirement that fuel charges be repositioned every two years to avoid slug end junction pitting of the process tube was deleted from the standard. Experience has shown that the repositioning of charges has little effect on tube life.

HW-46000 H, Process Standards, Reactor

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

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

Revisions to this standard are identical to those made for HW-46000 B, D, and F, above.

Process Standard C-070 - "Horizontal Rod Withdrawal, Power Increase"

A new requirement for hot startups specifies that the power level be halted in a specified tube outlet temperature range for one minute to verify instrumentation is responding properly. This requirement is intended to signal a change from the exponential rate of rise to a linear rate of rise in low megawatt regions to minimize the possibility of following fast periods into the megawatt power regions.

PROCESS CHANGE AUTHORIZATIONS

The number of process change authorizations issued during the month was: four to permit temporary deviation from Process Standards - Water Plant, HW-27155 Rev1; one to permit temporary deviation from Process Equipment Standards, HW-41000 and ten to permit temporary deviation from Process Standards, Reactor, HW-46000. These were:

PCA #2-105 - "Multiple VSR's Removed from Shutdown Reactor, C Reactor"

Process Standard C-100 requires ten boron spline tubes be substituted for each VSR out of the reactor after eight outage hours have elapsed. During an August, 1962 outage, VSR channel traversing was scheduled after eight outage hours to ascertain what corrective action would be necessary to eliminate the slow rod-drop time experienced on some vertical safety rods. Maintenance work could be more efficiently accomplished by permitting several VSR's to be simultaneously out of the reactor.

During the same outage, 140 columns of enriched material had been discharged from the reactor. Under these conditions, substitution requirements of Process Standard C-100 were unnecessarily restrictive. Authorization was given to permit up to five VSR's out of the reactor without spline substitution, provided restrictions were met on location of withdrawn rods, and enrichment charging while work was in progress on VSR channels.

PCA #2-106 - "Grove Valve Sensor - Faulty Meletron High and Low Pressure Annunciators - DR Reactor"

Process Standard A-010 requires the sensor pressure in the raw water Grove valve control system be monitored by high and low pressure annunciators.

During reactor operation on August 13, 1962, one of the two meletron controls for high and low pressure annunciation in the raw water Grove valve sensor system failed.

A meletron failure in the annunciator system does not have a direct relationship to the ability of the Grove valve to automatically function upon demand at the pre-established pressure for controller actuation. Also, automatic operation of the Grove valve can be backed-up procedurally by manually tripping the Grove valve controller at a time corresponding to what the sensed pressure would normally be following a BPA outage. Authorization was given to continue operation with one of the two meletrons out-of-service until repairs could be completed. During the time that the meletron was out-of-service, a procedure for backing-up automatic action of the system was specified. The procedure required manual operation of the Grove valve within ten minutes after any BPA failure on which steam turbines failed to function.

PCA #2-107 - "Removal of Export Backup, C Reactor"

Process Standards - Water Plant, 190-B-070, requires that two full high tanks be in service whenever the export system to a reactor is taken out of service.

Project CGI-905 includes the installation of a check valve and a duplex strainer in the export line in 105-C valve pit. To complete this installation, the near high tank and the export system must be removed from service.

Authorization was given to remove export backup and the near high tank water from service provided:

1. The far high tank is full and in service.

2. Export water is available from a four-inch bypass line which will be provided prior to removal of the near high tank water from service.

PCA #2-108 - "Graphite Thermocouple Stringers - H Reactor"

Process Standard C-040 was recently revised to require more thermocouple stringers than previously specified in the standard.

Several types of replacement stringers are being tested under PT-IP-313-N and early procurement of necessary materials for fabrication of improved graphite temperature monitoring thermocouple stringers is anticipated. Authorization was given to operate H Reactor with less than the required number of graphite stringers until the first minimum outage after October 19, 1962.

PCA #2-109 - "Graphite Thermocouple Stringers - F Reactor"

Process Standard C-040 specifies that F Reactor contain seven serviceable graphite thermocouple stringers. The standard also requires replacement of faulty stringers within three months from the time of failure.

During May, 1962, a graphite thermocouple stringer failed, resulting in F Reactor having less than the required number of stringers. Fabrication of a replacement stringer was nearly completed when a second stringer failed.

Authorization was given until October 22, 1962, to operate without the required number of graphite stringers until a second replacement can be fabricated.

PCA #2-110 - "Emergency Cooling Water Requirements - K Reactor"

Process Standard A-030 specifies backup water from two independent sources be supplied to a reactor during an outage. During August, 1962, KW Reactor was shut down when only one of the three emergency electrical generators at KW could be retained in service (one generator was down for maintenance when a second generator failed). Following shutdown of the reactor, it was necessary to remove the steam turbine driven pump from service for maintenance. An assessment of emergency backup requirements indicated that the last-ditch diesel pumps could provide adequate secondary backup for KW (shutdown), provided all front crossheaders at KW were throttled to 100 inches of water  $\Delta P$  or less. Authorization was provided to remove the steam-driven turbine pump at a single shutdown K Reactor, provided the special requirements of the PCA were met.

PCA #2-111 - "Removal of Export Pump, B, D, F, and H Reactors"

Process Standards, Water Plant, 190-B-070 specifies that upon loss of normal electrical power at B, D, F, or H Reactor areas, an emergency steam pump shall be placed on the export system within ten minutes.



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Interim improvements are being completed on the coolant backup system under Project CGI-905. Included in this project are modifications to the export system steam turbine pump set. Modifications will require removal of one unit at a time from the export system.

Two export pumps will provide the necessary backup flow for a dual-reactor area when one of the reactors is throttled for shutdown flow. Therefore, the provisions under Section I of the PCA permitted removal of the export pumps from service in a manner which will retain adequate last-ditch backup. Because of the difficulty in adhering to the requirements of Section I in all instances, provisions in Section II of the PCA will permit removal of the export pumps, for a limited period, with some reduction in last-ditch backup. Reduction in last-ditch backup is justified due to the extremely remote possibility of an extended loss of BPA power (power loss for an hour or more) at all four reactor areas (100-B, 100-D, 100-F and 100-H) concurrent with loss of steam at one of three old areas which have their steam turbines available.

Authorization was given until December 31, 1962, to remove one steam-driven export pump from service at a time under the provisions specified in the PCA.

PCA #2-112 - "Emergency Water Backup - K Reactors"

Process Standards - Water Plant, 190-B-090, specifies that the high pressure cross-tie line shall be flushed at least once per month with the V-72 and V-73 valves open at the operating reactor.

During a routine start-test of the 182-K diesel-drive pumps, KE Reactor was scrammed by a Panellit trip resulting from a pressure surge induced by acceleration of the diesel-driven pumps.

This PCA authorized closing of the V-72 valve at KW Reactor for a maximum of 30 minutes while methods were evaluated to maintain diesel-driven pump induced surges within acceptable limits. Special requirements to be observed were listed in the PCA.

PCA #2-113 - "Emergency Cooling Water Requirements - K Reactors"

Process Standard A-030 specifies that backup water to the reactor be supplied from two independent sources during an outage.

During August, 1962, the steam turbine at KE Reactor needed to be taken out of service for repair at a time when only one leg of BPA power could be retained in service. An assessment of emergency backup requirements indicated that the last-ditch diesel pumps could provide adequate last-ditch backup for KW Reactor (operating) and also provide adequate emergency backup for KE Reactor (shutdown), provided all front crossheaders at KE Reactor were throttled to 100 inches of water  $\Delta P$ , or less.

This process change authorized removal of the steam turbine driven pump at KE Reactor while BPA electrical backup is removed from the 151 sub-station,



provided the requirements stated in the PCA were met.

PCA #2-114 - "Confinement Exhaust Fans - C Reactor"

Process Standard D-070 requires both of the steam-driven emergency exhaust fans be capable of automatically backing-up the electrical fans, with the provision for taking one steam-driven fan out of service if the second emergency fan is placed in operation.

On September 2, 1962, the #9 steam-driven emergency exhaust fan was out of service for repair of the overspeed trip mechanism when it was detected that there was water leaking into the bearing lubricating oil reservoir on the operating (#8) steam-driven emergency exhaust fan. To ensure maximum reliability of the emergency exhaust system and prevent possible damage to #8 fan, it was desirable to remove #8 fan from operation and use the overspeed trip mechanism from #8 fan for replacement of the faulty overspeed trip mechanism on #9 fan. In this manner #9 fan could be placed into full operation in the shortest time possible, thus minimizing the period of time with reduced emergency fan backup.

Authorization was given for 12 hours to operate C Reactor with both steam-driven exhaust fans out of service, provided normal air balance was maintained with the two electric exhaust fans.

PCA #2-115 - "Turbine Pump Backup - DR Reactor"

Process Standards - Water Plant, 190-B-070, specifies that seven steam turbines idling on automatic plus two steam turbines on manual shall provide emergency backup flow at DR Reactor during operation.

A recent steam leak, during reactor operation, in a pump group of four steam-driven pumps, required these four emergency pumps be isolated for repairs.

Recent trip-out tests at DR indicated that six turbine-driven pumps will provide adequate emergency flow at DR Reactor.

This process change authorized, for two days, emergency steam turbine backup at DR Reactor consisting of seven steam turbines idling on automatic plus one steam turbine on manual for a maximum period of four hours, provided no sub-normal electrical power conditions exist.

PCA #2-116 - "Increased High Flow Trip Settings for Single-Pass Operation -  
KER 3 and 4"

Process Standard K-030 specifies the maximum permissible high-flow trip settings for KER 3 and 4 facilities. This trip is intended to shut the reactor down in event of supply water line rupture between orifice and tube. This process change authorized until November 7, 1962, an increase in high-flow trip settings from 92,000 lbs/hr to 103,000 lbs/hr while on single-pass operation. Analysis indicate the expanded trip setting to be adequate, and

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in addition, potential for supply line rupture should be very low on single-pass operation at low pressure and temperature.

PCA #2-117 - "Pressure Monitor Trip Identification, H Reactor"

H Reactor was shut down on September 6, 1962, by a Panellit trip on row 15. Identification of the gauge causing the scram was not effected.

Equipment, titled "Scram Information Device," has been developed which will identify the specific gauge responsible for initiation of a scram. The identification system is fully isolated from the existing pressure monitor circuitry.

This process change authorized until September 22, 1962, use of the "Scram Information Device" at H Reactor.

PCA #2-118 - "Confinement Exhaust Fans, C Reactor"

Process Standard D-070 requires that both of the steam-driven emergency exhaust fans be capable of automatically backing-up the electrical fans with the provision for taking one steam-driven emergency fan out of service if the second emergency fan is placed in operation.

On September 8, 1962, the #8 steam-driven emergency exhaust fan was out of service for repair of the overspeed trip mechanism when it was detected that water had leaked into the bearing lubricating oil reservoir on the operating (#9) steam-driven emergency exhaust fan. To ensure continued reliability of the emergency exhaust system and prevent possible damage to #9 fan, it was desirable to remove #9 fan from operation to change the lubricating oil. It was estimated the fan could be returned to operation in less than 30 minutes.

This process change authorized, for 30 minutes, continued operation of C Reactor with both steam-driven emergency exhaust fans removed from service, provided normal air system balance was maintained with the two electric exhaust fans.

PCA #2-119 - "Flux Monitor Range Switch Settings - B Reactor"

Process Standard C-030 requires that when operating near or at equilibrium power levels, the flux monitor amplifiers be at least four major divisions on the least sensitive range. This specification prevents operation on a range that would allow significantly higher power levels before a reactor trip.

Following start-up from a water leak, the amplifiers on three of the four flux monitors read below that required because of a depression in the flux in the region of the reactor where water entered the moderator.

This process change authorized, for 57 hours, continued operation of B Reactor with three flux monitor amplifiers not set on the least sensitive



range but set on a range which gives a reading of at least 30 per cent of full scale, provided the specific requirements of the PCA were met.

### PROCESS ASSISTANCE

One engineer audited conformance to process standards on all Processing Operations' shifts by making 16 inspections at each reactor during the report period.

### RUPTURE EXPERIENCE

<u>Failure Date</u>	<u>Tube Number</u>	<u>Lot Number</u>	<u>Type of Material</u>	<u>Tube Power Failure (kw)</u>	<u>Exposure MWD/T</u>	<u>Type of Failure</u>
9/3/62	1494-C	IP-381-A	I&E N <sup>1</sup>	1201	710	Side-Other
9/5/62	1175-B	KZ-355-A	I&E N	1157	588	Side Hot-Spot
9/6/62	2969-C	IP-381-A	I&E N <sup>1</sup>	1265	661	Split-Long.
9/8/62	2068-B	CZ-019-H	I&E N	1018	385	Side Hot-Spot
9/13/62	2890-H	KZ-270-D	I&E NB	982	685	Side-Other
9/16/62	2989-DR	KY-235-D	I&E EB (0.94%)	1038	45	Mech. Damage
9/23/62	3680-C	IP-490-A	I&E N <sup>2</sup>	1262	567	Side-Other
9/28/62	3086-DR	KY-171-D	I&E EB (0.94%)	1037	698	Hole
9/29/62	3768-B	KY-202-D	I&E EB (0.94%)	1183	810	Side-Other

### Legend

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

I&E NB - This is the symbol for internally and externally cooled production reactor fuel elements of natural uranium which have projections (bumpers) welded to the fuel element jacket.

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

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

<sup>1</sup> Production test of internally and externally cooled oversized self-supported fuel elements in an overbored channel.

<sup>2</sup> Production test of diffusion bonded internally and externally cooled self-supported fuel elements.

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

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

Mech. Damage - Failure probably caused by mechanical damage to the fuel element prior to irradiation.

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

OPERATIONAL PHYSICS OPERATION

PILE PHYSICS ASSISTANCE

Nonequilibrium losses were low, and flattening efficiencies were average during the report period.

Economics of the xenon-override core at the B Reactor were roughly explored. Calculations indicate that the present core must be used about once every 40 days to pay for the additional cost of enrichment. If productive poison were utilized instead of boron-carbide splines, gains would be theoretically predicted due to improved conversion efficiency alone (as in the E-N case); any potential increases in time operated efficiency would add to the net returns in the latter case.

SUMMARY OF OPERATING DATA OF PHYSICS INTEREST  
FOR THE MONTH OF SEPTEMBER, 1962

Reactor	B	C	D	DR	F	H	KE	KW
ECT in September (1)	1490	1630	1495	1485	1495	1485	2475	2510
12-Month Average ECT	1490	1660	1480	1475	1475	1515	2520	2540
Equil. Scram Time (2)	18-22	23-27	18-22	20-24	15-20	13-17	20-25*	25-35*
Recording Period:								
From:	8-16	8-15	8-18	8-16	8-15	8-14	8-16	8-16
To:	9-18	9-17	9-18	9-19	9-19	9-19	9-18	9-18

\*Equilibrium scram recoveries are not attempted at the K Reactors.

- (1) Effective Central Tubes: This value is defined as pile power level divided by the average power of the ten most productive tubes in the reactor.
- (2) This is defined as the maximum time available in minutes between scram and first indication of startup.

B Reactor - J. R. Fredsall

A general downstream flux peak has been indicated by recent spline flux traverses. Mixer removal from all reactor charges and the practice of using partially inserted splines are blamed for the flux distortion. Full spline insertion and downstream poison in PCCF are now being used to correct this problem.

Eight PCCF are now scheduled for removal by early 1963. This will leave nine PCCF installed.

C Reactor - D. W. Constable

Flattening efficiency and TOE dropped as a result of reactor tube replacement and ruptures. Three recent ruptures were all in over-bore fuel charges. Spline traverses indicate a significant increase in upstream flux peaking since June,



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a factor of special concern in the overbore region. A new hot startup procedure is now in use which limits the rate-of-power increase in the overbore tubes, and additional spline traversing is underway to more accurately define the upstream flux peaking. A possible cause of the increased skewing and peaking is ball removal during VSR channel broaching, since these lodged balls had previously been compensated for by short enrichment segments which are still charged.

The coolant supply hose to horizontal rod number 14 has become disconnected a total of three times resulting in one Beckman trip previously reported and two manual scrams. The rod has successfully been removed from the reactor without damage each time.

D Reactor - D. G. Albertson

The report period includes a two-week tube replacement outage in which fringe poison was installed for the first time. The poison (six charges of lithium-aluminum poison supported by compensating enrichment columns) was installed to reduce far-side shield temperatures. The total discharge for the two outages of the report period was 600 tubes. The resultant low reactor exposure necessitated an increase in enrichment loading and an increase in total control poison requirements.

DR Reactor - J. W. Hagan

Long operating periods have permitted use of supplementary control measures to attain a high flattening efficiency. The reactor level is limited by a reduced bulk outlet temperature limit imposed to reduce the tube corrosion rate; ECT is being held high for the same reason. Operating efficiency was, however, affected adversely by monitoring instrument failure; a scram recovery attempt failed due to failure of the subcritical monitor chamber positioners, and startup losses during a cold startup were increased about 10 per cent because the Flexowriter was out of service for almost two shifts. Both instrument systems have since been repaired although maintenance of the subcritical monitor chamber positioners is a continuing problem.

Present estimates are that the ball 3X poison lodged in the stack is worth 750 c-mk, approximately half of the effect estimated at time of the ball drop in July, 1961.

F Reactor - A. W. Medcalf

High flattening and startup efficiencies were attained at F Reactor during the report period. No important difficulties followed the startup of 9-3-62 in spite of 158 tubes being replaced in the outage.

Consistently, but seemingly unwarranted, high graphite temperatures indicated by stringer 2662 are being investigated.

H Reactor - E. L. Conner, Jr.

Reactor operation has been intermittent because of shutdowns for water leaks, ruptures and Panellit scrams. Three of the shutdowns were associated, directly or indirectly, with spline use. One water leak was caused by a vibrating piece of wadded spline upstream of the dummy charge; one of the Panellit scrams was on a tube with spline inserted but not being moved, and a Panellit scram occurred during removal of a flux traverse spline.

The central block discharge was being carried out during the outage of 9-22-62.

KE Reactor - L. L. Grumme

Operation at KE Reactor has been smooth and fairly continuous. Just before the scheduled outage of 8-29-62 a column of enrichment was charge-discharged with the OFF (Operational Fueling Facility). The reactivity effects were indefinite because of local variations resulting from spline withdrawals preparatory to a scheduled outage. During this outage a new 40-per cent half-rod was installed in the number 17 position; KE Reactor has now reverted to the use of inboard upstream control rod; no significant cycling problems have appeared as a result of this change.

KW Reactor - R. A. Chitwood

Plans were made to discharge half of the center section by alternate rows during the zirconium tube outage as a measure to maintain good flattening efficiency during the changeover. A permanent spline cap pattern has been designed which is compatible with this plan; the pattern will include about 295 spline caps.

Operation during the report period was interrupted only twice by unscheduled shutdowns. Higher power levels within bulk temperature limits will be permitted by the recent changes in the low lift pumps.

PROCESS PHYSICS DEVELOPMENTSafety Control Studies

Work continued during the month on operational physics aspects of the Hazards Summary Report. Principal contributions have been made to Volume II describing the reactor process.

Correlation data were obtained during the month between octant monitor readings and temperature recording equipment at KE. The data agreed with expectations in that there was good correlation between total current from front and rear chambers with tube outlet temperature during uniform changes in reactor level. However, the correlation broke down, as was expected, when total level was being held constant but rod movements were underway for adjustments of flux distribution; only in tubes immediately adjacent to the chambers was there good agreement in the latter case.



Reactivity Studies

Although there were still uncertainties in the data from the recent Redox and Purex inventories, it is expected that recommendations for normalization of IPD yield predictions to CPD recovery can be made in the near future. It currently appears that predictions for plutonium yield from both natural uranium and E-metal are within the range of monthly variations; however, it is expected that there will be a slight decrease in U-235 burn-out predictions and a slight increase in Pu-240 predictions.

Approval signatures have been completed on the NPR physics startup test authorization document, HW-72345, and it will be issued shortly.

Reactor Efficiency Studies

Work has been resumed by Instrument Development Operation on the circuitry for the automatic control prototype. This self-feedback concept is intended for trial under production test conditions following completion of design and laboratory instrument development work. The first stage of this work consisted of simulated N-reactor testing during 1961 in which the operator moved given increments of rod whenever monitoring indications went outside of the specified dead band.

Reactor Fundamentals Training

The refresher training program for Reactor Specialists was reactivated on September 12, as scheduled, as was the supplementary training in reactor fundamentals class for Pile Operators on September 14. The first two sessions of a reactor analyst class and working group, starting September 24, were devoted to operational physics aspects.

TESTING OPERATIONIRRADIATION TESTING OPERATIONIrradiations

Sample and experiment irradiations were handled as follows:

Reactor	Test Hole	Facility	Request No.	No. of Samples	Material-Purpose
B		Process Channel	HAPO-098	23	Graphite (burnout rate study)
F		Process Channel	HAPO-098	10	Graphite (burnout rate study)
C	Y	Hot Graphite	HAPO-177	1	Graphite (radiation damage study)
KW	2B	Hot Graphite	HAPO-177	4	Graphite (radiation damage study)
KE	2D	Quickie	HAPO-184	6	Washington Designated Program
F	E	Quickie	HAPO-219	3	Strontium (isotope production)
KW	3A, 3B 2D, 3D	General Purpose	HAPO-236	3	Flux monitor wires (fast flux study)
KE	2A	General Purpose	HAPO-245	1	Zirconium (electrical resistivity test)
KE	2D	Quickie	HAPO-249	1	Titanium, iron (fast flux comparison test)
C	B	Hot Graphite	HAPO-250	1	Various ceramic (radiation study of possible rod liner material)
KE	2D	Quickie	HAPO-252	1	Arsenic (tracer isotope production)
DR, H		PCCF	HAPO-254	4	Various chemicals (effluent water radioisotope reduction study)
KE	2D	Quickie	HAPO-254	1	Various chemicals (isotope production)
KW	4B, 4C	Snout	HAPO-258	6	Molybdenum (fast neutron damage study)
KE	2B	Magazine	HAPO-265	1	Boron-aluminum spline (burnout rate study)
KE	2D	Quickie	HAPO-256	1	Plutonium (fission yields of heavy plutonium isotopes)
KW	4B	Snout	HAPO-243	1	Reactor structural materials (fast neutron damage study)
		*Gamma	HAPO-171	5	Plastics and rubber (damage study)
		*Gamma		2	Sponge rubber (damage study)
		*Gamma		4	Coated concrete (damage study)
		*Gamma		6	NPR coatings (damage study)

\*Gamma irradiation facility is located in 105-KE Building storage basin

H-1 Loop (Aluminum Corrosion Studies)

Loop pH control and surface conditioning tests continued in preparation for the next test sample loading late in September. The loop was maintained at pH 4.5 and 550 F for 168 hours.

Reactor Moderator Monitoring

Nineteen graphite cores were removed from process tube channels 2171 and 2495 D Reactor. These cores were removed for stored energy measurements.

Following is a summary of the vertical bowing measurements. All distances are measured from the inlet tube flange for process tubes, and from the reactor skin for the horizontal control rod channel.

Tube No. 4674-C	Up .03" at 7' in 8 months Down .36" at 21'4" in 8 months
Tube No. 4092-C	Up .08" at 8' in 10 months Down .14" at 20' in 10 months
Tube No. 2551-C	No previous data
Tube No. 2570-C	No previous data
Tube No. 2596-C	No previous data
Tube No. 4674-H	Up .03" at 6' in 4 months Down .12" at 19' in 4 months
HCR-4 KW	No previous data

Borescoping Activities

HCR Channel No. 4, KW Reactor - The channel was examined to determine what caused the rod to stick. The channel was in good condition. The rod had rubbed the top of the channel for eight feet, beginning at the rod track.

HCR Channel No. 12, KE Reactor - The channel was examined to determine the type and position of channel blockage. The rod track had risen to the top of the channel at 18 feet in.

HCR Channel No. 17, KE Reactor - This channel was examined numerous times to assist in removal of the rod track and installation of rod liner blocks.

Thermocouple Stringer Channel 6, KW Reactor - The channel was examined to determine its condition and aid in tool design for stringer removal. The channel is badly broken for 14 feet into the reactor from the rod room side and is blocked at the 14-foot point.

Process Tubes, D Reactor - Several process tubes were examined for possible damage due to stuck charges and several more tubes were examined to determine the effectiveness of a rib cutting tool.

KER-3, KE Reactor - The tube was given a routine examination following discharge. Some pits were observed in the tube. A more complete examination will be conducted next outage.

COMPONENT TESTING OPERATION

Irradiated Fuel Element Examination

Examinations were completed on the fuel elements from 54 tubes requiring 275.72 fuel examination units.

<u>Number of Tubes</u>	<u>Production Test</u>
5	PT-12-A, Evaluation of Aluminum Components From Alternate Vendors
29	PT-216-A, Quality Certification Program
1	PT-361-A, Modification of Water Quality Tubes in KE Reactor
14	PT-381-A and 431-A, Oversize Fuel Elements in C Reactor
5	PT-423-A, Evaluation of Uranium Fuel Cores Having Various Heat Treatments

In addition to the above, aluminum jackets were chemically removed from 16 fuel elements from PT-262-A (Bumper Test) and measurements made on the bare uranium cores.

KE Metal Examination Facility

Flux profile measurements were made on 11 NAEL fuel element assemblies discharged from KER-3 on September 6.

Process Tube Corrosion Monitoring Program

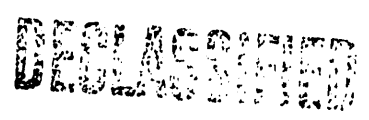
In-reactor measurement of 895 process tubes was completed. The number of tubes measured for each reactor and document numbers of the reports issued are as follows:

<u>Reactor</u>	<u>Number of Tubes Probologged</u>	<u>Report No.</u>	<u>HW Number</u>
KW	240	58	74763
F	89	59	74779
KE	204	60	74886
D	100	61	74895
KW	262	62	75024

Visual examination was completed on two process tubes as follows:

<u>Reactor</u>	<u>Number of Tubes</u>	<u>Reason Removed</u>	<u>HW Number</u>
H	1	leaker	74933
	1	outlet tube flange leak	

Special samples were taken from the tubes listed above and taken to 300 Area for further analysis by Radiometallurgy Laboratories.



Critical Reactor Component Examination

All Truarc snap rings on the front faces of KE and KW Reactors were examined; none were found to be broken.

Panelit System Programs

Gauges repaired, calibrated by Maintenance	-	59	
Gauges meeting calibration criteria	-	55	(93%)
-previous month	-		(44%)
In-board gauge reliability examination	-	1007	
Gauges meeting examination criteria	-	985	(97%)
-previous month	-		(98%)
-average for past year	-		(96%)
Response time determination	-	1007	
Gauges meeting response criteria	-	1007	(100%)
-previous month	-		(99.8%)
-average for past year	-		(99.0%)
In-board Bourdon coil examination	-	2005	
Non-leaking coils	-	1999	(99.7%)
-average rate past two years	-		(99.8%)
Gauge failure analysis	-	68	
2B-X1 switch examination	-	357	
-rejection rate	-		(27%)
-previous month	-		(46%)
Rebuilt gauges -- received from vendor and examined	-	516	
-rejected this month	-	63	(12.2%)
-rejected last month	-	53	(8.6%)
Gauges removed from panels and prepared for shipment to vendor as exchange gauges	-	863	

COOLANT TESTING OPERATION

KER Loop Operation

KER-1 and KER-2 - Remained shut down for CGI-839 modifications.

KER-3 - The loop was discharged on September 6 and left empty because of the primary pumps failures.

KER-4 - Testing of fourteen 23-inch NAEI fuel elements as authorized by PT IP-477-A continued. The objective of the test is to evaluate the irradiation behavior of N Reactor fuel elements at conditions equivalent to or more severe than those expected in N Reactor. In-reactor recirculation operating

conditions are 285 C maximum, 1555 psi, and pH 10. It is planned to discharge the fuel element during the KE Reactor outage of September 24 at an estimated average exposure of 1240 MWD/T.

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

<u>Tube</u>	<u>Production Test</u>	<u>Water Supplied</u>
SP-1 (2952-KE)	IP-475-AL	Normal process, pH 6.6 1.8 ppm dichromate
SP-2 (3050-KE)	IP-475-AL	Normal process, pH 6.6 1.8 ppm dichromate
SP-3 (4355-KE)	IP-361-A	Normal process
SP-4 (4456-KE)	IP-484-A	Process with sodium hydroxide added, pH 7.5
SP-5 (4557-KE)	IP-475-AL	Service, pH 6.6
SP-6 (4863-KE)	IP-475-AL	1.0 ppm dichromate added Service, pH 6.6
SP-7 (4963-KE)	IP-449-A	1.0 ppm dichromate added
SP-8 (5063-KE)	IP-449-A	Deionized

SP-8 was retubed with a new zirconium tube during the reactor outage of August 29.

#### KE Reactor Outage Time Requirements

No unscheduled outages were charged to production testing. A total of 17.1 outage hours was charged to production tests as listed below.

<u>Production Test</u>	<u>Description</u>	<u>Hours</u>
IP-361-A	Charge-discharge SP-3 (4355-KE)	0.5
IP-449-A	Install new tube in SP-8 (5063-KE) and charge	9.8
IP-477-A	Tray discharge KER-3 and borescope tube	6.8

#### Out-of-Reactor Facility Operation

TF-1 - Corrosion testing of A-212 carbon steel, 304 stainless steel, and Zircaloy-2 continued at 1600 psi, 300 C, and pH 10.

TF-2 - Testing was started to investigate the use of spring-loading to reduce the impact corrosion of Zircaloy-2. Operating conditions are 1800 psi, 300 C, and pH 10.0.

TF-3 - A test was performed to evaluate the corrosion problems involved in the use of carbon dioxide to remove magnesium oxide and associated rupture products from the PRTR.

Testing to evaluate nucleate boiling on the surface of a Zircaloy-2 heater has been initiated. This test is designed to simulate a NPR fuel element hot-spot condition to determine if accelerated corrosion of Zircaloy-2 occurs.

The operating conditions are 628 F, 1985 psi, and pH 10.0.

TF-4 - Testing to determine corrosion and crud release rates continued at 200 psi, 200 F, and pH 10. Loop operating conditions approximate those specified for the NPR graphite cooling system.

TF-5 - Corrosion testing of A-212 carbon steel and 304 stainless steel continued at 1400 psi, 290 C, and pH 8.0.

TF-6 - This facility has been deactivated following the discovery of cracks in the loop valves. The facility was in service from 1956 until July of this year and was used primarily for aluminum corrosion studies.

TF-7 - Testing to determine the effectiveness of phosphoric acid and sodium dichromate as corrosion inhibitors continued. An air-operated vibrator was placed on the PRTR test section on August 9 to impress a vibration on the test section. The test sections contain the following materials:

1. A PRTR fuel element that is being used to evaluate the fretting corrosion on a PRTR process tube
2. Two dummy fuel elements and two NIN fuel elements for corrosion testing
3. One KSE3 fuel element
4. Corrosion samples of carbon steel, stainless steel, Zircaloy-2 and aluminum

This testing was interrupted for two weeks in order to perform a special fretting corrosion test on a PRTR fuel element at operating conditions simulating those in NPR.


TF-8 - The facility remained shut down for pump replacement, heat exchanger repair, and installation of a sampling system.

TF-9 - Testing to evaluate thermocouple fuel elements using zirconium-beryllium braze compound was initiated. Testing conditions are 300 C and 1650 psi.

TF-13 - Heat transfer studies continued at 700 F and 125 psi.

TF-15 - Corrosion testing of stainless steel, Zircaloy-2, and Stellite continued at 900 F, 4800 psi, and pH 9.0 with ammonia and hydrazine added.

Design Test 1134 - Hydrostatic Cycling of NPR Pipe Sections - Testing of the ninth specimen is in progress.

  
 Manager, Research and Engineering



FACILITIES ENGINEERINGDESIGN ENGINEERINGRear Face Crossheader Examination

Decontamination of the rear face crossheader recently removed from 105-DR Reactor has been completed and the crossheader moved from the 200 Area decontamination facility to the 189-F Hot Shop. Dye penetrant inspection of the crossheader and Parker fittings is underway as the first step of the non-destructive testing portion of the evaluation program for this crossheader.

105-K Reactor Zirconium Tube Program - Design

Detailed design of new process tube assembly components included in the zirconium process tube replacement program for the 105-K Reactors has been completed. Purchase requisitions for the new components have been prepared with the exception of full reactor quantities of the various snap and retaining rings being evaluated in the design. Prototype quantities of these rings are being procured to permit the development of fabrication techniques for the materials utilized prior to the preparation of requisitions for the total quantities of rings required. Fabrication and shop testing of a prototype gunbarrel grooving tool has been completed. Further evaluation will be made prior to the procurement of a number of these machines for usage in the retubing program.

Five impact extruded nozzles have been received from the vendor. Metallurgical and physical examinations indicated that they satisfactorily meet all purchase order requirements and are considered acceptable; however, several minor dimensional discrepancies in the raw extrusions were noted which will require correction prior to the production of full reactor quantities of the nozzles.

Graphite Distortion

Design activities on various facets of the graphite distortion and control rod problem have continued. Vendor fabrication difficulties have continued to delay the receipt of sufficient quantities of the alternate ceramic VSR liner sleeves for test purposes. The fabrication problems encountered now appear to have been resolved and production of both the aluminum oxide and carbide sleeves is proceeding. Graphite VSR sleeving evaluations and flexible VSR-3X Ball compatibility tests have been resumed on a part time basis at the 195-D VSR Test Tower. Fabrication of polycrystalline graphite VSR sleeves for the one channel installation in 105-C Reactor has been completed. Installation of these sleeves is currently scheduled concurrently with an extended outage at this reactor late in November. Borescoping and traversing measurements have been obtained on five additional VSR channels at 105-C Reactor and borescoping data taken on one additional channel. These data are currently being evaluated.



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HW-75089

Detailed design drawings of a flexible VSR for 105-C Reactor for off-site procurement purposes have been completed. This design reflects the recommended increase in VSR length of 21 inches which will provide additional control in the lower regions of the reactor beyond the end of the present VSRs.

EQUIPMENT DEVELOPMENTTube Replacement

The graphite drilling machine designed to relieve the bore of the process tube graphite blocks continued to perform acceptably. Redesign of this drill has been completed and procurement drawings have been transmitted to the Special Outage Services Operation for initiation of procurement of production models. Redesign and fabrication of the vacuum system for in-pile debris removal has been completed with the exception of the steam eductors, which are promised for delivery in October. With the completion of this fabrication, major development work in support of aluminum tube replacement will be completed. With the exception of a minor amount of equipment debugging, effort on this program will be terminated.

105-K Reactor Zirconium Tube Program - Development

Development and testing of the straightening bar cutter concept for channel preparation is continuing. Testing has been completed on a four foot long, 1-5/16 inch diameter steel straightening bar. Results indicate that this bar removed less than 300 mils from the inside of the curve of the most highly distorted K Reactor channel. Fabrication of a six foot bar is progressing; preliminary tests indicate that approximately 500 mils of material can be removed. Procurement of a four foot straightening bars and sufficient insertable cutter bits for both four foot and six foot straightening bars has been initiated. Efforts to develop an expanding cutter technique have been curtailed due to the complexity of the cutting technique. Design of a work platform-mounted drive unit is 90% complete. A modular component design approach was used on this assembly so that fabrication could be begun as design of sub-assemblies was complete. Procurement of sub-assemblies has been initiated.

Development and testing of a charging machine capable of charging self-supported fuel elements in smooth bore zirconium tubes at the K Reactors are continuing. The onsite-fabricated machine is undergoing operational tests in the 103-D Building. Two additional machines are being procured offsite; the first, designed and fabricated by Pacific Steel Products Company; the second, being produced by Union Machine Works. The onsite-fabricated machine and the Pacific Steel Products machine are driven by compressed air; the Union Machine Works design utilizes hydraulic power.

Graphite DistortionVertical Safety Rod Channels

Off-reactor testing of equipment for vertical safety rod channel restoration is continuing. Initial testing of shield drilling machines for force block installation and graphite reamers for channel straightening is underway. Redesign of the chain cutter reamer is proceeding, with the objective of increasing the drive

power and stabilizing the cutting action. Design and fabrication of fixed and collapsible broaches to permit limited straightening of the VSR channels is nearing completion. Fabrication of a broaching ram to operate both broaches has been completed.

Horizontal Control Rod Channels

Track block removal of HCR channel #17 at 105-KE Reactor was completed; the channel was then cleaned of all debris and new cylindrical graphite sleeves were inserted in the channel for evaluation. The demonstration was successful and HCR channel #17 was returned to service.

Prototype High Speed Scanner

The prototype high speed scanner procured on Project CGI-802 continued to operate without failure; 14,675 total operating hours have been accrued.

Design Test Service

The NPR program utilized 780 hours of engineering effort for design service.

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PROJECT ENGINEERINGCGI-839, Modification of Fuel Element Test Facilities, 1706-KER

Construction work in Cells 1 and 2 continues and consists of process pipe and fitting installation. Pipe joints are being x-rayed and stress relieved. Power wiring is being installed to the 75 HP recirculating pumps and other power operated equipment. Instrumentation wiring is being installed.

Repair to three of the 275 HP recirculating pumps for Cells 3 and 4 is continuing at the vendor's plant. Pump No. 561 is being reassembled in preparation for final testing prior to shipment. New parts are being manufactured for Pumps No. 557 and No. 559. A new type first-stage impeller is also being made to eliminate the critical vibration in the present design.

Design effort on the loop safety circuit remains suspended due to procurement delays. A decision has been made by HOO-AEC to obtain new vendor proposals for safety circuit equipment systems. The new invitation to bid has not yet been released; consequently, reinitiation of the design effort will be delayed three to four months beyond the previously scheduled date of October 1.

CGI-844, 100-K Area Coolant Backup

Investigation of the last-ditch coolant system flow efficiency has continued. Analysis of ATP data indicates that the originally specified design flows for the last-ditch coolant backup system will be obtained by cleaning of the cross-tie piping system. Investigation of alternative chemical and mechanical methods of cleaning this piping is under way. To provide temporary relief from the last-ditch coolant flow reduction problem, a purchase order has been placed for auxiliary pressure control devices which will increase the pressure differential required to open the cross-tie system check valves. The higher pressure differential required for check valve opening will prevent diversion of flow from the cross-tie system to a nonstricken reactor during an emergency period.

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

Process Pump Set No. 2 in 190-KW was installed on September 19. The low lift motor, Serial No. 2, had to be removed from service due to extreme vibration, and the spare 1500 HP motor, Serial No. 5, was installed and has operated satisfactorily. The last submersible pump was installed at 181-KE on September 25. All pumps have now been installed and are operable.

CGI-905, Interim Modifications for Coolant Backup, 100-B, C, D, DR, F, and H

Outages have been held at 105-F and 105-D. One high tank was sandblasted and painted at 105-F (one-week outage) and both tanks were completed at 105-D. In addition, high tank coolant lines were installed, Groves valve impulse lines were extended, high tank automatic heaters were installed, and silicate injection lines to high tank were welded in. The 282-E

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and W reservoir automatic closure system was completed and is being tested. The silicate system at 190-C is complete and in process of being tested. A three-week outage at 105-H is in progress.

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

Field preparation work at 105-B has been completed, and is under way at the second area, 105-DR. The first ADC unit should be shipped by the vendor within the next few weeks.

CGI-960, "C" and "D" Work Platform Safety Improvements, All Reactors

The HOO-AEC was requested to negotiate a contract with Houghton Elevator Company to design the equalizer system modification and to furnish the specialized equipment. Estimates supplied by Houghton to date are based on their preliminary engineering study, but are being refined.

CGI-966, Safety Circuit Trip Identification Systems, 105-B, C, D, DR,  
F, and H Areas

All procurement drawings for the Cypak cabinet assemblies have been approved.

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

MJA's 21 and 25 are complete. The 105-KE gage portion of MJA-29 was completed on August 31, 1962, with the installation of the last 566 gages. Four hundred gages were installed at 105-KW on September 21 for a total of 3,133.

MJA-38, Weight Reduction, Front Face (C) Platforms, All Areas

Installation of structural modifications is 75% complete at 105-KE and 20% complete at 105-KW. A review of the aluminum grating installed at all areas is in process to determine adequacy of this material.

R-20520, K Retubing

The tube vendor has received enough billets for approximately 500 tubes and is installing his Vidigage inspection equipment. Several tubes have been reduced; however, inspection equipment is not available for checking to determine conformance to specifications.

Project Proposals Submitted to AEC

CGI-844, Rev. 3. 100-K Area Coolant Backup  
CGI-975. Fence Relocations, 100-B, D, and K Areas

56  
26

Directives Received

HW-494, Mod. No. 5, issued August 31, 1962, for extension of time on  
Project CGI-844, 100-K Area Coolant Backup

CPFF Construction Service Contractor-Liaison

Issued nine new work orders and supplemented four old jobs for a total of  
\$134,609 to J. A. Jones Construction Company.

Plant Forces Work Review

The Labor Standards Board approved one job for assignment to plant forces,  
estimated to cost \$4,042.



Manager, Facilities Engineering

RT Jessen:dgm

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NFR PROJECTPROCESS DESIGN OPERATIONProcess Research and Development

An analysis was made to check the response time requirements of the zone temperature sensing elements. The maximum water temperature transients for which protection would be obtained by sensing elements with various response times were calculated. It was assumed that to protect a tube, a sensing element must cause a trip signal before bulk boiling occurs in that tube. The maximum water temperature transient expected for the NFR is about 2F per second. To protect against this transient the response time of the zone temperature RTDs should not exceed three seconds. A five-second response time will protect against transients up to 1.65F.

Analyses of an emergency cold water injection accident and a rod withdrawal accident have indicated that the ball safety system as designed is adequate.

Analytical studies were made of the pressure transients and steam release rates from primary loop ruptures and to develop a program to simulate the emergency cooling Acceptance Test Procedure.

Failure sequence analyses have been made of the heat dissipation plant instrumentation.

A rough draft issue of HW-74986RD, "Criteria and Scope for ATP-2511, NFR Heat Dissipation Plant, Post Critical Operation," has been issued for review and comments.

Project CAI-816Primary Coolant Pumps

Byron Jackson has submitted a proposal for additional thermal transient tests. They have agreed that upon successful completion of these tests they will give an unequivocal engineering opinion that the pumps will perform reliably in the field provided the maximum seal out-leakage guarantee is increased to a total of 625 gpm for five pumps.

Process Tube Diversion Valves

The mechanical design proposed by Chandler-Evans as a solution to the air actuator timing problem with process tube diversion valves has been accepted by General Electric and drawings were approved at the vendor's plant on August 30, 1962. The design utilizes a dry-film lubricant on the actuator bore and approval of a lubricant was withheld pending the completion of tests. Production of parts for the actuator was initiated by Chandler-Evans shortly after approval of the mechanical design and they predict that diversion valve shipments will start in December, 1962. Three dry-film lubricants are being tested to demonstrate acceptable service life in the 500-600F operating environment.

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### Primary Loop Cone Valves

The engineering problem with primary loop cone valves was resolved when 16-inch, 10-inch, and 8-inch cone valves passed the high-pressure high-temperature seat leakage requirements.

### Horizontal Rod Drives

High deceleration forces have been encountered in the testing of a number of horizontal rod drives at Rucker. Ten drives have been accepted and stamped by General Electric Inspection. The anticipated problem with erratic motion at low shim speed has not been encountered.

### Irradiated Metal Handling

Final underwater system tests have been performed without incident on the segregation equipment for handling irradiated metal, at American Machine and Foundry. The discharge conveyor is complete and has been operated.

### Hot Water Quality Instrumentation

The preliminary specification and design drawings for the hot water quality instrumentation were received from Burns and Roe on September 10, 1962, and are being reviewed particularly the sections on sample pressure, flow and temperature regulation. Dr. E. L. Knoedler, water treatment consultant, visited Hanford September 17 through 20, 1962, to review and comment on this instrumentation.

### Rupture Monitor Valve Racks

Western Piping and Engineering has been attempting to qualify, but has not yet qualified, a procedure for welding 1/4-inch stainless steel tubing for the rupture monitor valve racks. The vendor forwarded to Hanford for examination several samples of practice welds, using 1/4-inch couplings and elbows. Most of the straight couplings would be acceptable as determined by non-destructive tests though several questionable areas were noted. All four 1/4-inch-tubing to 90° elbows submitted were unacceptable because of lack of fusion to the tube. Comments on the vendor's welding procedure specification and a list of suggestions to aid the vendor with his welding problems have been prepared and forwarded through Kaiser Engineers.

### Flow Monitor Transducers

Three of the six racks of flow monitor pressure-to-electrical signal transducers were inspected, stamped, and loaded into trucks by Barton Instrument Company on September 26, 1962, at Los Angeles, California. Later in the day, initiated by Barton Instrument Company, the racks were unloaded following a telephone call from Barton's sub-vendor, Brush Instrument Corporation, that random failures were being found in samples of the differential transformers at the lead wire joints.



Flow Monitor Isolation

A purchase requisition was issued for 1,004 transformers to isolate the Flow Data Logger from the Flow Monitor and thereby protect the reactor from potential spurious scram signals generated in the Flow Data Logger.

Connector Coupling Studs

The ultrasonic testing problem with connector coupling studs was resolved and this testing witnessed by General Electric engineers during a recent trip to Houston, Texas. The production of studs is progressing at approximately 800 units per day through ultrasonic testing at Texas Bolt. Physical testing of studs from the first lot has shown them to be within specification requirements in all respects.

Design Review of Supports for Primary Piping

Holmes and Narver have completed their structural review of the piping support structure and the thermal barrier, and have submitted a preliminary draft of their final report. Except for one detail, the investigation found the support structure and thermal barrier to be adequate for the requirements set forth in the design criteria. Provisions are being made at Hanford to correct the deficient detail by providing additional bracing between certain girders of the thermal barrier which will assist in transmitting lateral loads into the walls of the 105-N Building.

Equipment Development and Testing

Feasibility of using an H-type mechanical joint (developed by Boeing Aircraft Company) as an alternate to welding of instrument tubing has been established through hydrostatic tests, pull-apart tests, by thermal cycling, and by testing in corrosive solutions. Additional tests have been planned to evaluate effects of vibration, bending, decoupling forces, and sensitivity to dimensional variations in tubing to be joined. Specific details of the H-type fitting need to be resolved since the fittings tested were designed for thinner walled tubing than will be used, since the 17-4 PH steel of the fitting used a 900F heat treatment that is corrosion-sensitive instead of a recommended 1100F heat treatment, and since Inconel X is being considered as a substitute for the 17-4 PH material and for use with Inconel tubing. Two hundred H-type fittings (3/16-inch, 1/4-inch, 17-4 PH, and Inconel) have been ordered for testing as well as tools for installing the fittings.

The following Design Tests were completed with issuance of final reports:

- DT-1086 - Ball Safety System
- DT-1096 - Flow Restriction Meters
- DT-1107 - Micropositioner and Printed Circuit Counting Board
- DT-1129 - Confinement Steam Vent Test

The micropositioner and printed circuit counting board successfully passed an operational test of approximately 5,000 hours thus completing evaluation of these important safety circuit components.

FIELD ENGINEERING OPERATIONConstruction105-N and 109-N Buildings

Functional testing has now been completed on 15 of the mechanically operated shielding doors in the 105-N Building. There are a total of 20 mechanically operated doors in this building.

The building service piping installed on Subcontract SC-78 is now being flushed and hydrostatically tested, and the subcontractor is working on punch list items. A considerable portion of the work originally included in this subcontract has now been deleted and will be done by Kaiser Engineers CPFF forces.

The installation of power relay panels in the 105-N Building has resulted in increasing the rate of installation of electrical cable. To date, approximately 900,000 feet of cable has been pulled in the 105 Building, including the 105 and 109 Building inter-tie cables. This represents about 35 per cent of the total cable required.

The work on the instrument tubing in the 105-N Building is continuing at a slow pace. Approximately ten per cent of the required number of tubing welds have now been completed. The majority of these welds have been made on the bench in preparation for installation. Individual weldors on this work vary in production rate from ten to 20 acceptable welds per day, per man, to a high of 130 acceptable welds per day per man. The semi-automatic machine developed in the HAPO welding shop is now in possession of Kaiser Engineers and weldors are being trained in its use.

The gross gamma monitoring panels were received and set in place in the control room.

The temporary instrument calibration shop has been set up in the 105 Building. Test equipment has been installed and preparations have been made for initial calibration work.

117-N Building

The concrete walls and columns in the 117-N Building have now been completed in three of the four cells, and work is under way on the fourth cell. There have been no further difficulties with filter frame inserts.

The installation of the imbedded conduit in this building is now approximately 98 per cent complete.

153-N Building

Work has continued on the testing of wire insulation and the calibration and functional checking of relays and switchgear.

181-N Building

The motor has been removed from pump unit No. 3 and taken to Midway Substation to be disassembled and modified under the direction of the vendor's representative. None of the pump drive motors have operated satisfactorily.

182-N Building

The hydrostatic testing on the various piping systems has continued.

163-N and 183-N Buildings

The functional testing of the filter beds must be raised to provide adequate flow control.

The instrument calibration work and hydrostatic testing work of pipe in the demineralizer building is now nearing completion. Preparations are under way to start functional testing of the demineralization plant.

184-N Building

General Electric instrument technicians started preparation work for instrument calibration work on the 184-N Building on September 18, 1962.

The three boiler feed water pump motors have been bumped for rotation and determination of magnetic center. The No. 3 unit developed a bad oil leak on one bearing and it appears the bearing has been damaged.

File Erection

Completion of piping, ventilation, structural and other work in the horizontal rod rooms is still delaying installation of rod components.

Graphite cooling piping installation in the rod room is complete.

Installation has started on the shield cooling piping.

The pouring of concrete for the top shield has been completed and installation of the skin plate has begun.

Modification of trip mechanism for the ball safety system is under way at the J. A. Jones shop with machining complete on 12 units. Two units have been bench tested and accepted.

Activity of the installation work on the hydraulic elevators is increasing on the piping and electrical work.

Primary Loop Engineering

Production in the HUICO shop continues to improve. Field erection activities have been lessened by a reduction of Kaiser Engineers forces assigned to Primary Pipe due to late delivery of valves in the 105 Building and by inadequate work sequencing through the HUICO shop.

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A total of 368 pipe spools have been shipped to the field from the HUICO shop. This represents a total weight of 242.3 tons. Based upon the number of pipe spools required to complete the job, approximately 38 per cent of the total are now in the field; this excludes the reactor connectors.

Administration

The following material has been issued during the period August 27, 1962 through September 23, 1962:

Drawings	43
Criteria	8
Specifications	3
Requisitions	30
ATP's	3
Other	<u>5</u>
Total	92

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

Drawings	2
Specifications	0
Scope	0
ATP's	<u>0</u>
Total	2

Bailey Meter material processed as of September 23, 1962 is as follows:

Released as Noted for Fabrication Drawings	140
Released for Information	49
Released for Fabrication Drawings	80
Not Released for Fabrication Drawings	4
Approved Without Exceptions (GE)	5
Not Approved (GE)	<u>2</u>
Total	280

Following is the status of Subcontract KE-11252 (HUICO) data as of Tuesday, September 25, 1962:

Total Number Received	2759 (includes 1983 received for information only)
Number Approved	723
Number Approved With Exceptions	25
Number Not Approved	22
Number Currently Being Reviewed	6
By GE & B&R (jointly)	6
By B&R (109-N)	0
Number Received for Information Only	1983
No Approval Required	

PROGRAM EVALUATION

Design Status

	<u>Wt'd Total</u>	<u>Certified Schedule</u>	<u>Actual % Complete</u>
<u>Reactor Plant as of 10/1/62</u>			
<u>Title I</u>			
Scope		100	100 (1)
<u>Title II (2)</u>			
Drawings	60	97.0	97.2
Specifications	5	100.0	100.0
Requisitions	10	89.0	83.9
ATP's	10	68.0	59.4
Development and Testing	<u>15</u>	<u>97.0</u>	<u>96.5</u>
Total	100	93.4	92.1

Heat Dissipation Plant as of 10/1/62

<u>Title I</u>			
Scope		100	98.8
<u>Title II</u>			
Detail Design		100	95.0
	<u>Req'd</u>	<u>No. Issued to Scheduled</u>	<u>9/16/62 Actual</u>
Preliminary Drawings (bid)	1130	1108	1014
Detail Drawings (for const.)	1130	1108	1108
Specifications (bid)	153	152	150
Requisitions	183	169	169
ATP's (preliminary)	15	6	6
(final)	15	2	2

Composite Design Completion as of 10/1/62  
(Reactor and Heat Dissipation Combined)

	<u>Certified Schedule</u>	<u>Actual % Complete</u>
Total	97.1	94.2

- (1) This percentage represents only the completion of 44 criteria and does not include updating or revising.
- (2) Weights and schedule revised 5/1/62 and submitted to AEC for approval.

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Costs

Congressional approval was granted for the \$188 million requested for NPR. However, to date, this amount has not been released to Hanford. The current Hanford release is for a total authorization of \$156.7 million.

Kaiser Engineers are preparing new cost estimates for submission to the Atomic Energy Commission early in October.

Schedules

On April 13, HOO-AEC submitted Revision # 4 to the Certified Construction Schedule to Washington for their consideration. This schedule shows construction completion October 1, 1963.

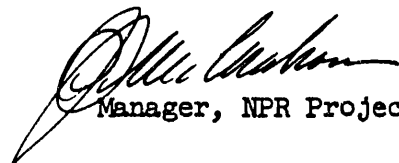
The construction status as of 10/1/62, based on the Revision # 4 to the AEC Construction Schedule, dated April 13, 1962, is as follows:

	<u>Scheduled</u>	<u>Actual</u>
Temporary Construction	84	84
General Area Systems	67	74
105-N Building	77	64
109-N Heat Exchanger Building	75	56
163N-183N Water Treatment Facilities	97	97
181-N River Water Pump House	100	99
182-N High Lift Pump House	97	96
184-N Standby Power House	96	95
153-N Switchgear Building	91	98.8
NPR Project (CAI-816)	77	65

Kaiser Engineers are preparing new schedules for consideration which will be submitted to the AEC early in October.

ATP'S

General Electric's analysis of performing the NPR-ATP's has been completed, and a letter will be issued to the Atomic Energy Commission shortly.

  
Manager, NPR Project

JS McMahon:mf

FINANCIALNEW PRODUCTION REACTOR

As of September 9, 1962, General Electric incurred costs and commitments for the New Production Reactor aggregated \$22,946,000 with \$23,750,000 authorized. The latest official estimate of General Electric incurred costs at completion is \$27,165,000.

GENERAL AND PERSONNEL ACCOUNTING

The PA&C revised FY-1963 budget and the FY-1964 budget review by US-AEC and the Bureau of the Budget is continuing. There has been no further indication of disposition of the budgets at the US-AEC level.

Review of the alternate budget item, Coolant Backup, which was transmitted to US-AEC on August 3, 1962, is apparently continuing at Washington. There has been no indication of disposition of this item.

PRODUCT COST AND BUDGETS

An analysis of Irradiation Processing Department activities relating to spare parts inventory control was prepared for use at discussions of the subject with the Assistant Manager for Administration, Hanford Operations Office.

BUSINESS AND INFORMATION SYSTEMS

During the month of August, approval was received to begin issuing a daily Radiation Exposure Record. This report is being calculated and run in the Production Computing Operation which issued two reports daily. The purpose of this report is to maintain a more accurate record on the exposure received by "critical" crafts and the amount of exposure available to them. It is anticipated that the Manufacturing Section will be able to more effectively utilize the amount of exposure received by the crafts and reduce the amount of overtime requirements to obtain exposure. This report has been well received by the Manufacturing management. The general opinion is that a much better control over the exposure will be possible through the use of this report.

SH Small

Manager, Finance

SH Small:ch

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SIGNIFICANT REPORTS ISSUED

<u>Number</u>	<u>Class'n.</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-73130	Unclass.	WJ Dowis	9/10/62	Power Reactor Design Study and Evaluation - Hanford Graphite Superheat Reactor (HGSR).
HW-74884	Unclass.	WT Love	8/31/62	Review of the Fatigue Sensitivity of Steels to Notches and Cracks and Application to NPR Primary Pipe.
HW-74736	Secret	JD Agar	8/28/62	Top Shield Temperatures at Existing Hanford Reactors.
HW-74986 RD	Unclass.	FJ Mollerus, Jr.	9/18/62	Criteria and Scope for ATP-2511 - NPR Heat Dissipation Plant, Post Critical Operation.
HW-74975	Secret	WS Nechodom	9/28/62	Review of Hanford Reactor Seismoscope Systems.
HW-74797	Unclass.	LB Brinkman	8/31/62	Owner Operator Process and Functional Requirements - Installation of Automatic Backwash System at 183-DR.
HW-73906	Conf.	ME Schack	8/20/62	Design Criteria - Modifications for Use of Zirconium Tubes, 100-K Reactor.
HW-74699	Secret	CE Peck	8/24/62	A Feasibility Study, The Application of Cooling Towers for Reduction of Hanford Plant Heat Load to the Columbia River.
HW-72367	Unclass.	FJ Kempf CF Howden RW Benoliel	6/24/62	PT IP-483-AT, Installation of Force Measurement Test Blocks in One VSR Channel at 105-C and 105-K Reactors.
HW-75048	Unclass.	RH Shoemaker Jr.	9/24/62	Hydraulic Model Tests and Prototype Data Analysis - Rear Riser and Crossunder Piping, B, C, D, DR, F and H Contract DDR-145.

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HW-75089

<u>Number</u>	<u>Class'n.</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-74443-1	Unclass.	DF Arnold	8/1/62	Installation Steps for CGI-939, Applicable to 105-B, C, D, DR, F, and H.
HW-74759	Unclass.	DG Baston	8/28/62	Evaluation of Report on International Instruments Electronic Control Meters, Models 2547-1 and 2547-2.
HW-74913	Unclass.	GL Erickson	9/14/62	Instrument Evaluation Report, Stromberg-Carlson (Div. of General Dynamics) Log N and Period Meter, Serial #203.
HW-75654	Unclass.	JM Goff, Jr.	8/20/62	Design Test 1129 - NPR Confinement Steam Vent Test Report.
HW-74392	Unclass.	KG Hawkins	8/31/62	Design Test 1096 - NPR Flow Restriction Meters Final Report.
HW-74815	Unclass.	M Pociluyko	9/4/62	Flow Test Report on Eight N-Sized KER Suitcase-Handle Spacers.
HW-74790	Unclass.	KG Hawkins	9/18/62	Design Test 1086 - NPR Ball Safety System Trip Mechanism Test Report.
HW-74557	Unclass.	W Seeburger DH Curtiss	8/3/62	Trip Report, Visit to Wolverine Tube Company, July 31 to August 1, 1962.
HW-74771	Unclass.	JR Young	9/4/62	Quarterly Report - The Reactor Process Tube Problem.
HW-73106	Unclass.	RD Duncan	3/26/62	Engineering Study - Increased Capacity for the Reactor Atmosphere Dryer System.

TRIPS

<u>Name</u>	<u>Firm &amp; Location</u>	<u>Date</u>	<u>Purpose</u>
J. H. Fastabend	Western Gear Los Angeles, Calif.	8/17/62	Discuss special tooling problems related to N Maintenance.
	UCLA Los Angeles, Calif.	8/20 to 8/24/62	Attend course on Strain Gages.
	Electrofilm, Inc. Los Angeles, Calif.	8/22/62	Discuss solid lubricants for diversion valve actuators.
D. H. White	Pacific Steel Products Seattle, Washington	8/21 and 8/22/62	Assist in technical resolution of magazine fabrication problems.
R. A. Rohrbacher	Heath Plating Seattle, Washington	8/22/62	To inspect imperfect RTD cable coils and work out a procedure to separate and reject unacceptable cable sections.
	Western Piping & Engin. San Francisco, Calif.	9/10 and 9/11/62	Provide assistance to vendor on welding problems.
L. G. Henke	Chapman Valve Mfg. Co. Indian Orchard, Mass.	8/28 to 8/29/62	Participate in engineering discussions on cone valves.
	Zallea Bros. Wilmington, Delaware	8/29 to 8/30/62	Review and approve vendor drawing of pressure balanced expansion joints.
L. P. Reinig	Chandler-Evans Hartford, Connecticut	8/29 and 8/30/62	Resolve engineering problems, NPR diversion valve actuator timing.
J. F. Nesbitt	AMF Atomics Greenwich, Connecticut	9/11 and 9/12/62	Witness tests on segregation equipment.
	Mayfran Engineering Cleveland, Ohio	9/13 and 9/14/62	View discharge conveyor and witness first operation.
G. F. Bailey H. R. Kosmata	AEC Sioux Falls, S. Dakota	9/11 to 9/14/62	Present papers at the AEC Nuclear Superheat Meeting.

<u>Name</u>	<u>Firm &amp; Location</u>	<u>Date</u>	<u>Purpose</u>
F. J. Mollerus, Jr. W. J. Mundt	Burns and Roe, Inc. Hempstead, New York	9/24 to 9/28/62	Discuss remaining design items.
O. H. Greager	San Francisco, Calif.	9/11 to 9/15/62	Attend GETHC Meeting.
N. R. Miller R. E. Trumble R. E. Hall R. Nilson	San Francisco, Calif.	9/9 to 9/14/62	Make presentations on NPR design to GETHC.
D. H. Curtiss J. H. Brown	Wolverine Tube Co. Inkster, Michigan	9/16 to 9/19/62	Review status of purchase orders for zirconium process tubes.
L. M. Keene	Byron Jackson Co. Los Angeles, Calif.	8/27 to 8/29/62	Witness power factor testing of raw water pump motor being supplied for Project CGI-883.
K. E. Hawkins	Pacific Valve Long Beach, Calif.	8/28 thru 8/30/62	To discuss and resolve the manufacturing difficulties with flapper caps.
B. W. Herrman	Dresden Nuclear Power Station Morris, Illinois	8/22/62	Discuss in-core flux monitor chambers.
D. F. Arnold	Astrodata Anaheim, Calif.	9/4 thru 9/12/62	To witness vendor acceptance testing on analog to digital converter system.
J. A. Dear	Kirkhill Rubber Co. Los Angeles, Calif.	9/17/62	To provide assistance on problems involved in extruding plastic inserts for fuel magazines.
D. L. Hovorka P. B. McCarthy	Union Machine Works and Pacific Steel Products Seattle, Washington	8/30/62	Discuss scheduled design of charging machines with fabrication vendors.
P. B. McCarthy	Same	9/19/62	Same.
D. A. Hoover	Wolverine Tube Company Inkster, Michigan	9/17 and 9/18/62	To observe progress on manufacturing and inspection of Zircaloy-2 process tubes for K Area retubing.

<u>Name</u>	<u>Firm &amp; Location</u>	<u>Date</u>	<u>Purpose</u>
R. B. Shreve C. J. Crane	Astrodata Anaheim, Calif.	8/28 to 9/14/62	Receive special training on the maintenance and calibration of analog to digital computer system.
G. J. Rogers	San Francisco, Calif.	9/10 to 9/14/62	To make a presentation to the General Electric Company Technological Hazards Council.
J. H. Hoage	Marine Iron Works Tacoma, Washington	9/10 and 9/11/62	Consult with vendor on graphite broach heat treatment.
T. Prudich	AEC Washington, D.C.	9/4 and 9/5/62	Attend Combined Operations Meeting.

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<u>Name</u>	<u>Firm &amp; Location</u>	<u>Date</u>	<u>Purpose</u>
W. R. Kanne	GE - APED San Jose, Calif.	9/6 and 9/7/62	Technical discussions in preparation for presentations to GETHC.
R. Haeffner	DuPont Savannah River, Georgia	9/11/62	Discuss fuel design techniques.
H. Shimizu	Atomics International Canoga Park, Calif.	9/12/62	Discuss technical aspects of contract.
M. W. Burkett	National Carbon Company New York, New York	8/21/62	Discuss boron graphite.
H. Hallsey	Boeing Company Seattle, Washington	9/10/62	To demonstrate and discuss the "H" type fitting which may prove applicable as an alternate for socket welds on small tubing.
O. L. Harper	Parker Aircraft Renton, Washington	9/10/62	Same as above
W. Armbruster	Parker Aircraft Kirkland, Washington	9/10/62	Same as above.
G. O'Sullivan	Consolidated Controls Corp. Bethel, Connecticut	9/14/62	Presentation of reactor controls and instrumentation.
A. L. Nelson	Dupar Dynamics Kennewick, Washington	9/19/62	To discuss Parker weld sockets.
Dr. E. L. Knoedler	Sheppard T. Powell Baltimore, Maryland	9/17 to 9/20/62	Discuss water treatment problems.
C. E. Jones	AEC Chicago, Illinois	9/4 and 9/5/62	Discuss absolute filters, charcoal filters, and methods of testing filters.
B. K. Smith	Epsco, Inc. Cambridge, Mass.	7/25/62	Discuss high speed scanning system.
A. R. Day	Byron-Jackson Company Los Angeles, Calif.	9/17 thru 9/19/62	To assist in installation of low and high lift process pump No. 2, 190-KW.

<u>Name</u>	<u>Firm &amp; Location</u>	<u>Date</u>	<u>Purpose</u>
M. G. Michel R. D. Christensen	Byron-Jackson Company Los Angeles, Calif.	9/19/62	To visit 190-C and 181-K.
L. A. Hopkins J. H. Lynch S. Mullen	Vicon Corporation Pasco, Washington	9/10/ 62	To demonstrate Torginol seamless floor.

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