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REACTOR BRANCH MONTHLY REPORTS JANUARY - DECEMBER 1962

BY: RL PLUM

ATOMIC ENERGY COMMISSION
HANFORD OPERATIONS OFFICE

STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : Files

DATE: February 8, 1962

FROM : R. L. Plum, Chief
Reactor Operations Branch

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SUBJECT: MONTHLY REPORT - JANUARY 1962

HAN - 80948
Report # 1

Classification DECLASSIFIED

OR:GTO:RGR

By Authority of CG-PR-2
DS Lewis 4-7-92
DD Dixon 6-11-92
PM Eck 6-11-92

OPERATING EXPERIENCE

Production

Reactor input production (MWD) was 1.1% above forecast; 0.4% above at the six old reactors and 1.8% above at the K areas.

Efficiency

Over-all TOE was 65.8% (63.5% forecast); 61.2% at the six old reactors and 79.8% at the K areas. Lower efficiency at the old reactors was largely due to water leaks, ruptures, and scheduled tube replacements.

Non Equilibrium Loss Summary

Non equilibrium losses per reactor startup in CY 1961 averaged only 0.29 effective day lost per startup; a goal of 0.3 effective day per startup had been set.

Power Level

The administrative level of 4400 megawatts was reached by both K reactors, and a new record level of 2295 megawatts was reached by C reactor. A new production record was achieved at KE, 0.8% above their previous record during May 1960. There was no increase in combined reactor instantaneous power level.

Fuel Ruptures

Thirteen ruptures were removed from six of the reactors. Eight KE-E, 4 KE natural and one oversize KE natural. Five of the KE-E ruptures were at H, two at K and one at C. Two of the natural ruptures were at D, one at B, and one at KE. The oversize rupture was at C.

[redacted]

Power Level Limits

The power level limitations that predominated at all reactors during the month of January are as follows: B, D, DR, and F reactors by tube corrosion considerations; C and H reactors by rupture control considerations; and K reactors by administrative power level limits.

MAINTENANCE AND EQUIPMENT EXPERIENCE

Tube Replacement

Six hundred thirty-nine tubes were installed as follows: 344 at B, 144 at DR, 121 at H, 11 at C, 8 at D, 8 at F, 2 at KW, and 1 at KE.

Water Leaks

Twenty-one tube and 5 Van Stone leaks were corrected: Tube leaks--6 at H, 6 at D, 3 at B, 3 at F, 2 at C, 1 at DR. Van Stone leaks--3 at H, 1 at D, 1 at B.

Engineering in Support of Power Forecasting

A Quarterly Savings Report showed electrical power savings of $58,007 for the first two quarters of FY-62, effected by utilizing interruptible power.

105-H Tube Problem

A report was issued summarizing the results of the investigations to date on the nineteen transverse process tube cracks which have occurred during the past two years at 105-H reactor. Results indicate these tube failures to be of the fatigue type occurring at the top of the tube, transverse to the longitudinal axis, generally occurring at an angle of 45 degrees to the surface of the tubes, and originating on the internal tube surface. It is concluded that these cracks are caused by a combination of short radius bending of the process tube due to graphite distortion combined with cyclic thermal stresses which produce a fatigue type of failure. This problem is felt to be peculiar to the 105-H reactor because of the trunion block configuration utilized in the graphite stack design for this reactor. Since no tube with less than three years of service has yet failed in this manner, an interim measure being taken is to replace all tubes in the central zone of H reactor that are older than 3 years.

[redacted]

DECLASSIFIED

VSR's 105-C

Vertical safety rod channel #48 at 105-C was examined following removal of the rod from service due to binding. Examination indicated a slip plane in the graphite stack typical of that observed previously in this portion of the rod pattern with both tube and filler blocks protruding into the channel approximately 1-3/4 inch. A B-sized vertical safety rod will be installed in this channel as an interim measure.

Horizontal Control Rod Track Block Removal

An attempt to remove track blocks from HCR channel 17 at the 105-KE reactor was unsuccessful. This attempt was part of a planned effort to install graphite sleeves in one HCR channel to prevent 3X System ball entry into the channel.

The outer six feet of the K area HCR channels have no track blocks and the side filler blocks are keyed to prevent their movement into the channel. Due to a reduction in width of the channel in the outer six feet, it was impossible to pull the blocks out. Equipment to split the track blocks before removal is being designed.

REACTOR OUTAGES

Date Down	Date Up	Outage Hours	Remarks
B REACTOR			
1/2	1/4	44.5	Leak testing and tube replacement.
1/7	1/10	57.8	Removal of an [illegible] regular metal rupture from tube 2088. Tube replacement.
1/13	1/29	383.1	Scheduled charge-discharge and replacement of 340 tubes. Miscellaneous maintenance.
1/29	1/29	0.7	Panellit trip due to fluctuation in water pressure while adjusting gauges.
C REACTOR			
1/5	1/[illegible]	40.7	Removal of an [illegible]-1 metal rupture from tube 3271.

[redacted]

C REACTOR (continued)

1/16	1/19	72.9	Removal of an oversize I&E natural metal rupture from tube 4463. Probologging and miscellaneous maintenance.
1/23	1/25	42.8	Leak testing and tube replacement.
1/28	1/29	26.6	Leak testing and tube replacement.

D REACTOR

1/1	1/4	68.3	Charge-discharge following leak testing.
1/7	1/9	46.2	Leak testing.
1/9	1/10	28.1	Removal of an I&E regular metal rupture from tube 2773.
1/14	1/16	42.6	Leak testing and tube replacement.
1/20	1/20	0.2	Power surge due to the grounding of a power line.
1/24	1/26	42.1	Leak testing and tube replacement.
1/27	1/27	3.4	Two Panellit trips due to oscillating gauges.
1/30	Still Down		Removal of an I&E regular metal rupture from tube 2371.

DR REACTOR

12/31	1/14	344.0	Scheduled charge-discharge and replacement of 180 tubes.
1/16	1/18	47.2	Leak testing and tube replacement.
1/19	1/19	0.5	Gas loop trip due to a voltage drop on the loop compressor when wind blew power lines together.

F REACTOR

1/10	1/12	55.8	Water leak and tube replacement.
1/19	1/20	41.6	Leak testing and tube replacement.

H REACTOR

12/31	1/2	32.1	Removal of an I&E-E metal rupture from tube 2667. Charge-discharge.
1/4	1/5	30.5	Leak testing and tube replacement.
1/7	1/8	28.2	Removal of an I&E-E metal rupture from tube 2580. Tube replacement.
1/9	1/9	1.0	Successful quick discharge of an I&E-E metal rupture from tube 2576.
1/11	1/13	51.6	Leak testing and tube replacement.
1/13	1/13	1.8	Three unexplained Panellit trips.
1/16	1/18	32.5	Removal of an I&E-E metal rupture from tube 1968. Tube replacement.
1/21	1/22	32.0	Removal of an I&E-E metal rupture from tube 2669. Tube replacement.
1/25	1/26	29.3	Removal of an I&E-E metal rupture from tube 3174.
1/27	Still Down		Scheduled tube replacement.

KE REACTOR

1/23	1/27	102.5	Removal of an I&E regular metal rupture from tube 4667. Scheduled charge-discharge and maintenance.
1/27	1/27	0.5	Tripped by loop 1 when the control valve packing failed.

KW REACTOR

1/3	1/6	70.6	Scheduled charge-discharge and miscellaneous maintenance.
1/6	1/6	1.1	Manual trip due to insufficient control rod.
1/8	1/9	33.5	Miscellaneous maintenance work following a dual Beckman trip. (No. 2 Beckman circuit was caused to be bypassed by an electrical identification tab which dropped into a relay).

[redacted]

KW REACTOR (continued)

1/21	1/23	44.5	Removal of an I&E-E metal rupture from tube 2779. Charge-discharge and miscellaneous maintenance.
1/23	1/23	5.3	Unexplained Panellit trip.
1/23	1/23	0.7	Unexplained Panellit trip.
1/23	1/23	1.2	Unexplained Panellit trip.
1/23	1/24	4.3	Unexplained Panellit trip.
1/24	1/24	1.7	Removal of an I&E-E metal rupture from tube 2571.
1/27	1/28	33.0	Tripped by the crosstie system when the #3 high-lift discharge line check valve malfunctioned at (70).

RESEARCH AND DEVELOPMENT - EXISTING REACTORS

Splines

A straightener for the reclamation of used splines has been successfully demonstrated and is in current use on a test basis at KW reactor. Application at the remaining reactors is planned.

The first of a large order of nonpoisonous splines was received; initial performance of the splines for obtaining flux traverses was satisfactory.

E-N Loading

The second E-N core loading in the H reactor was being discharged at month end; natural uranium will be recharged. On the basis of rupture statistics analyses by Process Technology, an optimum discharge exposure of 750 MWD/T was indicated to Manufacturing. Rupture effects were less significant than tube replacement and water leak problems; therefore, the second loading was run to 875 MWD/T prior to discharge. Flux mapping of the E-N loading indicated a rupture severity index of twice that in a natural uranium core.

Effluent Water Data

The table below shows the average concentrations of radioisotopes on reactor effluent water from samples taken during December 1961. Concentrations are in units of picocuries per milliliter:

Effluent Water Data (continued)

Reactor	As^{76}	P^{32}	Zn^{65}	Np^{239}	Cr^{51}
B	62	3.9	27	71	280
C	76	7.0	11	135	530
D	103	9.8	*	180	*
DR	86	6.5	11	120	570
F	56	7.2	18	160	1100
H	76	5.7	8	85	560
KE	52	6.9	9	81	660
KW	87	10.4	16	81	570

* No valid results

Recycle Program

The composition of enriched recycle fuel as of December 31, 1961 is given below:

Percentage of Recycle Fuel in Enriched Fuel (by tubes)

B	C	D	DR	F	H	KE	KW
53%	82%	51%	64%	69%	66%	92%	96%

VSR's 105-C

Testing of a prototype 105-C reactor sized flexible vertical safety rod has continued. It has been determined that although the rod configuration will satisfactorily pass under power through a three-inch distortion in a six-foot length of channel, the rod could not pass through this distorted channel under drop testing due to rod buckling. Additional guided rod drop tests are under way to determine the maximum stack distortion which can be accommodated by the present rod design.

Bumper Fuel Development

Bumper fuel test results from KW reactor are being analyzed. The OIIIN-B fuel elements charged into D reactor for investigation of dimensional stability were discharged at their scheduled goal exposure of 900 MWD/T on 1/1/62.

Nickel Plated Fuel Program

Twenty columns of nickel plated OIIN fuel were discharged from DR reactor during the 12/31/61 outage at an estimated exposure of 750 MWD/T. Two of the columns were examined immediately after discharge at the 105-DR tech viewing pit with the following preliminary observations:

1. There was definite sloughing of the nickel plate on one element and indications of sloughing and flaking on others.

2. Nickel plate was observed to be penetrated in the area in contact with the process tube ribs.

3. Several pieces were noted to contain a network of fine hairline cracks in the plate.

One column containing a rupture suspect was discharged late in the outage and subsequently covered with other metal. Twenty-eight of the thirty pieces have been recovered and will be examined.

Coextruded Fuel

A fuel column of zircaloy-clad [redacted] fuel was discharged from [redacted] reactor on 1/3/62 at an average tube exposure of 1159 MWD/T.

REACTOR MODIFICATION PROGRAM

Overbore Fuel Development

The first overbore fuel element failure was experienced on 1/13/62. The metal was machine-charged into a smooth-bore aluminum process tube on 8/1/61, and was machine-discharged at an exposure of 631 MWD/T, or 79% of goal. The rupture will be scheduled for examination by Radiometallurgy and final classification of the rupture type will be deferred until after the examination. Visual inspection of the ruptured piece revealed four damaged support rails, severe groove corrosion attack (to the Al-Si), and severe hot area corrosion on the bottom half of the element.

The aluminum tube was not recharged with fuel.

Nineteen columns were recharged during the rupture outage. Four were long fringe-zone columns and fifteen were short central-zone columns.

NEW PRODUCTION REACTOR

Stuck Rod Computations

A study is being made to determine the maximum number of HCR's which can be out of service such that the remaining HCR's will keep the NPR just critical under accident conditions.

NPR Fuel Development

The five 23-inch NIE1 elements charged into KER-1 December 14, 1961 to evaluate the effect of pre-irradiation warp condition on fuel behavior have reached an exposure of 850 MWD/T.

Five 23-inch NIE1 elements charged in KER-2 on September 17, 1961 to evaluate high exposure fuel element distortion and swelling have reached an exposure of 1910 MWD/T.

Four capsules containing enriched Zr-2 jacketed fuel samples to determine the effect of jacket uniformity on localized jacket straining were charged into DR reactor on January 7, 1962 for an irradiation period of about 100 days (2000 MWD/T exposure); current exposure is 50 MWD/T.

NPR Graphite Irradiations

Two capsules containing NPR graphite are under irradiation at the GETR and are performing satisfactorily. The measured temperatures of the graphite specimens range from 350° to 750° C. The first capsule is scheduled for discharge on March 17. At that time a third capsule will be charged into the position vacated. The second capsule is due to be discharged May 19 and will be replaced by a fourth capsule containing some of the specimens irradiated in the first capsule.

(Year) January

OUTAGES (1962)

Reason	B	C	D	DR	F	H	KE	KW	Total
Charge-Discharge	38.8	36.5	29.4	59.9	3.3	38.9	70.3	72.9	350.0
Maintenance	73.1	50.5	72.6	46.0	43.1	35.3	4.5	65.6	390.7
Rupture Removal	30.4	3.2	46.9			13.5	1.4	10.4	105.8
Leak Testing	37.4	39.7	92.1	13.1	33.7	114.3			330.3
Tube Replacement	284.3	40.3	9.4	200.5	6.0	126.2	5.9	6.5	679.1
Project Work	8.2		0.2	4.2	3.0		10.4		26.0
Production Tests	5.9	22.8	3.4	6.8	4.0	7.0	9.1	9.5	68.5
Standard Check Instrument & Circuitry	3.3		0.3	0.8	4.3		1.4	0.5	10.6
Rupture Suspects									
Miscellaneous	0.7		0.7	36.3		1.6		32.7	72.0
Total	192.1	193.0	255.0	367.6	97.4	336.8	103.0	198.1	2,033.0
Scheduled Outages									
Unscheduled Outages									

Tube No.	Date Charged	Date Ruptured	Tube Power (KW)	Concentration MWD/Ton	Assigned Production Loss		Observations
					MWD	Days	
[illegible]	11-7-61	1-5-62	1424	611	374	.18	I&E-E, Hot spot.
[illegible]	11-24-61	1-7-62	1195	208	2329	1.43	I&E-Reg., Unclassified, (13,000 PSI)
[illegible]	9-10-61	1-7-62	1113	746	386	.24	I&E-E, Hole
[illegible]	11-20-61	1-9-62	1148	253	200+	1.24	I&E Reg., Unclassified (14,000 PSI'
[illegible]	9-10-61	1-9-62	1085	738	1041	.65	I&E-E, Hole
[illegible]	9-10-61	1-16-62	1157	390	143	.09	I&E-E, Hole
[illegible]	9-8-61	1-21-62	1034	880	259	.16	I&E-E, Hole
[illegible]	12-1-61	1-21-62	1763	510	1772	.44	I&E-E, Hot Spot
[illegible]	12-26-61	1-23-62	1596	254	267	.06	I&E-Reg., Hole
[illegible]	12-4-61	1-24-62	1724	510	398	.10	I&E-E, unknown (Rupture Prone)
[illegible]	9-8-61	1-25-62	1143	829	116	.07	I&E-E, Hole
[illegible]	12-12-61	1-30-62	1107	976	1492	.93	I&E-Reg., Split (13,000 PSI)
[illegible]	1-1-61	1-14-62	1488	331	406	.20	Oversize I&E-Nat., Side

STANDARD FORM NO. 64

Office Memorandum UNITED STATES GOVERNMENT

TO : Files

DATE: March 9, 1962

FROM : R. L. Plum, Chief
Reactor Operations Branch

This document consists of 10 pages
No. 1 of 1 copies, Series A

SUBJECT: MONTHLY REPORT - FEBRUARY 1962

HAN - 80948
Report # 2

OR:GTO:RGR

OPERATING EXPERIENCE

Production

Reactor input production (MWD) was 3.7% above forecast; 0.8% above at the six old reactors and 6.6% above at the K's.

Efficiency

Over-all time operated efficiency was 69.4% (66.2% forecast); 63.4% at the six old reactors and 87.2% at the K's. Efficiency was low at the old reactors due largely to scheduled outages for tube replacement.

With improved operating continuity at the older reactors, flattening efficiency also increased. Nonequilibrium losses were higher than normal summer and fall values, primarily as a result of the increased time required to raise the power to the higher winter-time power levels; however, the average loss per startup was about 0.3 equivalent day, the average of 1961 performance.

Power Level

There was no increase in the combined reactor instantaneous power level. The administrative level of 2310 megawatts was reached at C reactor with an increase of 15 megawatts. The power level at B Reactor was increased 40 megawatts for a record level of 1935.

Fuel Ruptures

Three ruptures, two I&E regular and one I&E enriched, were removed from the reactors. The regular metal ruptures were at C and D, the enriched at B.

Power Level Limits

B, D, DR, and F - tube corrosion considerations. H - rupture control consideration. C, KE, and KW - administrative limits.

MAINTENANCE AND EQUIPMENT EXPERIENCE

Tube Replacement

Five hundred seventy-five process tubes were installed; 364 at F, 189 at H, 12 at C, 6 at B, 3 at D, and one at KW.

Water Leaks

Ten process water leaks were corrected; five were tube leaks and five were Van Stone. Two of the tube leaks were at B, 2 at D, and one at C. Four of the Van Stone leaks were at B and one at H.

VSR's, 105-C

Following successful completion of off-reactor testing of the prototype 105-C Reactor flexible vertical safety rod, this rod was installed in channel No. 35 at 105-C Reactor to replace a "B" sized rigid rod which would not enter the last foot of the VSR channel. The larger sized flexible rod successfully entered the full length of the channel with a measured drop time 1.38 seconds, which is well within the process standard requirement of 2.5 seconds.

REACTOR OUTAGES

B REACTOR

Date Down	Date Up	Outage Hours	Remarks
2/11	2/12	29.7	Leak testing and tube replacement.
2/13	2/13	0.5	Adjust water flow on three gamma monitoring sample lines.
2/14	2/16	45.4	Leak testing and tube replacement.
2/22	2/25	67.4	Leak testing, tube replacement and charge-discharge.
2/25	2/25	6.0	Correct faulty thermocouples.
2/26	Still Down		Removal of an I&E B-metal rupture from tube 2463, leak testing and tube replacement.

DECLA[redacted]

C REACTOR

2/3	2/5	39.6	Removal of an I&E regular metal rupture from tube 2289, charge-discharge and maintenance.
2/5	2/5	1.5	Panellit trip due to loose spline cap on tube 0670.
2/15	2/22	142.4	Front pigtail leak at crossheader adaptor on tube 3456. Scheduled charge-discharge and maintenance.

D REACTOR

1/30	2/2	51.0	Charge-discharge following rupture removal.
2/7	2/9	43.0	Leak testing and tube replacement.
2/9	2/9	0.3	Replacement of faulty front-face cap.
2/16	2/18	40.9	Leak testing and tube replacement following a Panellit trip.
2/18	2/19	14.0	Removal of a stuck I&E regular metal rupture from tube 3775 and tube replacement.
2/21	2/21	0.1	Unexplained Panellit trip.
2/23	Still Down		Scheduled charge-discharge, maintenance and replacement of approximately 400 tubes.

DR REACTOR

2/6	2/8	59.5	Scheduled charge-discharge following leak testing.

F REACTOR

2/7	2/9	35.6	Miscellaneous maintenance following a Panellit trip.
2/10	2/26	411.4	Scheduled tube replacement.
2/27	2/27	6.3	Adjust radiation shielding on "A" test hole.

H REACTOR

1/27	2/13	407.6	Replacement of 300 tubes, charge-discharge and miscellaneous maintenance.
2/13	2/13	2.7	Correction of abnormal water pressure on tube 3472.

[redacted]

Files

March 9, 1962

KE REACTOR

2/16	2/18	56.5	Charge-discharge following a Panellit trip.
2/19	2/19	0.7	Unexplained Panellit trip.

KW REACTOR

2/13	2/16	72.0	Scheduled charge-discharge and miscellaneous maintenance.
2/16	2/16	8.0	Adjustment of Panellit gauges for 5 pump operation.
2/24	2/25	34.8	Unexplained Panellit trip and miscellaneous maintenance.

RESEARCH AND DEVELOPMENT - EXISTING REACTORS

Self-supported Fuel

A rupture classified as a groove-corrosion side failure was experienced in a CIVN-S fuel element on 2-3-62 at a tube exposure of 1003 MWD/t. Failure was apparently due to severe corrosion attack. Visual observation revealed six of the eight support rails were damaged, resulting in improper fuel positioning in the process tube during irradiation. Two KVN-S columns were discharged from KW Reactor without difficulty during the 2-13-62 outage at an exposure of 800 MWD/t.

Bumper Fuel Development

Irradiation of these elements proceeded uneventfully.

Other Programs

Irradiation of nickel plated fuel continued uneventfully.

One column of coextruded zircaloy clad material was discharged from KW Reactor during the 2-13-62 outage at an exposure of 1475 MWD/t.

E-N Load

The second E-N Load in H Reactor was discharged at the end of January. The large batch dissolution of the E-metal from the first E-N core has been completed but analytical results have not been reported. The fringe blanket of the E-N load remains in the reactor and will be discharged late in CY 1962.

Effluent Water Data

The table below shows the average concentrations of radioisotopes in reactor effluent water samples taken during January 1962. Concentrations are in units of picocuries/cc.

Reactor	As^{76}	P^{32}	Zn^{65}	Np^{239}	Cr^{51}
B	68	4.4	*	*	*
C	91	8.8	36	180	1100
D	64	7.4	18	150	680
DR	63	9.6	47	100	860
F	50	8.1	61	160	2600
H	60	7.0	90	90	460
KE	54	11.4	18	90	680
KW	55	10.9	15	100	800

* Insufficient Data

Reactor Effluent Studies

The study report on the feasibility of disposal of the reactor effluent through an inland lake has been completed. The results of this study indicate that a significant reduction in river contamination will not be realized by discharging the reactor effluent to an artificial lake prior to its return to the Columbia River.

Pinchbottle Program

Three samples of irradiated, recycled enriched uranium have undergone isotopic analysis. Analytical results for Np 23[illegible] yield are given below together with theoretical values. The obvious discrepancy between theory and analytical results is being investigated.

Sample	Neptunium Yield from E-Metal	
	Np^{237} G/T (Analytical)	Np^{237} G/T (Theoretical)
A. Recycle	2.92	2.10
B. Recycle	3.40	2.75
C. Recycle	4.33	3.15
D. Virgin (Comparison)	2.70	2.40

Splines

The availability of nonpoisonous splines for obtaining flux traverses has permitted improved evaluation of the axial flux distribution which has been particularly helpful in correcting C and DR Reactor flux distribution problems.

Xenon-Override Test - B Reactor

Planning for the production test of the partial xenon-override core has been completed, with charging scheduled during the outage of 3-1-62.

Safety Control Studies

Relief was obtained in the administration of total control at DR Reactor as a result of comparison tests (PT IP-447-C) made during January and February.

Pile Reactivity Studies

A renormalization in the accountability program is again planned in conjunction with Nuclear Materials for July 1. Predictions are still about 1.5% higher than desired on plutonium recovery from E-metal.

Control Efficiency Studies

Work is still in progress on control rod logic circuits. The production test sponsored at KW Reactor for HLO for the purpose of obtaining empirical transfer function data will apparently need a supplement to permit deliberate rod movements large enough for test purposes.

[redacted]

Shield Protection Studies

The 125 depleted uranium pieces for PT IP-400-C have now been fabricated. A 100-tube block will be loaded with these pieces upstream of the regular charge to determine their effectiveness in reducing front-face radiation levels.

Rear Crossheader Expansion Joints and Guides, B, D, F, DR, H Reactors

Rear crossheader expansion joints and crossheader guides have been successfully demonstrated as a means of alleviating the problem of rear crossheader vibration and thermally induced stress at the ends of the headers. Document HW-72575 has been issued to document study work on this problem.

Tube Replacement

Major items now being developed in support of the tube replacement program are: (a) a remotely controlled tube chopper, (b) drilling equipment mounted on the work platform, (c) anodized tubes and insertion devices, and (d) decontamination.

Operational Fueling Facility

Operational fueling tests were performed at 105-KE on February 9, and were completely successful. Ten tubes were refueled while at equilibrium power at an average rate of one every thirty minutes, a rate sufficient to meet the reactor's continuous refueling requirements.

Temperature Monitoring Equipment

The 116-point model of the high speed scanning equipment purchased for test and evaluation under Project CGI-802, has been under test in the 1713-D laboratory for more than a year. Final acceptance tests were performed this month and the requirements were met.

REACTOR MODIFICATION PROGRAM

Overbore Fuel Development

Two columns of overbore-size bumper fuel elements were discharged from C Reactor during the 2-16-62 outage at an estimated average tube exposure of 765 MWD/t. No further discharges of self-supported overbore fuel occurred during the report period. The failed element referred to in last month's report remains in storage awaiting radiometallurgical examination.

[redacted]

Zirconium Tubes

Preliminary designs of impact extruded replacement inlet nozzles and caps for possible use at the 105-K Reactors with zirconium process tubes have been prepared. Purchase requisitions have been issued for prototypes of the proposed nozzles for test and evaluation purposes. Design for other components of the proposed assemblies are being prepared.

NEW PRODUCTION REACTOR

NPR Fuel Development

The five 23-inch NIE1 elements charged into KER-1 on December 14, 1961 to evaluate the effect of pre-irradiation warp condition on fuel behavior were discharged 2-17-62 at an exposure of 1075 MWD/t. Cursory examination of the discharged elements indicates no grossly abnormal distortion. The elements will be stored until precise dimensional changes can be measured.

KER-1 was recharged on 2-17-62 with a thermocouple element to evaluate the reliability and sensitivity of the thermocouple element as a crud film detector. Other objectives are to measure the temperature effect of crud film deposition as the result of decontamination of a carbon steel system and to measure the effect of filming resulting from the loss of pH control. The thermocouple element and the four NIE1 heater elements in the charge are scheduled to a 2000 MWD/t goal.

Five 23-inch NIE1 elements charged in KER-2 on 9-17-61 to evaluate high exposure fuel element distortion and swelling have reached an exposure of 2385 MWD/t.

On 2-18-62, two NAE1* fuel assemblies were charged in KER-3 to permit further testing of this loop, which has been modified for the irradiation of N Reactor prototype fuel elements under N Reactor conditions.

Four capsules containing enriched Zr-2 jacketed fuel samples to determine the effect of jacket uniformity on localized jacket straining were charged into DR Reactor on 1-7-62. Target exposure is about 2000 MWD/t. Current exposure is 300 MWD/t.

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* NAE1 N Reactor, concentric tube assemblies, enriched uranium, first model.

[redacted]

[redacted]
(Year)

OUTAGES (2-62)

Reason	B	C	D	DR	F	H	KE	KW	Total
Charge-Discharge	15.1	57.9	34.0	21.9	46.0	69.3	24.1	43.5	311.8
Maintenance	86.7	29.2	43.2	9.8	104.0	4.9	4.3	33.9	316.0
Rupture Removal	12.5		14.0						26.5
Leak Testing	89.2	33.3	28.4	11.5	13.4	8.3			184.1
Tube Replacement	12.1	62.2	101.7	16.3	229.7	200.8	14.2	9.3	646.3
Project Work		7.4	.9		12.1	7.6		13.6	41.6
Production Tests	.7	17.4	11.2		5.3		13.9	5.4	53.9
Standard Check Instrument & Circuitry	4.2		4.6		3.2	7.3		.9	20.2
Rupture Suspects									
Miscellaneous	0.5		15.1		15.6	6.0	0.7	8.2	46.1
Total	221.0	207.4	253.1	59.5	429.3	304.2	57.2	114.8	1,646.5
Scheduled Outages									
Unscheduled Outages									

RUPTURED [redacted] LATION FOR February 1962

Tube No.	Date Charged	Date Ruptured	Tube Power (KW)	Concentration MWD/Ton	Assigned Production Loss		Observations
					MWD	Days	
2289C	9-16-61	2-3-62	1494	1003	59	.03	I&E Reg. Self-support, side other
3775D	8-6-61	2-18-62	1172	1158	1486	.91	I&E Reg. Bumper, Split.
2163B	1-3-62	2-26-62	1273	270	1067	.60	I&E Enr., Hot Spot

STANDARD FORM NO. 64

Office Memorandum · UNITED STATES GOVERNMENT

TO : Files

DATE: April 10, 1962

FROM : R. L. Plum, Chief
Reactor Operations Branch

SUBJECT: MONTHLY REPORT - MARCH 1962

HAN-80948
Report #3

OR:GTO-RGR

THIS DOCUMENT CONSISTS OF 14 PAGES
NO [redacted]

OPERATING EXPERIENCE

Production

Reactor input production (MWD) was 9.6 per cent above forecast; 12.8 per cent above at the six old reactors and 6.4 per cent above at the K's.

Efficiency

Over-all time operated efficiency was 73.2 per cent (66.1 per cent forecast); 69.5 per cent at the six old reactors and 84.4 per cent at the K's. Efficiency was above forecast, particularly at the old reactors, due to less outage time than forecast for maintenance and the correction of water leaks.

Power Level

There was no increase in the combined reactor instantaneous power level. The individual reactor record power levels were increased 5 megawatts at B (1935 to 1940) and 30 megawatts at D (1945 to 1975), the latter being an all-time high for the five old reactors. A new monthly production record was achieved at KW, exceeding the previous record of December, 1961 by 3.5 per cent.

Fuel Ruptures

Seven ruptures, four I&E regular and three I&E enriched, were removed from the reactors. Two of the regular metal ruptures were at DR, one at B and one at H. The enriched ruptures were at H, KE and KW. The KW rupture was a coextruded zirconium-clad fuel element charged on a production test.

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Power Level Limits

Power levels were limited by tube corrosion considerations at DR, F and H; rupture control considerations at both K's; graphite temperatures at B; and bulk outlet temperatures at D. Power level at C reactor was on the administrative limit.

MAINTENANCE AND EQUIPMENT EXPERIENCE

Tube Replacement

Seven hundred fifty three new process tubes were installed; 402 at D, 218 at DR, 119 at C, 4 at each H and KE, and 3 at each B and F.

Water Leaks

Eleven process tube leaks were corrected; 7 tube leaks and 4 Van Stone leaks. Three of the tube leaks were at H, 2 at B and one each at DR and F. Two Van Stone leaks were at H and one each at B and DR.

Riser Failure 105-D Reactor

A previously repaired section of the near rear riser of D reactor was inspected when leaking was reported, and extensive localized cracking was found in this area. The failure was attributed to stress corrosion cracking brought about by salts deposited by water from a leaking weld and the stresses caused by a structural support. A contoured patch plate was welded over the entire area.

REACTOR OUTAGES

Date Down	Date Up	Outage Hours	Remarks
B Reactor			
2/26	3/31	79.9	Leak testing following rupture removal.
3/9	3/11	39.7	Removal of an I&E regular metal rupture from tube 2378. Charge-discharge and leak testing.
3/12	3/13	19.2	Correction of a spline-cap leak.

Files

April 10, 1962

B Reactor (Cont'd.)

3/19	3/20	26.9	Leak testing and tube replacement.
3/31	Still down		Water leak. Charge-discharge.

C Reactor

3/10	3/18	192.1	Scheduled charge-discharge and tube replacement; miscellaneous maintenance.
3/18	3/18	0.3	Unexplained Panellit trip.
3/27	3/30	75.9	Leak testing.

D Reactor

2/23	3/11	388.8	Scheduled replacement of tubes. Charge-discharge and miscellaneous maintenance. 2 + 5 Tubes.

DR Reactor

3/2	3/3	44.1	Water leak. Charge-discharge & miscellaneous maintenance.
3/11	3/13	39.4	I&E regular metal rupture in tube 1078.
3/15	Still down		I&E regular metal rupture in tube 1584, and tube replacement.

F Reactor

3/1	3/2	42.9	Leak testing.
3/26	3/27	43.1	Scheduled charge-discharge.
3/27	3/28	2.7	Low pressure Panellit trip due to rear cap leak on tube 3984.

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April 10, 1962

H Reactor

3/12	3/14	53.6	I&E regular metal rupture in tube 1372. Charge-discharge.
3/15	3/15	0.7	Two unexplained Panellit trips.
3/15	3/16	16.4	Leak testing.
3/18	3/20	32.9	Leak testing.
3/29	3/30	32.3	Removal of an I&E-E metal rupture from tube 4169.
3/31	Still down		Tube replacement.

KE Reactor

3/5	3/8	77.4	Scheduled charge-discharge.
3/28	3/31	83.3	I&E-E metal rupture in tube 2091. Charge-discharge.

KW Reactor

3/12	3/14	34.6	Manual trip due to a production test (PT-397-A) rupture in tube 3446. Charge-discharge.
3/16	3/17	36.1	Tripped due to a heat cycle. Charge-discharge.

RESEARCH AND DEVELOPMENT - EXISTING REACTORS

VSR Channels - C Reactor

Arrangements have been completed to obtain 128 excess unmachined pieces of N reactor graphite for use in the prototype VSR sleeve installation at C reactor. This graphite will be used for fabrication of test sleeves in the initial in-reactor test installation planned for later this year. Efforts were made at C reactor to broach VSR channel #41. The broaching accomplished decreased rod insertion time on the channel from 2.41 seconds to 2.22 seconds, but the over-all results are not considered as

[redacted]

successful as previous broaching efforts on other channels. In the efforts to straighten the channel, graphite was removed from the tube block of process channel #4092 by the broaching operation to expose a portion of tube wall to the VSR channel. This process tube channel will be used in the future for graphite oxidation studies to avoid any possible damage to a process tube resulting from VSR impact.

Rear Hardware - C Reactor

A prototype rear nozzle elbow and replacement connector have been installed on the rear face of C reactor for test purposes. This work is part of a program to improve C reactor rear connectors, which have been the major source of water leaks encountered at this reactor. No operating difficulties have been encountered with this prototype during the first operating cycle.

Self-Support Fuel

Two columns of KVN-S fuel elements having an exposure of 780 MWD/T were discharged on 2/13/62 from KW reactor.

Bumper Fuel Development

Two columns of bumper fuel elements were discharged from D reactor on 2/24/62 at an exposure of 400 MWD/T. Both columns have been sent to 105-C for post-irradiation examination.

Other Programs

Seventeen columns of nickel-plated fuel were discharged from DR reactor on 3/2/62 at an estimated exposure of 1100 MWD/T. The two remaining columns of coextruded fuel were discharged from KW reactor on 3/12/62 as a result of a rupture occurring in one of the columns. The column containing the rupture had an exposure of 1647 MWD/T. The cause of failure has not yet been determined.

Effluent Water Data

The following table shows average concentrations of radionuclides in reactor effluent water from samples taken during February, 1962. Units are in 10-12 curies/~~day~~ cc.

Reactor	As^{76}	P^{32}	Zn^{65}	Np^{239}	Cr^{51}
B	77	6.2	17	110	450
C	117	9.4	26	310	580
D	94	8.7	45	420	1100
DR	97	8.0	61	170	1400
F	66	7.8	34	140	970
H	62	6.7	11	110	500
KE	73	15	25	120	880
KW	65	14	14	60	360

All data were taken with the reactor cooling water at a nominal 18 ppm alum feed.

Effluent from Nickel-Plated Fuel Elements

Final effluent samples from individual process tubes at 105-DR loaded with nickel-plated fuel elements showed no significant change from earlier reported results. For several months, the average P^{32} concentration has been 10 to 20 times the riser concentration. Results are being summarized for inclusion in a full report on the production test.

Ball 3X Test of Prototypic Hose Handling Equipment

A prototypic model of proposed hose handling equipment for the Ball 3X Vacuum Recovery Systems at the older reactors was tested at 105-D reactor. Four feet of balls were removed from two vertical safety rod channels simultaneously in a lapsed time of less than four minutes. A number of minor mechanical modifications are being made to improve the reliability and efficiency of the mechanism.

Tube Replacement

A prototype graphite drill for channel reconditioning embodying front graphite removal, one-piece drill shaft, and work-platform mounting was used at DR reactor on March 20 and 21 to drill about 80 channels. Operating time cycles of five to ten minutes were established. The drill bit was a carbide-tipped shell end mill. Drilling was performed front-to-rear. Subsequent tube insertion was more difficult than anticipated, and a new cutter head design is being tested.

VSR Channel Rehabilitation

Parts for the tooling test mockup have been fabricated. This is a mockup of pertinent parts of the top shield and graphite stack which is to be installed in the 195-D test tower for testing the tools that are being designed to enlarge and recondition the rod channels for reception of liners. The first tools scheduled for testing are debris removal tools for the channels and ball exit piping.

The shield boring machinery is completely designed and partially fabricated. The boring head is completed and functionally tested, and two types of graphite cutting tools are being "debugged."

Pile Physics Assistance

Initial operation with the enriched core test to reduce minimum downtime proved successful. The measured reactivity gain with the core of 50 enriched columns in B reactor was consistent with a calculated gain of 14 mk. Although the initial power levels utilizing the enriched core were conservatively maintained at a low level, the initial performance indicates that with experience startup efficiencies utilizing the enriched core will be little different from normal startup efficiency.

Difficulties with non-poisonous spline insertion have delayed the program for routine flux monitoring spline traverses. Thicker nonpoisonous splines have been ordered.

Horizontal rod sticking is being encountered at several reactors. However, the operating efficiency has not been significantly affected, because the sticking either has been corrected or was not serious enough to warrant keeping the rods out of service. Reactor safety is not affected, since the HCR's are not used for "insertable" safety control.

REACTOR MODIFICATION PROGRAM

Overbore Fuel Development

Performance of the overbore fuel at C reactor was normal with no additional fuel charged or discharged during the report period.

NEW PRODUCTION REACTOR

NPR Fuel Development

The thermocouple element charged into KER-1 to evaluate the reliability and sensitivity of a thermocouple element as a crud film detector has achieved an exposure of 600 MWD/T.

Five 23-inch NIE-1 elements charged in KER-2 on 9/17/61 to evaluate high exposure fuel element distortion and swelling reached an exposure of 2860 MWD/T on 3/20/62. These elements will be discharged in the near future to permit modification of KER-2 loop.

The two prototypic NAE-1 fuel assemblies charged in KER-3 on 2/18/62 have reached an exposure of approximately 310 MWD/T.

Five NAE-1 fuel elements were charged in KER-4 on 3/7/62 to provide loop operating experience with a partial charge of NPR fuel elements. Current exposure is 160 MWD/T.

Four capsules containing enriched Zr-2 jacketed fuel samples to determine the effect of jacket uniformity on localized jacket strain, which were charged into D reactor on 1/7/62, were discharged on 3/17/62 at an exposure of approximately 1000 MWD/T.

NPR Graphite Irradiations

The first capsule containing specimens of NPR graphite charged into the GETR on 11/30/61 was discharged 3/12/62. The maximum exposure attained by the discharged samples is equivalent to approximately 1.3 years of exposure in the center of the NPR. Physical measurements will be made and the samples recharged into the GETR at a later date. A capsule containing new samples was charged into the reactor replacing the capsule which was discharged on 3/12/62.

Pile Reactivity Studies

using a neutron source and detectors

The N reactor stack purity test/was carried out successfully on March 3 and 4. No appreciable differences were found between the mockup and actual stack measurements.

OUTAGES (Year) 1962 March

Reason	B	C	D	DR	F	H	KE	KW	Total
Charge-Discharge	33.0	53.1	32.0	75.2	28.6	23.5	80.2	36.1	361.7
Maintenance	25.2	36.6	21.0	29.0	39.8	18.4	18.0	3.0	191.0
Rupture Removal	1.8			9.7		29.5	1.2		42.2
Water Leak ~~Testing~~	43.5	26.2		19.6	5.8	51.2			146.3
Tube Replacement		140.0	201.9	309.5	12.8	2.0	23.0		689.2
Project Work		7.5	2.0					3.7	13.2
Production Tests	21.0	4.2	1.0	9.1	1.7	7.2	36.0	22.4	102.6
Standard Check ~~Instrument & Circuitry~~	2.7	.4		4.6		5.3	2.3	1.0	16.3
Rupture Suspects									
Miscellaneous		.3	3.1	21.6		.6		4.5	30.1
Total	127.2	268.3	261.0	478.3	88.7	137.7	160.7	70.7	1592.6
Scheduled Outages									
Unscheduled Outages									

RUPTURED SLUG TABULATION FOR March, 1962

Tube No.	Date Charged	Date Ruptured	Tube Power (KW)	Concentration MWD/Ton	Assigned Production Loss		Observations	
					MWD	Days		
2378 B	1/13/62	3/9/62	1234	289	154	.09	I&E Regular	End Failure
1078 DR	12/30/61	3/11/62	1123	467	386	.22	I&E Regular	Hot spot
1372 H	1/27/62	3/12/62	1148	263	834	.48	I&E Regular	End failure
3446 KW	8/14/61	3/12/62	1623	1647	2431	.58	I&E-E	Unclassified (Co-extruded ziracloy clad)
1584 DR	12/30/61	3/15/62	1056	486	384	.22	I&E Regular	Hot spot
2091 KE	1/23/62	3/28/62	1729	695	241	.06	I&E-E	Hole
4169 H	3/12/62	3/29/62	1194	157	1094	.63	I&E-E Bumper	Charge Machine Damage

STANDARD FORM NO. 64

Office Memorandum · UNITED STATES GOVERNMENT

[redacted] DECLASSIFIED

TO : Files

DATE: May 9, 1962

FROM : R. L. Plum, Chief
Reactor Operations Branch

SUBJECT: MONTHLY REPORT - APRIL, 1962

HAN-80948
Report #4

OR:GTO:RGR

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OPERATING EXPERIENCE

Production

Reactor input production was 100% of forecast; 1.3% below at the six old reactors and 1.4% above at the K's.

Efficiency

Over-all time operated efficiency was 68.2%; 63.5% at the six old reactors and 82.2% at the K's. The low efficiency was due in part to outages resulting from an electrical power failure on April 6.

Power Level

There was no increase in the combined reactor instantaneous power level or the individual reactor record power levels.

Fuel Ruptures

Eleven ruptures, five I&E natural, two I&E enriched, three overbore I&E natural, and one KER were removed from the reactors; 3 of the I&E natural ruptures were at D and two at DR; the 2 I&E enriched and 3 overbore ruptures were at C. The 3 overbore ruptures all occurred at the same time in the same tube, apparently due to a "hot spot" in the flux pattern.

Power Level Limits

During the report period, power levels at the B, D, H and K reactors were primarily restricted by bulk outlet temperature limits. Tube corrosion considerations restricted power levels at DR and F reactors. The power level at C reactor was restricted by both administrative and bulk outlet temperature limits.

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MAINTENANCE & EQUIPMENT EXPERIENCE

Tube Replacement

Five hundred fifty-nine new process tubes were installed; 353 at B, 190 at H, 8 at D, 7 at DR and one at C.

Water Leaks

Twelve process tube leaks were corrected; 3 tube leaks and 9 Van Stone. The tube leaks were at C, DR and H. Five of the Van Stone leaks were at D, 3 at DR and one at B.

Power House Performance

A total failure of the electrical power supplied to the 100 areas from the BPA System occurred on April 6. A preliminary report of this incident has been issued (HW-73389).

This incident tested the response of the steam boilers in the 184-B, D, F, and H power houses, supporting the validity of the changes in instrument controls already made on the boilers in the 181-F Building. The response of these boilers was very good as measured by the ratio of the heat input to output, and good control of the critical feed water system was maintained throughout the acceleration cycle. Similar instrumentation changes are under way at the power houses in the other 100 areas.

REACTOR OUTAGES

Date Down	Date Up	Outage Hours	Remarks
B Reactor			
3/31	4/1	38.2	Leak testing.
4/6	4/7	30.3	Power failure trip.
4/8	4/9	25.6	Leak testing.
4/13	Still down		Scheduled tube replacement. A total of 353 tubes was installed.

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May 9, 1962

C Reactor

4/5	4/5	0.3	Unexplained Panellit trip.
4/5	4/7	48.7	Removal of an overbore size I&E regular metal rupture from tube 2969; removal of two I&E-E metal ruptures from tube 2955.
4/12	4/14	56.6	Leak testing. Inspection of the overbore size fuel elements discharged from tube 2969 on 4/5 failed to confirm the presence of a rupture. Leaking tube 1468 was replaced.
4/16	4/16	0.6	Correct rear connector leak.
4/16	4/18	57.6	Removal of three overbore size ruptures from tube 3062.

D Reactor

4/2	4/5	82.4	Scheduled charge-discharge.
4/6	4/8	34.2	Miscellaneous maintenance following a power failure trip.
4/14	4/16	42.2	Removal of an I&E natural metal rupture from tube 2281 and replacement of three leaking tubes.
4/16	4/16	2.0	Removal of an I&E natural metal rupture from tube 1684.
4/21	4/23	48.1	Removal of an I&E natural metal rupture from tube 1962. Charge-discharge and tube replacement.

DR Reactor

3/15	4/3	450.9	Completed the replacement of 210 process tubes.
4/4	4/4	0.4	Manual trip due to indications of high temperature, caused by faulty thermocouple.
4/6	4/8	36.2	Miscellaneous maintenance following a power failure trip.
4/8	4/8	0.3	Panellit trip when spline stub was removed from tube 0885.

[redacted]

DR Reactor (Cont'd.)

4/15	4/18	76.4	Charge-discharge and leak testing following a Panellit trip.
4/20	4/21	37.5	Removal of an I&E natural metal rupture from tube 1064. Tube replacement.
4/22	4/22	0.2	Panellit trip due to a non-seated charge.
4/26	4/27	38.6	Panellit trip. Removal of an I&E natural metal rupture from tube 3879.

F Reactor

4/6	4/8	41.8	Charge-discharge following a power failure trip.
4/27	Still down		Scheduled tube replacement.

H Reactor

3/31	4/14	354.0	Tube replacement - 192 removed, 189 installed.
4/14	4/14	2.5	Two scrams for thermocouple repairs.
4/15	4/15	0.2	Panellit trip caused by valving of PCTF before Panellit gauge was jumpered.
4/15	4/15	0.3	Panellit trip due to faulty Panellit jumper.
4/21	4/23	35.9	Leak testing and tube replacement.
4/24	4/24	0.2	Unexplained Panellit trip.

KE Reactor

4/1	4/1	1.2	Correction of two rear cap leaks unsuccessful when discharge platform failed to operate.
4/4	4/6	38.8	Charge-discharge and maintenance following PT rupture removal from Loop 1.

KE Reactor (Cont'd.)

4/6	4/6	0.7	Tripped due to a power failure.
4/26	4/29	88.7	Charge-discharge and maintenance following a Panellit trip. Replaced No. 3 low lift pump set on Project CG-883.
4/30	4/30	0.9	Two unexplained Panellit trips.

KW Reactor

4/6	4/10	92.7	Scheduled charge-discharge following a power failure trip.
4/25	4/26	33.0	Charge-discharge following a Panellit trip.

RESEARCH AND DEVELOPMENT - EXISTING REACTORS

Poison Splines

The application of value analysis techniques to the spline design, combined with appropriate vendor contacts, resulted in a further reduction of 25% in the cost of splines. This was reflected in a bid opening with the previous low unit price of $15.84 reduced to $11.88.

Reactor Efficiency Studies

Preliminary efficiency data for the E-N loading show that during the last six months of 1961 H reactor's operating efficiency exceeded that of the four older reactors by approximately 4%. Although H-reactor operating efficiency during that period was approximately 10% lower than during the corresponding period in 1960, the principal cause of the reduction - water leaks - resulted in an average reduction of nearly 12% for the four older reactors.

Self-Supported Fuel

One column of KVNS fuel was discharged from KW reactor on March 16 with 217 MWD/T exposure. Thirty three thousand pounds force was required for initial breakaway. The eliptical-bumper fuel test has reached about 82% of goal exposure; the next scheduled discharge is expected May 1.

Other Programs

Fourteen columns in F reactor which were charged with alternating oil-quenched and normal fuel cores on February 10 have reached an estimated 42% of their goal exposure. The purpose of this test is to determine dimensional changes under irradiation.

Zircaloy Process Tubes

Modifications to the bid package on the procurement of Zircaloy-2 process tubes for retubing the K reactors were made and inquiry was sent to the vendors on April 20.

A single process tube graphite channel mockup is being fabricated in support of the 105-K reactor's zirconium tube replacement program. This mockup will be used to investigate the effects of graphite distortion on the new process tube assemblies--including fuel supports, tube surfaces, deflection and thermal expansion stress, and longitudinal movement of the process tube.

K Reactor Mixer Recommendations

Water-mixer fuel element placement has been recommended for the ninth and sixth fuel position from the rear in both natural and enriched columns at the K reactors. The recommendation was made to obtain additional tube life to avoid or reduce aluminum tube replacement before installation of Zr tubes. The loss in plutonium production at the K plants through such use of mixers has been estimated to be 0.4 ± 0.2%.

VSR Channels

Vertical safety rod sleeves for 105-C reactor were fabricated from excess NPR graphite, and off-reactor testing is under way to determine the adequacy of these sleeves as a vertical safety rod channel liner material. Alternate designs of both pyrolytic graphite and alumina oxide test sleeves have been completed and bid invitations issued to a number of prospective vendors. The installation of force measurement test specimens in VSR channel #47 at 105-C reactor has been delayed. A recent examination indicated that several tube-bearing blocks were protruding into the channel to a greater degree than previously expected. Suitable methods of returning the channel to the original cross-section dimensions must be devised before the force measurement blocks can be installed.

Effluent Water Data

The table below shows average concentrations of radionuclides in reactor effluent water from samples taken during March, 1962. Units are 10^{-12} curies/cc.

Reactor	As^{76}	P^{32}	Zn^{65}	Np^{237}	Cr^{51}
B	96	5.6	14	160	320
C	104	8.4	29	170	380
D	101	12.5	32	240	1040
DR	94	9.4	*	240	*
F	67	6.8	11	120	760
H	97	10.2	16	150	500
KE	164	20.9	38	310	780
KW	130	16.2	16	140	660

(* No valid samples)

All reactors were on a nominal 18 ppm alum feed for the month except KE and KW. The alum feed at both K water plants was reduced to a nominal 9 ppm on March 9 in order to attain an optimum zeta potential value (-3 to -4 milivolts). Both plants operated until April 12, at feed rates between 9 and 10 ppm. Results were not encouraging.

On April 12 the alum feed at KE was increased to a nominal 13 ppm and the effort will be to maintain the zeta potential at about zero. The feed rate at KW was left unchanged.

Zeta potential control is based on laboratory experiments which show greater parent isotope removal by this method. Samples of filtered water taken from several reactors indicated slightly less phosphate ion removal at the K reactors at the same zeta potential, but the analysis is not sensitive enough to be conclusive.

Tube Cracking - H Reactor

Preliminary comments have been received from the General Engineering Laboratory regarding their review of the analysis of the process tube transverse fatigue crack problem at 105-H reactor. The comments generally support the conclusions drawn regarding the cause of this problem and the proposed program for further investigation. The development of equipment and techniques for measuring the vibration of process tubes while in the reactor and for ultrasonic inspection of process tubes for incipient cracking is continuing.

Tube Replacement

Thirty-two channels were drilled in 105-H reactor to prepare them for tube insertion. A special cutter 38" long, carrying four shell end mills at six-inch intervals was used. This was done to check an earlier generated hypothesis after a test at 105-DR that the use of more cutting tools per channel would lower the incidence of tube sticking during insertion. All tubes were successfully inserted in these thirty-two channels.

Criticality Incident - 200 West Area

The remote manipulator vehicle was extensively used during the recovery work following a criticality incident in the 234-5 Building. Additional assignments were executed to:

1) Develop tooling to enter the Recuplex hood from outside the room, view and cut a pipe that would drain the K-9 vessel without losing the seal on the hood.

2) Arrange a forklift for remote control, equip it with a remotely operated power hacksaw to cut the mezzanine railing inside the doorway of the Recuplex room, and then put the manipulator on the mezzanine floor.

3) Devise a means to enter the hood and, after sealing behind the entry, to launch a projectile to break the tank.

REACTOR MODIFICATION PROGRAM

Overbore Fuel Element

Tube 2969-C was discharged on April 5 on suspicion of a rupture and 3062-C caused a Panellit trip on April 16 with activity readings indicative of a rupture. Examination did not disclose any failures in 2969-C, but two side hot-spot failures were found in an I&E^2 tube on the same header as 2969-C. 3062-C contained three split-type failures and three apparent incipient split-type failures. The average exposure on 3062-C was 670 MWD/T with an average tube power of 1450 KW. The remainder of the 44-tube block was discharged with the exception of the eight central tubes bearing conversion ratio test material. Examination of the metal is proceeding. There is indication, unproved at present, that the overbore ruptures are connected with two recent hot startups at C reactor, one the day of the ruptures.

NEW PRODUCTION REACTOR

Graphite

Preliminary measurement data on the specimens of NPR core graphite (grade TSX) from the first test capsule discharged from the GETR indicates a contraction in the transverse direction of 0.04% and in the longitudinal direction of 0.08%. The CSF graphite reference specimens contracted about the same amount as the TSX specimens. The amount of contraction is about that expected.

Exposure on the test specimen is equivalent to about 1.3 years of NPR operation. The contraction observed so far extrapolates to a total stack contraction of 2.5 inches over a reactor lifetime of 25 years. However, this is the first measurement made on this specimen, and the influence on the observed contraction rate of the early growth inception will not be obtainable until after the second irradiation and measurement.

NPR Fuel Development

The thermocouple element charged in KER-1 to evaluate such an element as a crud film detector failed on April 14. The failure occurred three days after reactor startup following the first decontamination of a thermocouple train and heater assembly. The cap on the element appears to be pushed off; further examination will be necessary in Radiometallurgy. KER-1 will remain empty for the CGI-839 modification.

KER-2 is also empty for the CGI-839 modification. The last experiment in Loop 2 was designed to evaluate high exposure fuel element distortion and swelling. The five 33-inch NPR

NPR Fuel Development (Cont'd)

elements of this test were discharged on March 28 at an exposure of 3015 MWD/T.

Two NAE1 fuel assemblies, charged on February 18 to permit functional testing of KER-3 after modification, were discharged on March 28 at an exposure of 420 MWD/T. The loop was recharged on March 30 with eleven 23-inch NAE1 assemblies. Goal exposure is tentatively 1000 MWD/T.

Five NAE1 assemblies charged in KER-4 on March 7 have reached an exposure of 545 MWD/T.

RUPTURED SLUG TABULATION FOR APRIL, 1962

Tube No.	Date Charged	Date Ruptured	Tube Power (KW)	Concentration MWD/Ton	Assigned Production Loss		Observations
					MWD	Days	
2955 C	1-5-62	4-5-62	1585	752	791	.37	2 Ruptures; I&E^2, Hot Spot
2281 D	4-2-62	4-14-62	1246	77	325	.18	I&E, Natural, End failure, Bumper
3062-C	12-8-61	4-16-62	1439	671	546	.26	3 ruptures, I&E, Natural, Overbore Size Split
1684-D	4-2-62	4-16-62	1267	79	148	.11	I&E, Natural, Hole, Bumper
1064-DR	3-15-62	4-20-62	1169	121	645	.39	I&E, Natural, Hole
1962-D	4-2-62	4-21-62	1179	118	89	.05	I&E, Natural, End Failure, Bumper
3079-DR	3-15-62	4-26-62	1183	221	1823	1.11	I&E, Natural, Unknown
2160-IE (FTR-1)	2-16-62	4-4-62		796	780	.19	10" I&E^2, with thermocouple attached

DECLASSIFIED

OUTAGES (Year) (4/62)

[redacted]

Reason	B	C	D	DR	F	H	KE	KW	Total
Charge-Discharge	38.1	10.0	61.3	31.7	29.3	1.0	42.0	95.8	309.2
Maintenance	45.9	26.2	63.2	69.8	51.5	27.2	36.2	15.3	335.3
Rupture Removal		7.3	6.3	30.8					44.4
Leak Testing	29.8	66.4	41.3	48.9		27.3			213.7
Tube Replacement	284.0		12.1	7.6	36.4	283.7	5.8	7.5	637.1
Project Work	25.9			0.5		8.4			34.8
Production Tests	4.2	53.5	1.2	11.1	2.8	0.7	37.9	5.1	116.5
Instrument & Circuitry (Standard Check)	13.7		1.7	1.1		4.5	3.6		24.6
Rupture Suspects									
Miscellaneous	37.8	0.3	21.8	20.1	14.8	14.3	4.8	2.0	115.9
Total	479.4	163.7	208.9	221.6	134.8	367.1	130.3	125.7	1831.5
Scheduled Outages									
Unscheduled Outages									

[redacted]

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

[redacted] DECLASSIFIED

TO : Files

DATE: June 12, 1962

FROM : R. L. Plum, Chief
Reactor Operations Branch

THIS DOCUMENT CONSISTS OF 12 PAGES

SUBJECT: MONTHLY REPORT - MAY, 1962

HAN-80945
Report #5

OR:GTO:RGR

OPERATING EXPERIENCE

Production

Reactor input production (MWD) was 4.3% above forecast; 2.3% above at the six old reactors and 6.6% above at the K's.

Efficiency

Over-all time operated efficiency was 71.4% (70.9% forecast); 66.9% at the six old reactors and 85.0% at the K's.

Power Level

There was no increase in the combined reactor instantaneous power level or the individual reactor record power levels. A production record was achieved at B reactor, exceeding their previous record (April, 1961) by 2.6%.

Fuel Ruptures

Seven ruptures, six I&E natural and one I&E enriched, were removed from the reactors. Two of the I&E natural ruptures were at C, two at DR, one at B and one at D. The enriched rupture was at H.

Power Level Limits

During the report period, power levels at B, C, D, F, H and the K reactors were primarily restricted by bulk outlet temperature limits. Tube corrosion considerations continued to restrict power level at DR reactor.

[redacted] GROUP 1 DECLASSIFIED SECRET

[redacted] or the disclosure of its contents [redacted] unauthorized person is prohibited.

MAINTENANCE AND EQUIPMENT EXPERIENCE

Tube Replacement

Eight hundred and twenty-nine new process tubes were installed; 354 at F, 249 at H, 220 at C, 3 at B and 3 at D.

Two hundred and thirty-eight tube channels were drilled in 105-H reactor with a new drill drive unit and the cutter assembly described in last month's report. Tube insertion was unsuccessful in 20 of the first 140 channels drilled, requiring insertion of another tube. On the second group of 98 channels, the drill shaft was lengthened so that the drill entered the rear gunbarrel. These channels were also lower in the reactor. The combined result was that only two tubes were lost on insertion.

A pushing machine was developed and was used successfully for removing split tubes from H reactor.

Water Leaks

Nine process water leaks were corrected; 3 tube leaks and 6 Van Stone. Two of the tube leaks were at C and one at D. Three Van Stone leaks were at H, 2 at B and one at D.

Process Standard H-020 - "Handling of Irradiated Enriched Slugs"

At reactors with three discharge chute pits, the chute pit floor limit was doubled for .95% U-235 enriched slugs on the basis that discharging shall be done in the two outside pits with the center pit acting as a separator. A new requirement on random loading of buckets of E-slugs is that no slug shall be permitted to extend above the top edge of the bucket. System geometry is thus better defined.

REACTOR OUTAGES

Date Down	Date Up	Outage Hours	Remarks
B Reactor			
4/13	5/1	421.0	Tube replacement.
5/1	5/1	2.8	Unexplained Panellit trip.
5/2	5/2	0.9	Repair ball valve oil line leak in order to discharge poison.

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June 12, 1962

B Reactor (Cont'd.)

5/2	5/2	0.1	VSR's 16 and 25 dropped out of upper limit switch.
5/12	5/14	44.0	Removal of an I&E natural metal rupture from tube 1068. Tube replacement.
5/15	5/17	52.0	PCCF malfunction, charge-discharge and maintenance.

C Reactor

5/5	5/9	103.6	Removal of an I&E natural metal rupture from tube 1384. Charge-discharge and maintenance.
5/10	5/10	0.2	Repair faulty thermocouple.
5/10	5/10	1.7	Four unexplained Panellit trips.
5/11	5/12	41.8	Removal of an I&E natural metal rupture from tube 1159.
5/20	5/23	56.2	Charge-discharge and maintenance following a trip when leads to the No. 4 pump motor burned out.
5/25	Still down		Tube replacement.

D Reactor

5/2	5/4	40.4	Leak testing and tube replacement.
5/4	5/4	0.5	Remove stuck perf from PCCF machine.
5/27	5/29	59.2	Removal of an I&E natural metal rupture; charge-discharge.
5/29	5/30	20.9	Leak testing and tube replacement.
5/30	5/30	0.4	Faulty ball valve on tube 3564.

DR Reactor

5/1	5/3	44.5	Removal of an I&E natural metal rupture from tube 1265.
5/8	5/9	35.1	Removal of an I&E natural metal rupture from tube 3072. Maintenance.

F Reactor

4/27	5/15	437.6	Replacement of 355 tubes.
5/31	Still down		Scheduled charge-discharge.

H Reactor

5/6	5/8	36.1	Removal of an I&E-E metal rupture from tube 0576, charge-discharge and maintenance.
5/8	5/9	14.7	Water leak. Tube replacement.
5/12	5/27	358.6	Replacement of 249 tubes.
5/27	5/27	0.4	Unexplained instrumentation trip.
5/28	5/28	0.3	Unexplained high pressure Pannelit trip.
5/28	5/30	28.1	Miscellaneous maintenance following the correction of a water leak.

KE Reactor

5/14	5/16	49.2	Trip due to a leak in Panellit gauge 2483. Charge-discharge and miscellaneous maintenance.
5/16	5/16	1.0	Correction of two rear-face cap leaks.
5/18	5/19	36.3	Repair of valve in cross-tie system.
5/19	5/19	0.4	Unexplained Panellit trip.
5/19	5/19	0.4	Improper switching while by-passing KER Loop 4.
5/19	5/19	0.2	Manual trip due to insufficient control rods.

KE Reactor (Cont'd.)

5/23	5/24	33.7	Trip due to the failure of a small transformer in loop instrumentation.

KW Reactor

5/4	5/5	38.0	Front-face pigtail leak. Charge-discharge.
5/17	5/20	55.3	V-73 cross-tie valve repair and charge-discharge.
5/20	5/20	6.6	Unexplained Panellit trip.

RESEARCH AND DEVELOPMENT - EXISTING REACTORS

Graphite Distortion - 105 C

The collection of graphite distortion data at 105-C reactor in support of the vertical safety rod and graphite study program has continued. Examination of two additional vertical safety rod channels indicates that the slip plane in the graphite stack, which has been previously observed, was also present in the channels examined. A number of both tube and filler blocks were observed protruding into the channel with an estimated channel displacement of one inch in VSR channel #53 and 1-3/4 inch in channel #47.

VSR Channel Sleeves

Drop testing of a 105-C reactor size flexible vertical safety rod in a mockup VSR channel lined with polycrystalline graphite sleeves has continued. The sleeve section has a 2½ inch horizontal displacement in a six-foot long arc. Minor cracking has been observed in the test sleeves after ten to fifteen VSR drops. After forty drops the liner sections have remained intact, although cracking and considerable wear has occurred on the surface of the liners at the point of rod contact.

Process Tube Cracking - 105 H

As part of the investigation of the process tube transverse fatigue cracking problem at H reactor, two process tubes were inspected for transverse cracks using newly developed ultrasonic inspection equipment. One of the tubes inspected, in channel #2371, had indications of a crack approximately 32 feet from the front Van Stone flange, which is the general location of the majority of the previous tube failures. This process tube has been removed from the reactor and inspected visually. The results of the visual inspection were inconclusive but indicated that a crack might be present. The tube is being sectioned for metallurgical examination to determine if the suspected crack was present as indicated.

HCR's - K Reactors

Preliminary designs for a new flexible HCR and step plug for use at the K reactors have been completed. This new control rod will provide sufficient flexibility to accommodate future expected graphite distortion in these reactors, as well as eliminate the difficulties being encountered with the present rod designs. Shop fabrication of prototype rod sections for test and evaluation is under way.

Self-Supported Fuel

Thirty-one columns of CIVNS fuel were discharged from C reactor during the 4/16/62 outage. Discharge forces for sixteen of the columns ranged from 500 lbs. to 1500 lbs.; however, only three of the sixteen columns required less than 1000 pounds.

Two columns of KVNS fuel elements were discharged from KW reactor during the 5/17/62 outages at tube exposures of 586 MWD/T and 753 MWD/T. Discharge forces of 2500 and 3900 lbs. were required. Both columns were recharged without difficulty.

Fuel Charging Problems

Two Zircaloy-2 process tubes (2557 and 3065KW) were charged with different types of self-supported fuel elements to determine if fuel design and dimensions were the cause of previous charging difficulties. Tru-lined self-supported fuel elements with support ring diameters of 1.715 inch charged without difficulty into tube 3065KW. Flat-base fuel elements of 1.710 inches support diameter charged without difficulty into 2557KW. The results of these tests indicate that at least part of the previous charge difficulties were caused by oversized fuel pieces.

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June 12, 1962

Water Mixer Efficiency

The efficiency with which water-mixer fuel elements lower the water temperature between the ribs in corroded process tubes was measured in the Thermal Hydraulics Laboratory of HLO. The tests employed a C process tube, with ribs reduced from .102 inch to about .060 inch, and CIIN fuel elements. The water temperature between the ribs was raised above bulk conditions by injecting steam into the bottom coolant annulus upstream of the mixer location. Temperature data recorded by thermocouples upstream and downstream of the mixers indicated the mixer efficiency to be 60% (water temperature was reduced 5°C compared to an upstream temperature differential of about 8°C). These data apply to the mixer fuel elements currently in use in the reactors. Similar tests were run with a special mixer design in an attempt to improve efficiency by affecting the interchange between the coolant at the top and bottom of the annulus as well as the hole coolant. Additional tests will be run to measure the pressure drop of the mixer elements and to determine the effect of similar mixing only on mixer efficiency.

Effluent Water Data

The table below shows the average reported concentrations of selected radionuclides from reactor effluent samples taken during April, 1962. Units are 10^{-12} curies/cc.

Reactor	As^{76}	P^{32}	Zn^{65}	Np^{239}	Cr^{51}
B	96	6.8	44	120	360
C	123	9.0	39	120	410
D	104	10.0	59	190	690
DR	94	4.9	180	390	1430
F	112	11.3	130	110	2600
H	106	11.3	20	100	380
KE	133	20.1	100	330	2000
KW	151	18.6	24	130	660

All the old reactors continued at a nominal feed rate of 18 ppm alum in the water treatment. The alum feed rate of 13 ppm which was started at KE on April 14 gave no apparent reduction

of As^{76} and P^{32} over the previous 9-10 ppm. On April 30 the alum feed rate at KW was increased to 18 ppm in order to establish a comparable base with other reactors. Results of the increased alum feed were not marked, but sufficiently encouraging to warrant further testing. Zeta potential measurements taken just downstream of the alum addition point before the acid for pH control is added (in K plant only) have indicated that zeta potential control is applicable at this point rather than at the mixing flume.

Pile Physics Assistance

On the basis of improved fuel performance, the incentive for radial enrichment to maintain high flattening efficiency would be expected to decrease. Tube corrosion considerations during the past few months, however, have made it desirable that flattening efficiencies be maintained through the summer at the high winter levels.

Reactor Fundamental Training

In order to encourage training class participants to continue their self-development beyond the formal training classes, a voluntary program of self-testing has been initiated. To date approximately 60 operators and specialists have requested the comprehensive forms which are based on material in the IPD Physics Primer, and nine have completed their use.

Uranium Recycle

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

Per Cent of Recycled Fuel in Enriched Fuel

	B	C	D	DR	F	H	KE	KW
April 30 Status	87	99	100	90	85	85	98	≈100
April Discharge	62	96	97	95	58	78	96	96

REACTOR MODIFICATION PROGRAM

Zirconium Tube Program

The design criteria for the 105-K reactor zirconium tube replacement program have been completed in rough draft form and issued for comment. Designs for a new inlet nozzle and for modification to the existing rear-face nozzle have been computed. Preliminary pressure drop tests for the new nozzles indicate that a screen-type insert in the nozzle will be satisfactory from a pressure drop standpoint. Mechanical testing of this screen is under way to determine if it will satisfactorily solve the fuel element support program.

Overbore Hardware

Fabrication of the improved rupture removal equipment for use on the overbored fuel test facility at 105-C reactor has been completed and equipment delivered to White Bluffs for demonstrations on the mockup. A purchase order has been placed for replacement nozzle caps for the forty-tube overbore installation. These new nozzle caps are being procured to eliminate the cocking difficulty experienced with the caps presently in service.

Overbore Fuel Development

Examination of thirty-five central-zone overbore charges discharged during the 4/16/62 outage has been completed at the 105-C metal examination facility. Following is a brief summary of the visual indications of uranium core cleavage, including the elements from the rupture tube:

Visual Examination	Positive Worm Track	Possible Worm Track	Varified Split	Total Pcs.	Tubes Involved	Ingot Cores	Dingot Cores
Before cleaning	11 pcs.	2 pcs.	3 pcs.	16 pcs.	5	9	7
After Cleaning	16 "	1 "	3 "	20 "	9	8	12

All worm track indications were in the longitudinal plane and most extended the full length of the fuel element. Excepting the three split elements, only one worm track was observed per element. Eight elements have been set aside for Radiometallurgy examination. Ten central-zone 19-piece columns were discharged and recharged during the 5/5/62 outage at C reactor. Eight of the ten columns were for conversion-ratio determination, and they were discharged at an average tube exposure of about 750 MWD/T. The average tube exposure of the other two columns was 840 MWD/T, with one tube reaching about 950 MWD/T.

NEW PRODUCTION REACTOR

NPR Fuel Development

The eleven 23-inch N reactor fuel elements charged into KER Loop 3 on 3/30/62 to evaluate the behavior of N fuel under anticipated N reactor operating conditions have reached an exposure of 465 MWD/T. Two-thirds of this exposure has been accumulated at low temperatures because of loop operating difficulties.

Five 23-inch N reactor fuel elements being irradiated in KER-4 to evaluate loop behavior were discharged 4/26/62, at an exposure of 630 MWD/T. The loop was recharged on 4/26/62 with fourteen 23-inch N reactor fuel elements for irradiation to about 2000 MWD/T to determine the behavior of N fuel at N reactor operating conditions. These elements have reached an exposure of 165 MWD/T.

KER Loops 1 and 2 were out of service for modification under project CGI-839.

Graphite Irradiation

The second graphite irradiated capsule was discharged 5/19/62. The third capsule continues under irradiation. The fourth capsule has been charged into the position vacated by the second capsule. The fourth capsule contains 13 specimens which were irradiated in the first capsule to a maximum exposure equivalent to about 1.3 years in the NPR.

OUTAGES (Year) (1962)

[redacted]

Reason	B	C	D	DR	F	H	KE	KW	Total
Charge-Discharge	18.2	59.9	36.6	29.8	28.7	88.3	40.7	32.6	334.8
Maintenance	38.4	31.3	48.8	9.7	80.1	36.5	34.4	24.6	303.0
Rupture Removal	12.6	66.5	3.0	8.3		3.6			94.0
Leak Testing	30.1	29.5	15.0	9.3		30.9			114.8
Tube Replacement	4.3	157.8	5.1	12.6	238.9	269.4	5.8	10.8	704.7
Project Work	.4			5.4			8.1	4.6	18.5
Production Tests	2.8	8.0	9.9	4.4		1.0	22.1	16.3	64.5
Standard Check [redacted]	.4	.8	1.7		2.8	1.5	3.6	11.0	21.8
Rupture Suspects									
Miscellaneous	4.9	1.7	2.0		20.6	7.0	8.5		44.7
Total	112.1	355.5	121.3	79.5	371.1	438.2	123.2	99.9	1700.8
Scheduled Outages									
Unscheduled Outages									

[redacted]

RUPTURED SLUG TABULATION FOR MAY, 1962

Tube No.	Date Charged	Date Ruptured	Tube Power (KW)	Concentration MWD/Ton	Assigned Production Loss		Observations
					MWD	Days	
1265 DR	3/15/62	5/1/62	1194	197	602	.35	I&EN End
1384 C	3/10/62	5/5/62	1389	425	2018	.97	I&EN Unknown
0576 H	10/28/61	5/6/62	1087	1294	266	.16	I&E-EB Split-long
3072 DR	3/15/62	5/8/62	1022	226	87	.05	I&EN End
1159 C	3/10/62	5/11/62	1116	423	4829	2.33	I&EN Hot Spot
1069 B	1/13/62	5/12/62	1166	627	1020	.58	I&EN Unclassified
2166 D	1/31/62	5/27/62	1155	811	242	.13	I&ENB (Water Mixer) Side Other

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

TO : Files

DATE: July 12, 1962

FROM : R. L. Plum, Chief
Reactor Operations Branch

SUBJECT: MONTHLY REPORT - JUNE, 1962

HAN-80948
Report #6

OR:GTO-RGR

OPERATING EXPERIENCE

Production

Reactor input production (MWD) was 8.5% above forecast; 12.8% below at the six old reactors and 39.9% above at the K's. Production for the second quarter was 4.3% above forecast.

Efficiency

Over-all time operated efficiency was 68.6% (71.1% forecast); 62.2% at the six old reactors and 87.7% at the K's. Efficiency was below forecast at the six old reactors and above at the K's due largely to deferring a six-day dual reactor outage at the K's for the tie-in of the Emergency Backup Coolant System. This provided an additional week which was utilized for tube replacement at one of the old reactors.

Power Level

There was no increase in reactor power levels.

Fuel Ruptures

Four ruptures, all I&E natural metal, were removed from the reactors. Two were at D, one at DR and one at F. The three D and DR ruptures were dingot metal.

Power Level Limits

The primary limitation to reactor power levels at the end of the month for all reactors was bulk outlet temperature.

MAINTENANCE & EQUIPMENT EXPERIENCE

Tube Replacement

On the tube replacement program, 614 new process tubes were installed for a total of 3863 to date this year.

A total of 645 process tubes were installed during the month; 295 at DR, 191 at C, 147 at H, 7 at F, and 5 at D.

Three hundred ninety-nine tube channels at C reactor and 275 channels at DR reactor were drilled with the new drive unit and cutter assembly described in the May report. Only two new tubes stuck and were damaged on insertion at C reactor, although approximately 30 were damaged in this way at DR reactor. The higher percentage of tubes lost at DR reactor is attributed in part to the already loosened graphite block condition.

Fifteen tube leaks and 10 Van Stone leaks were corrected. Eight of the tube leaks were at C, 3 at F, 2 at D and 2 at H. Five Van Stone leaks were at H, 4 at C and one at DR.

REACTOR OUTAGES

Date Down	Date Up	Outage Hours	Remarks
B Reactor			
6/13	6/17	106.8	Scheduled charge-discharge. Miscellaneous maintenance.
6/18	6/18	.6	Unexplained Panellit trip.
6/23	6/25	35.9	Miscellaneous maintenance following a Panellit trip due to a faulty spline cap seal on tube 3479.
C Reactor			
5/25	6/11	395.3	Replacement of 399 tubes.
6/11	6/12	37.0	Leak testing and tube replacement following a Panellit trip.
6/13	6/13	1.7	Thermocouple repair.

C Reactor (cont'd.)

6/20	6/25	115.1	Leak testing, tube replacement and miscellaneous maintenance.
6/25	6/25	1.9	Investigation of excessive steam formation in the rear face revealed that one of the two exhaust fans normally used was not on.

D Reactor

6/11	6/13	41.7	Leak testing and tube replacement.
6/13	6/13	.3	Panellit trip due to a faulty gauge on PCCF tube 1475.
6/14	6/16	47.7	Removal of an I&E natural metal rupture from tube 3065. Charge-discharge.
6/18	6/20	37.6	Removal of an I&E natural metal rupture from tube 3378 and replacement of the tube.

DR Reactor

6/5	6/6	38.5	Charge-discharge, leak testing and the correction of two faulty lug rings.
6/9	6/25	403.0	Replacement of 296 tubes.
6/26	6/26	.4	Unexplained Panellit trip.
6/26	6/26	2.1	Removal of an I&E natural metal rupture from tube 1268.

F Reactor

5/31	6/2	63.3	Scheduled charge-discharge. Miscellaneous maintenance.
6/3	6/3	1.8	Replace leaking front connector on tube 1585.
6/12	6/15	68.3	High pressure on tube 4167 due to a broken thermocouple well. Leak testing and miscellaneous maintenance.

F Reactor (cont'd.)

6/25	6/29	112.8	Removal of an I&E natural metal rupture from tube 2272. Charge-discharge and miscellaneous maintenance.
6/30	6/30	1.2	Trip due to a loose spline cap on tube 3172.

H Reactor

6/1	6/1	.2	Panellit trip due to faulty gauge circuitry.
6/1	6/2	34.8	Beckman trip during recovery due to ultra-sensitive trip setting. Tube replacement.
6/7	6/9	45.7	Leak testing and tube replacement.
6/10	6/12	42.6	Leak testing and tube removal.
6/19	6/19	.3	Trip due to a faulty rear connector on tube 0682.
6/24	Still down		Scheduled tube replacement.

KE Reactor

6/18	6/21	92.4	Scheduled charge-discharge.
6/21	6/21	1.3	Three Panellit trips apparently due to metal charges washing down stream.
6/22	6/22	.9	Manual trip to correct leaking rear face cap.
6/22	6/22	.2	Beckman trip during range change.

KW Reactor

6/11	6/14	82.3	Scheduled charge-discharge.

Files

July 12, 1962

RESEARCH & DEVELOPMENT - EXISTING REACTORS

Graphite Distortion

A graphite distortion problem program document (HW-73778) has been issued which reviews the status of pertinent design and development programs currently under way and outlines the expected problem areas on which additional engineering efforts will be required. Preliminary schedules are shown for current and planned development programs in support of the vertical safety rod and horizontal control rod operational and graphite distortion problems.

C Reactor VSR Test

Drop testing of a C reactor size flexible VSR in an out-of-pile VSR channel lined with polycrystalline graphite sleeves is continuing. The tests completed to date have indicated that the liner sections will not be satisfactory for a $2\frac{1}{2}$-inch horizontal channel displacement in a six-foot arc, due to wear and breakage of the liners from VSR impact. Additional tests are under way on a channel having a 1-3/4 inch displacement which approximates the maximum channel distortion which has been observed to date in the reactor. Alternate VSR tip arrangements to reduce the impact of the rod striking the liner in the $2\frac{1}{2}$-inch displacement tests were unsuccessful. Rod drop tests in a channel section filled with 3X balls resulted in failure of the liner at the ball level due to rod impact. Additional rod drop tests are being made to determine the internal pressure in the channel resulting from the impact of the rod into the balls.

Two sets of samples of alternate VSR ceramic liner materials have been discharged from C reactor after an exposure of 4×10^{20} nvt. These samples of aluminum oxide, aluminum silicate, and nitride bonded silicon carbide have been sent to the Radiometallurgy Laboratory for testing to determine the irradiation effect upon these materials. Additional samples will be removed from the reactor over a bi-monthly schedule for the next twenty months.

VSR Channel Restoration

The clearing of VSR channels was begun at C reactor on June 21. Channel #47 was entered and two block ends, approximately 4 inches thick, that were lodged in the channel, were drilled with

a 1-23/64 inch drill bit. This initial hole was subsequently opened to 2-3/8 inches to allow passage of the television camera. This channel is now open to permit bottom removal of 3X balls in the usual manner. Further channel restoration efforts were abandoned when the 1-5/8 inch drill bit came loose and lodged in the Ball 3X piping below the unit. Preparatory work is under way to permit removal of the bit during the next reactor outage. Laboratory testing of VSR channel enlargement tooling is continuing in the 195 Test Tower.

VSR's 105-DR

An evaluation has been completed of the modifications required for installation of a B-size flexible vertical safety rod in DR reactor. Listings of the necessary replacement components and designs for a step plug sleeve insert have been prepared. The use of the smaller B-size rod in 105-DR reactor is being undertaken in order to improve the speed of VSR insertion time on several of the VSR channels which are currently indicating evidence of binding. Design work has been initiated on the modifications necessary to permit installation of a B-size vertical safety rod on an interim basis at the K reactors. A safety analysis has indicated that the use of these smaller diameter rods will provide adequate control strength at the K reactors.

VSR Studies

A study has been completed and a report issued (HW-74046) on the effect of various channel sleeving materials and rod sizes on the VSR strength. From this study the following conclusions can be drawn:

1. B rods will be acceptal in the K reactors.

2. Ceramic liners will result in a maximum loss of about 3% in local control rod strength in channels so lined. Graphite liners will increase the local control strengths of the VSR's by about 3%.

3. Although B rods and liners are acceptable in C reactor at present, they will probably not be strong enough in C reactor after overboring.

4. B rods are acceptable in DR reactor provided the appropriate alterations are made in total control requirements to take into consideration the weaker rods.

[redacted]

105-DR 3X Balls

Analysis of DR reactor cold startup data indicated a burnout recovery of approximately 150 C-mk from the residual boron-steel balls left by the 1961 Ball 3X drop. The number of compensating enrichment columns allowed within total control limitations was correspondingly reduced.

Production Accounting

Effective July 1, 1961, the IPD production accounting program was normalized on the basis of twelve 2-ton test batches and routine CPD recovery experience. Subsequent experience has demonstrated that the 1961 normalization was successful; only minor modifications will be recommended for the July, 1962 normalization. The predicted yield in natural uranium will be increased approximately one-half per cent and the predicted plutonium yield in E metal will be reduced about one per cent. The net effect on IPD total plutonium predictions will be of the order of 0.1 per cent.

K Reactor Graphite Channels

Design of the K reactor one-tube graphite channel mockup facility was completed on June 23. The mockup is being constructed to permit development of tooling for channel straightening and demonstration of tube configuration for predicted graphite conditions at the K reactors. Construction is in progress and the mockup is approximately 70% complete.

Operational Fueling

Cavitation tests of the Venturi mounted on the nozzle were concluded in the laboratory on the K reactor mockup. Test results reveal no damage occurs to the inlet connector during operation with the tube empty. All test data is reported in HW-73874, dated June 14, 1962.

Remote Operation - 115 Buildings, B/C, D/DR, and H

A feasibility study of operating the B, C, D, DR, and H reactor gas treatment system remotely from the reactor control room has been completed. Document HW-73892, "Remote Operation - 115 Buildings, D/DR, B/C, and H, Feasibility Report," has been issued and reports favorably on the proposal.

[redacted]

Voltage Studies

Development Test DT-IP-511-E, Voltage Recording Tests - 105-F, HW-73973, was approved and issued. The objective of this test is to determine voltage surges incidental to the startup of major pieces of equipment and the effect on reactor safety instrumentation. The necessary instruments have been installed and the test has begun. It is expected to continue for several weeks.

Self-Supported Fuel

Eighteen columns of CIVNS fuel elements were discharged during the 5/25/62 outage at C reactor. No unusual discharge forces were required. No charge-discharge of self-supported fuel occurred during the report period from KW reactor.

Bumper Fuel

The irradiation phase of the elliptical bumper rail evaluation was completed on 5/27/62 with a discharge of the last eight columns from D reactor at an average tube exposure of 1060 MWD/T. The examination was scheduled for the week of 6/11/62. This data will be machine processed and analyzed.

Other Fuel Programs

Fourteen monitor columns charged into F reactor to evaluate the oil-quench process reached their scheduled goal exposure of 800 MWD/T on 6/25/62 and were discharged during that outage.

Ten monitor columns charged into B reactor to evaluate alpha extrusion as an alternate fabrication process have accumulated an estimated tube exposure of 380 MWD/T. The first scheduled discharge of four columns at about 400 MWD/T will occur at the next outage.

Eighteen columns consisting of Sylcor Hot Press, Hanford Hot Press and Hanford AlSi fuel elements were charged into C reactor during the 5/25/62 outage. A total of 192 elements from each of the above processes are being irradiated to a goal of 800 MWD/T in Part I of this test.

Files

July 12, 1962

Reactor Graphite Stack Distortion

Production Test IP-512-A approved six vertical and two horizontal special traverse measurements, and, to date, four vertical traverses have been made. Preliminary examination of the data qualitatively confirms that the Y-2 hole traverse data previously obtained does represent the most severe vertical distortion in the K reactor stacks. Y-2 hole is a graphite channel above the top row of tubes in the center of the reactor. The horizontal traverses will be run at an early date.

E-N Load - Conversion Ratio

Several batches of blanket-supporting enriched uranium have been dissolved. Tritium extraction has been completed on material from the second E-N core loading and two large batches of blanket columns. Analytical results have not yet been received from these extractions.

Uranium Recycle

The percent of recycled enriched fuel present in the reactors at the end of May and discharged during May are given below:

Per Cent of Recycled Fuel in Enriched Fuel

	B	C	D	DR	F	H	KE	KW
May 31 Status	87	100	100	94	91	88	98	100
May Discharge	93	99	100	85	85	90	100	100

Ball 3X System Review

An over-all review of the Ball 3X safety system philosophy and criteria for the present Hanford reactors has begun. Approximately two months will be required for completion.

[redacted]

Effluent Water Data

The table below shows the average reported concentrations of selected radioisotopes from reactor effluent samples taken during May, 1962. Units are 10^{-12} curies/ml.

Reactor	As^{76}	P^{32}	Zn^{65}	Np^{239}	Cr^{51}
B	59	9.1	14	340	180
C	92	9.5	19	130	390
D	100	11.7	280*	340	1030
DR	104	4.6	27	120	480
F	74	10.8	88	140	860
H	77	10.2	58	-- **	-- **
KE	74	20.5	45	280	1800
KW	77	16.2	28	120	480

* No apparent reason for this high reading. Further tests are being made.

** No valid samples - Samples are taken while the reactor is operating. H reactor was down a substantial part of the month. Unfortunately those samples taken were lost or not considered valid.

The average concentrations of P-32 and As-76 in the old reactors were about the same as in April. However, a factor of two improvement over previous years' experience is indicated. The concentrations of P-32 and As-76 at the K reactors is about the same as a year ago.

All old reactors continued at a nominal feed rate of 18 ppm alum in the water treatment process. Alum feed rate at KE was increased from 13 ppm to 18 ppm on May 21 as a result of unsatisfactory P-32 reduction at the lower feed rate. On May 22 the alum feed rate at KW was increased from 18 ppm to 20 ppm as the first step in a test of the usefulness of still higher alum feeds.

Experience to date with 20 ppm at KW has not shown any significant reduction in P-32 release as compared with 18 ppm.

Carbon 14 Study

A document describing the effects of C^{14} in reactor effluents is being prepared in cooperation with HLO personnel. The document summarizes known facts about C^{14} discharged via the stacks and to the river in the past, along with data accumulated to date by the current study program. Analysis of all known data indicates that dose to workers in the reactor areas and to the surrounding populace due to Hanford C^{14} contribution is insignificant compared to the natural background. The contemplated change in reactor atmosphere constituents currently being tested at the K reactors would increase C^{14} by about a factor of ten (to ≈1 c/day from eight reactors) but this is still an insignificant amount of C^{14} based on any hazard to personnel. The C^{14} released through the stack appears to be almost entirely in the oxide form. Since animal organisms tend to discriminate against and eliminate CO_2, the dose from C^{14} taken into the body by breathing is almost infinitesimal. The dose from ingestion of foodstuffs containing C^{14} would be slightly higher. The dose to persons in the Ringold area from food grown in that area would be 0.1 to 0.2 mrem/year, assuming a release rate of approximately 1 c/day.

Process Tube Cracking - 105-H

Visual inspection of tube #2371, which had indications of a transverse fatigue crack when inspected by ultrasonic inspection equipment as reported last month, has not been completed.

REACTOR MODIFICATION PROGRAM

Overbore Fuel Development

No charge-discharge activity occurred during the report period. Radiometallurgy Laboratory examination of the eight elements mentioned in last month's report has not been completed.

C Overbore-Conversion Ratio

Fuel discharged May 5 from the eight conversion ratio test columns is still cooling in C basin.

Zirconium Tube Replacement Program

The design of modifications in support of the zirconium process tube replacement program at the 105-K reactors has continued. Flow testing of a complete nozzle, process tube and fuel element chain has been satisfactorily completed with the system pressure

drop of the new assembly equal to that of the presently installed equipment. Fabrication of prototype impact extruded inlet nozzles by the vendor is proceeding with no significant problems encountered to date. Design testing of alternate front- and rear-face gas seals, snap ring groove modifications and snap ring materials is under way. Design has been completed and shop fabrication started on a prototype gunbarrel snap ring regrooving tool.

NEW PRODUCTION REACTOR

NPR Fuel Testing

KER Loops one and two remain out of service for modification under project CGI-839.

KER-3: Eleven 23-inch N reactor fuel elements charged into KER Loop 3 on 3/30/62 were discharged on 6/16/62 at an average exposure of 807 MWD/T. The majority of this exposure was accumulated at low temperature operation because of loop operating difficulties and it was necessary to install a new charge of fuel for high temperature service to acquire meaningful prototype data.

KER-4: The fourteen 23-inch N reactor fuel elements scheduled for 2000 MWD/T goal exposure, charged into KER-4 on 4/26/62, have accumulated an exposure of 443 MWD/T. Some loop operating difficulties have forced limited operation periods with cold water.

NPR Mockup Experiments

The NPR mockup exponential pile experiments to determine basic lattice data for the present fuel design have been completed. The data and results are available for the set of experiments run without control rods. The data for the set run with varying amounts of control rod inserted have been taken, but the results are not yet ready for publishing.

OUTAGES (Year) (6/62)

Reason	B	C	D	DR	F	H	KE	KW	Total
Charge-Discharge	31.1	27.0	40.8	53.3	45.3	40.6	52.7	48.5	339.3
Maintenance	55.3	31.7	22.6	21.0	60.1	20.5	10.9	22.8	244.9
Rupture Removal			46.6	2.1	49.9				98.6
Water Leak ~~Leak Testing~~	21.3	113.9	3.4	17.7	47.2	76.5			280.0
Tube Replacement	8.7	203.6	9.0	273.7	23.7	148.2	5.6	4.8	677.3
Project Work								5.3	5.3
Production Tests	18.2	19.8	4.4	60.8	3.7		25.0	0.9	132.8
Standard Check ~~Instrument & Circuitry~~	8.1	2.0		7.0			0.6		17.7
Rupture Suspects									
Miscellaneous	0.6	1.0	0.5	8.4		4.8			15.3
Total	143.3	399.0	127.3	444.0	229.9	290.6	94.8	82.3	1811.2
Scheduled Outages									
Unscheduled Outages									

RUPTURED SLUG TABULATION FOR JUNE , 1962

Tube No.	Date Charged	Date Ruptured	Tube Power (KW)	Concentration MWD/Ton	Assigned Production Loss		Observations
					MWD	Days	
3065 D	4/2/62	6/14/62	1107	533	2752	1.58	I&E-N - Unclassified Dingot Bumper
3378 D	4/2/62	6/18/62	1232	600	1289	.74	I&E-N - Side Other Dingot Bumper
2272 F	4/6/62	6/25/62	1168	486	3777	2.19	I&E-N - Hot Spot 6800 psi
1268 DR	3/15/62	6/26/62	910	455	919	.57	I&E-N - Unknown Dingot

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

TO : Files

DATE: August 10, 1962

FROM : R. L. Plum, Chief
Reactor Operations Branch

SUBJECT: MONTHLY REPORT - JULY, 1962

HAN-80948
Report #7

OR:GTO:RGR

OPERATING EXPERIENCE

Production

Reactor input production (MWD) was 3.9% below forecast; 1.6% above at the six old reactors and 12.4% below at the K's.

Efficiency

Over-all time operated efficiency was 73.3% (76.1% forecast); 77.7% at the six old reactors and 60.2% at the K's. Efficiency was low at the K's due to outages for the tie-in of the emergency backup coolant system and subsequent outages to flush sand from the cross-tie system.

Power Levels

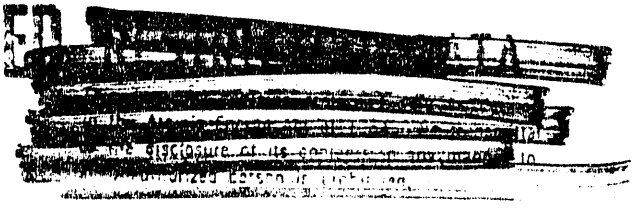
There was no increase in reactor power levels.

Ruptures

Five ruptured fuel elements, all I&E enriched metal, were removed from the reactors. Two were at C, two at F and one at B. One of the F ruptures was caused by charging machine damage.

Power Level Limits

During this report period, the primary limitations to reactor power levels for all reactors were bulk outlet temperature limits.



MAINTENANCE AND EQUIPMENT EXPERIENCE

Water Leak Corrections

Nineteen new process tubes were installed; eight at D, seven at F, two at B and two at DR.

Five process water leaks were corrected; three tube and two Van Stones. The tube leaks were at D, DR and F. The two Van Stone leaks were at D.

Uranium Recycle Fuel Experience

The percent of recycled fuel in the enriched fuel present in the reactors at the end of June and discharged during June are given below:

	Percent of Recycled Fuel in Enriched Fuel							
	B	C	D	DR	F	H	KE	KW
June 30 Status	91	≈100	100	95	93	91	99	≈100
Monthly Discharges	83	100	100	96	96	100	97	100

Tube Replacement

Redesign of the graphite channel drilling machine, vacuum system, and tube pushing machine was continued during the month. No on-reactor test work was performed due to shutdown of the tube replacement effort during July.

VSR Channel Restoration

The on-reactor testing of channel clearing tools scheduled for July has not been completed due to rescheduling of 100-C reactor outage time. It is planned to test this tooling on 100-C reactor as scheduled outage time becomes available. The second prototype of the chain saw cutter, designed to enlarge the VSR channels to 4-11/16 inches x 5-1/2 inches, was tested in the 195-D mockup and performed satisfactorily.

BPA Midway Fault of July 10, 1962

A fault at Midway Substation resulted in loss of BPA power to Hanford at 0016, July 10, 1962. Equipment and circuitry critical to reactor safety performed satisfactorily and all operating reactors (excepting B and C reactors which were already shut down) scrammed without incident. All reactor cooling loads were transferred to the secondary systems except for C reactor which was at planned shutdown flow on BPA-powered pumps that were able to carry through the fault without an interrupting trip. Boiler response was satisfactory at all affected reactors. A 151-H circuit breaker fault on opening was the only equipment malfunction and did not affect reactor safety. Two high-lift pumps at KW reactor failed to trip off and underwent some cavitation until manually tripped from the system. Further investigation is under way to determine the reason the two K pumps failed to trip.

REACTOR OUTAGES

Date Down	Date Up	Outage Hours	Remarks
B Reactor			
7/8	7/13	126.7	Scheduled charge-discharge and maintenance.
7/13	7/13	.7	Unexplained high pressure Panellit trip on tube 2561.
7/14	7/15	23.3	Repair of front nozzle pigtail adapter leak on tube 1794.
7/23	7/24	27.4	Removal of an I&E-E metal rupture from tube 4078.
7/24	7/24	.5	Beckman trip due to operational error.
C Reactor			
7/2	7/4	48.7	Leak testing.
7/4	7/4	.7	Tightening of rear caps on overbore tubes.
7/8	7/10	62.0	Tripped when #11 HCR cooling water hose came loose from a connector. Charge-discharge and maintenance.

C Reactor (cont'd.)

7/11	7/13	33.5	Manually tripped when No. 14 HCR cooling water hose came loose from connector. Miscellaneous maintenance.
7/19	7/20	44.0	Removal of an I&E-E metal rupture from tube 1692. Miscellaneous maintenance.
7/27	7/29	36.3	Removal of an I&E-E metal rupture from tube 3962.
7/29	7/29	.3	Panellit trip while removing a spline stub from tube 2776.

D Reactor

7/10	7/13	74.1	Tripped by a heavy power surge on the BPA system when a transformer faulted on the Priest Rapids #1 Line at Midway. Charge-discharge, maintenance, and tube replacement.
7/13	7/15	37.7	Leak testing and tube replacement.
7/31	Still down		Water leak.

DR Reactor

7/5	7/6	35.1	Panellit trip due to the failure of a rear pigtail adaptor on tube 2086. Charge-discharge.
7/10	7/11	35.1	Tripped by a heavy power surge on the BPA system when a transformer faulted on the Priest Rapids #1 Line at Midway. Miscellaneous maintenance.
7/16	7/20	93.1	Partially engaged front cap on tube 1793. Charge-discharge and miscellaneous maintenance.
7/20	7/20	.2	Unexplained Panellit trip.
7/23	7/24	33.9	Panellit trip due to non-seated charge in tube 3982. Miscellaneous maintenance.
7/24	7/24	1.5	Repair a flange leak on tube 3293.

[redacted] DECLASSIFIED

F Reactor

7/1	7/2	33.6	Removal of an I&E-E metal rupture from tube 3958.
7/5	7/6	39.2	Panellit trip due to a broken rear pigtail on tube 3684. Miscellaneous maintenance and leak testing.
7/7	7/7	11.8	Removal of an I&E-E metal rupture from tube 2059.
7/10	7/11	34.1	Tripped by a heavy power surge on the BPA system. Retubed five air channels; decontamination and leak testing.
7/23	7/24	37.2	High pressure Panellit trip on tube 3371. Miscellaneous maintenance.

H Reactor

6/24	7/4	317.8	Scheduled tube replacement.
7/10	7/11	37.9	Trip by a heavy power surge on the BPA system. Miscellaneous maintenance.

KE Reactor

7/10	7/12	51.5	Tripped by a heavy power surge on the BPA system. Charge-discharge.
7/16	7/22	167.3	Scheduled project work CG-844 and miscellaneous maintenance.
7/23	7/23	1.1	Tripped when VSR #70 dropped due to a faulty holding coil on the solenoid seal.
7/23	7/24	23.5	Flushing of high-pressure cross tie system piping through V-71 and V-74 valves.
7/28	7/29	31.9	Unexplained Panellit trip.
7/29	7/29	.4	Panellit trip due to an oscillating gauge.

KW Reactor

7/1	7/4	72.9	Scheduled charge-discharge.
7/6	7/8	34.7	Unexplained Panellit trip. Replaced two sections of VSR #43.
7/8	7/8	2.6	Install one additional section of VSR #43.
7/10	7/11	42.6	Tripped by heavy power surge on the BPA system. Rear-face decontamination and maintenance.
7/16	7/21	134.7	Scheduled project work CG-844
7/23	7/24	31.8	Panellit trip due to a faulty jumper on gauge 4462. Miscellaneous maintenance.

RESEARCH AND DEVELOPMENT - EXISTING REACTORS

Operational Fueling

Installation of the rear-face actuator operating console in the 100-KE reactor control room was completed on July 20. The system was tested and is functioning properly. Twenty-seven flapper caps were installed on outlet nozzles; five operational fueling front nozzles, with Venturis at the nozzle, were installed on the inlet face. Additional flapper caps and operational fueling front nozzles will be installed as equipment and outage time become available, in preparation for a Production Test.

Other Fuel Programs

Eighteen columns consisting of Sylcor Hot Press, Hanford Hot Press and Hanford AlSi canned fuel elements charged into C reactor during the 5/25/62 outage have reached an average exposure of 220 MWD/T as of 7/20/62. A total of 192 fuel elements of each of the above types is included in the test exposure.

[redacted] DECLASSIFIED

Files

August 10, 1962

Zircaloy-2 Process Tube Bending Tests

Investigations have been made to determine the dimensional changes to Zircaloy-2 process tubes under various conditions of distortion imposed by the reactor graphite channels. These investigations were made in a mockup of K reactor graphite tube and trunnion blocks. A K-size Zircaloy tube (ID = 1.724) was inserted in tube and trunnion blocks and deflected by bending at the center of its length about a center, pivotal trunnion block. Six tests were run with various block deflections and various amounts of graphite removed from the center trunnion block and sections of the adjacent tube blocks. Preliminary data have been received, but these data with the first conclusions that can be drawn from these and other data from the continuing tests will be reported in the following months.

E-N Load

Analytical data are now available from all sample batches taken from the H reactor fringe prior to loading the E-N blanket. All tritium yield data from the second striped core and from representative blanket samples have been received. Only the data for the enriched metal from the second core are still to be received.

VSR Withdrawal Rates

Studies are being made to review the maximum allowable rates for insertion of reactivity during cold startup of the reactor. These studies will use the maximum physically possible withdrawal rates to determine future mechanical limitations on VSR withdrawal. This will remove all reliance upon procedural control for safe VSR withdrawal rates.

Zirconium Process Tube Replacement Program

The performance of design and related test work in support of the zirconium process tube replacement program at [illegible] reactors has been continued. A series of on-reactor measurements have been made to determine the source of gas leaks in the reactor process tube assembly. These tests indicate that the primary process tube gas leak source on the K reactors at this time is the rear centering flange gasket which has deteriorated from radiation and temperature effects. Due to the inaccessibility of this gasket it will not be possible to replace it as part of

[redacted]

this program, but studies have begun to determine the most feasible method of remedying the leaks at this point. Testing of broached existing rear-face nozzles has confirmed that they have adequate strength for reuse on the retubing program. Analytical studies to determine process tube deflection stress, graphite removal and resultant temperature distribution under future distortion patterns are proceeding. The preparation of design and the performance of test work on other components of the modified process tube assemblies for use with zirconium tubes is continuing on schedule.

VSR Sleeves

Activities on various facets of the graphite distortion and control rod problems have continued. Prototype quantities of pyrolitic graphite and ceramic VSR channel liner sections have been received for out-of-reactor testing.

Drop testing of a 105-C reactor size flexible VSR in a channel lined with polycrystalline graphite sleeves has been completed. These tests have indicated that a channel life in excess of 100 drops will be obtained when the channel distortion does not exceed 1-3/4" horizontal displacement.

VSR's

The design of modifications required to permit the use of a "B" size VSR at the 105-K reactors is approximately 50% complete. A "B" size VSR has been successfully installed in 105-DR reactor. The continuing performance of this rod to date has been satisfactory.

Effluent Water Data

The following table shows average reported concentrations of selected radioisotopes from reactor effluent samples taken during June, 1962. Units are 10^{-12} curies/cc.

[redacted]

Files

August 10, 1962

Reactor	As^{76}	P^{32}	Zn^{65}	Np^{239}	Cr^{51}
B	64	9.4	57	170	740
C	78	4.0	16	94	300
D	90	9.1	37	140	510
DR	103	5.3	31	170	770
F	59	8.1	82	140	1300
H	62	7.4	14	93	320
KE	50	12.6	23	230	850
KW	48	13.0	26	100	550

REACTOR MODIFICATION PROGRAM

Zircaloy-2 Process Tubes - K Reactors

A purchase order was placed with Wolverine Tube Division of Calumet and Hecla Corporation for 5200 tubes at a total price of $2,792,400. The date of the order, H2K-888-33584, is 22nd of June, 1962. Delivery schedule is as follows:

October 25, 1962	200	
December 26, 1962	300	more
March 25, 1963	1400	"
June 25, 1963	1400	"
September 25, 1963	1400	"

NEW PRODUCTION REACTOR

Self-Supported Fuel

The two tubes of KVNS fuel elements charged during the 5/20/62 outage at KW have accumulated an average exposure of 450 MWD/T as of 7/20/62.

[redacted]

RUPTURED SLUG TABULATION FOR July, 1962

Tube No.	Date Charged	Date Ruptured	Tube Power (KW)	Concentration MWD/Ton	Assigned Production Loss		Observations
					MWD	Days	
3958F	6-25-62	7-1-62	1159	9	1060	.64	I&E^2 Leak or Charge Machine
2059F	4-27-62	7-7-62	1242	468	1261	.77	I&E^2 4,100 psi Hot Spot
1692C	3-27-62	7-19-62	1175	838	2460	1.30	I&E^2 8,000 psi Hot Spot
4078B	5-15-62	7-23-62	1154	661	1518	.90	I&E^2 Side Other
3962C	5-25-62	7-27-62	1280	412	1349	.71	I&E^2 Unclassified

OUTAGES (July) (Year)

Reason	B	C	D	DR	F	H	KE	KW	Total
Charge-Discharge	34.5	31.5	44.6	82.1	1.6	5.7	29.5	59.7	289.2
Maintenance	77.0	65.5	20.1	49.4	102.4	9.7	46.8	99.3	470.2
Rupture Removal	15.8	40.8			25.1				81.7
Leak Testing		42.0	30.8	15.5	14.5	9.1			111.9
Tube Replacement	10.3	36.2	9.9	17.8	5.1	58.1		13.0	150.4
Project Work	20.3						126.1	79.6	226.0
Production Tests	9.4	8.0	6.5	14.2	0.8	6.0	12.9	6.3	64.1
Standard Check ~~Instrument & Circuitry~~		1.5			5.0	4.0	0.3	5.5	16.3
Rupture Suspects									
Miscellaneous	11.3		7.5	19.9	2.4	24.0	59.0	54.9	179.0
Total	178.6	225.5	119.4	198.9	156.9	116.6	274.6	318.3	1,588.8
Scheduled Outages									
Unscheduled Outages									

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

[redacted]

TO : Files

DATE: September 13, 1962

FROM : R. L. Plum, Chief
Reactor Operations Branch

THIS DOCUMENT CONSISTS OF 2 PAGES
NO. 1 OF 1 COPIES, SERIES –

SUBJECT: MONTHLY REPORT - AUGUST, 1962

HAN-80948
Report #8

OR:GTO:RGR

OPERATING EXPERIENCE

Production

Reactor input production (MWD) was 5.8% above forecast; 2.6% below at the six old reactors and 15.6% above at the K's.

Efficiency

Over-all time operated efficiency was 73.8% (74.7% forecast; 69.5% at the six old reactors and 86.8% at the K's.

Power Level

There were no increases in reactor power levels.

Fuel Ruptures

Six ruptured fuel elements, three I&E natural, including one of the overbore size, and three I&E E-metal, were removed from the reactors. The natural metal ruptures were at B and D, the overbore natural at C. The enriched ruptures were at B, DR and H.

Power Level Limits

Power levels were limited at all reactors during the month by bulk outlet temperature considerations.

GROUP 1
[redacted]

DECLASSIFIED

[redacted]

[redacted]

MAINTENANCE AND EQUIPMENT EXPERIENCE

Tube Replacement

Four hundred and sixty-six new process tubes were installed; 304 at C, 158 at F, 2 at D and 2 at KE.

Water Leaks

Seven process water leaks were corrected; four tube and three Van Stone. Two tube leaks were at D and two at H. The Van Stone leaks were at D, F and H.

Hazard Summary Reports

Major effort is being expended in the preparation of complete, updated hazards summary reports for the Hanford production reactors. Issuance is planned for late fall.

REACTOR OUTAGES

Date Down	Date Up	Outage Hours	Remarks
B Reactor			
8/7	8/10	80.4	Scheduled charge-discharge and maintenance.
8/13	8/15	29.7	Removal of an I&E natural metal rupture from tube 3868.
8/22	8/24	36.2	Removal of an I&E E-metal rupture from tube 0989.
C Reactor			
8/1	8/3	40.2	Trip caused by a burned out transformer for the instrument air compressor. Miscellaneous maintenance.
8/3	8/3	2.1	Change Venturis on two tubes.
8/9	8/28	454.4	Scheduled replacement of 302 tubes.

C Reactor (Cont'd.)

8/29	8/29	3.1	Manual trip due to loss of cooling water to HCR No. 14.
8/29	8/30	36.1	Removal of an overbore-size I&E natural metal rupture from tube 3162.

D Reactor

7/31	8/2	54.3	Leak testing and charge-discharge. Corrected 68 rear-face gas leaks.
8/5	8/6	38.0	Repair of a weld leak at a crossheader nipple for the pigtail.
8/11	8/13	42.0	Tripped due to a short in the brake coil on No. 7 HCR. Miscellaneous maintenance.
8/13	8/13	0.4	Additional rod comparison tests authorized by PT-IP-447C.
8/27	8/28	43.4	Removal of an I&E natural metal rupture from tube 2583. Leak testing and tube replacement.

DR Reactor

8/17	8/18	26.5	Removal of an I&E E-metal rupture from tube 1285.
8/19	8/20	23.5	Unexplained Panellit trip.
8/20	8/20	0.5	Tripped due to a defective spline cap seal.

F Reactor

8/6	8/7	38.8	Scheduled charge-discharge.
8/7	8/7	3.6	Repair two broken sample lines in rear riser room.
8/9	8/10	33.0	Leak testing. Removed and replaced ball valve tube 3665 due to rear Van Stone leak.

[redacted]

F Reactor (Cont'd.)

8/10	8/10	1.5	Marmal trip when the PCCF machine came loose from the ball valve while charging poison.
8/24	Still down		Tube replacement.

H Reactor

8/1	8/4	73.9	Leak testing and charge-discharge.
8/7	8/8	35.3	Leak testing.
8/15	8/17	33.8	Removal of an I&E E-metal rupture from tube 0359.
8/27	8/28	36.2	Leak testing.

KE Reactor

8/3	8/5	39.0	Tripped due to a high-pressure surge while testing the backup coolant system. Miscellaneous maintenance and charge-discharge.
8/29	Still down		Scheduled charge-discharge.

KW Reactor

8/24	8/27	85.5	Loss of #2 emergency generator when the main exciter failed. Charge-discharge and miscellaneous maintenance.

RESEARCH AND DEVELOPMENT - EXISTING REACTORS

VSR Channel Sleeves

A feasibility report on lining the VSR channels with either ceramic or graphite sleeves has been issued. The study compared the physics aspects of sleeving C and K reactors with 1) 95% Al_2O_3, 2) 85% Al_2O_3, 3) NPR-grade graphite. The conclusions of the physics comparison show the graphite sleeve to give the highest local control strength to the rods of the three cases considered. Also, the graphite sleeve shows no loss in reactivity against respective losses of 6.7 mk and 7.1 mk for the 85% and

95% Al_2O_3 ceramic sleeves. A further comparison shows an even higher local control strength for the case of overboring without a sleeve. All of the pyrolytic graphite sleeves have been received from the vendors and are ready for testing. The irradiated ceramic samples of candidate SR channel liner materials are being examined by radio-metallurgy.

VSR Studies

The flexible vertical safety rod and horizontal control rod tests are continuing. B-reactor size flexible vertical safety rod design modifications for K-reactor installation is nearly completed. Alternate poison materials are being tested in the 305 Test Reactor for possible filler material for these rods. A test section of the proposed K-reactor flexible horizontal control rod design is being fabricated to test fabrication methods for a full-length prototype and will be used for structural deflection tests when finished.

Cooling Towers

A feasibility report on the use of cooling towers for reactor effluent heat burden reduction has been completed. The study concludes that 900 MW cooling size towers at each old reactor (1800 MW at the K's) would reduce the river temperature increase during warm weather by 4° F for an estimated cost of $1,600 to $2,000 per MW.

Process Standards Change

A new requirement for hot startups specifies that the power level rise must be stopped in a particular tube outlet temperature range for one minute for instrumentation response verification. This procedural requirement signals a change from the exponential rise region to the linear rise rates in low megawatt regions; thus minimizing possibilities of following exponential rise rates into higher power regions.

Spline Traverses

Fifty nonpoison spline traverses were made during the first month of full-scale use of the system with good accuracy in the results indicated due to their consistency. Meaningful analysis of flux distribution trends can be made after a few months use of the new system.

E-N Studies

An E-N charge pattern has been selected for use in further test core loadings at H reactor which effectively increases the N slug inventory by 6%. The E-N demonstration core loading test is expected to resume in early CY-1963 at H reactor.

Fuel Programs

Four monitor columns containing alpha-extruded dingot material discharged from B reactor during the 6/13/62 outage have been visually inspected at 105-C Metal Examination Facility and nothing unusual was noted. The data analysis is under way. The remaining six monitor columns of this test now have an average exposure of 700 MWD/T.

Eighteen columns consisting of Sylcor Hot Press, Hanford Hot Press and Hanford AlSi canned fuel elements charged into C reactor during the 5/25/62 outage have reached an average exposure of 375 MWD/T as of August 20, 1962. A total of 192 fuel elements of each of the above types is included in the test and is scheduled to an 800 MWD/T goal exposure.

Uranium Recycle

All reactors are using better than 90% of recycled fuel in enriched fuel.

Fission Product Inventories

As a part of the hazard summary reports for the current reactors the fission product inventory for 70-day irradiations at 1000 MW were computed at both 24-hour cooling and one-year cooling. The results are given in the table below and can be applied to any reactor, since the power level is just a multiplicative constant. The number of isotopes used was 123; however, some of these are metastable states. The results, given in megacuries, are for broad classes of fission products and those isotopes of biological significance.

Files

September 13, 1962

TOTAL FISSION PRODUCT INVENTORIES

(70 Days Irradiation Time)

Type	Mc/1000 MW 24 Hours	Mc/1000 MW One Year
Noble Gases	68.6	.0253
Halogens	76.4	.0307
Volatile Solids	53.4	.487
Nonvolatile Solids	522	10.2

BIOLOGICALLY SIGNIFICANT ISOTOPES

Xe^{133}	54.2	-
Xe^{135}	13.9	-
I^{131}	17.2	.0307
I^{132}	29.9	
I^{133}	25.0	
I^{135}	4.28	
Ru^{103}	17.3	.0811
Ru^{105}	.193	-
Ru^{106}	.395	.198
Te^{127}	.959	.0119
Te^{129}	4.54	.0021
Te^{132}	29.7	-
Cs^{137}	.250	.244
Sr^{89}	24.3	.174
Sr^{90}	.229	.224
Zr^{95}	27.3	.571
Ba^{140}	49.5	-
Ce^{144}	7.42	3.07

Effluent Water Data

Reactor	P^{32}		As^{76}		Np^{239}		Zn^{65}		Cr^{51}	
	7/62	7/61	7/62	7/61	7/62	7/61	7/62	7/61	7/62	7/61
B	10.5	6.9	43	73	230	63	200	11	3100	370
C	4.0	7.1	66	96	90	82	17	19	320	350
D	6.4	13.1	64	51	210	150	160	22	1900	800
DR	1.6	9.7	72	49	96	14	12	4	700	340
F	8.3	9.0	38	42	160	57	110	57	1300	400
H	6.5	6.0	61	103	91	62	13	62	340	130
KE	11.2	5.7	31	50	68	18	14	18	430	260
KW	9.2	7.9	46	39	69	48	11	48	470	250

Phosphorus-32 and As-76 releases again decreased, compared with last month, as a result of changing raw water conditions, but Zn-65 and Cr-51 releases increased. All reactor water plants continued on an alum feed rate of 18 ppm, except KW at 20 ppm.

REACTOR MODIFICATION PROGRAM

Zirconium Tube Replacement

Design and related testing in support of the zirconium process tube replacement program at the K reactors continued. Scoping of the program and the design criteria will be issued shortly. Prototype inlet and modified outlet nozzles and caps are installed and being tested on the two zirconium process tubes in KW reactor. Prototype impact extruded inlet nozzles have been received from the vendor and are undergoing metallurgical examination as another portion of the nozzle development program.

Testing of zirconium process tubes to determine graphite distortion patterns has progressed sufficiently to indicate the necessary areas of graphite removal. Present studies indicate a negligible effect on conversion ratio or flux distribution patterns due to the required amounts of graphite removed.

Overbore Fuel Development

Nineteen tubes of overbore fuel were discharged from C reactor. Eight aluminum tubes were removed and replaced with smooth-bore zirconium tubes; one overbore air channel 4463 was replaced with a smooth-bore zirconium tube. A total of 20 tubes was charged.

NEW PRODUCTION REACTOR

KER Testing

Loops one and two remain out of service for modifications under CGI-839.

KER-4: The fourteen 23-inch N reactor fuel elements scheduled for an average exposure of 1450 MWD/T (maximum exposure of 2000 MWD/T) reached an average accumulated exposure of 955 MWD/T on August 20, 1962.

Use of LiOH in N Coolant

The change in reactivity caused by the presence of depleted or normal LiOH in NPR coolant is given below. Also given are the concentrations necessary to cause one milli-k change in reactivity.

Reactivity Effect of LiOH

	$-\Delta k/k$		Conc. to give $\Delta k/k = -0.001$
	3.8 ppm LiOH	6.8 ppm LiOH	
Depleted LiOH	6.9×10^{-6}	1.2×10^{-5}	550 ppm
Natural LiOH	4.5×10^{-5}	8.0×10^{-5}	85 ppm

The effect of LiOH on the reactivity is negligible with either depleted or natural LiOH for concentrations in the above range.

[redacted]

Heat Generation Distribution

The calculation of the nuclear heat generation in the NPR lattice materials has been completed for the operating reactor.

The results of the calculation for the operating NPR reactor for 0 and 1000 MWD/T are shown below:

Total NPR Heat Generation Rates per Fission for 0 and 1000 MWD/T Exposure

Exposure	Mev/fission
0 ≈ 1 day operation	201.4
1000 MWD/T (90 days operation)	203.5

Fractional Distribution of Heat Generation in NPR Lattice Materials for 0 and 1000 MWD/T Exposures

Material	0 Exposure	1000 MWD/T Exposure
Graphite	4.31%	4.37%
Zr-2 Process tube	.44%	.46%
H_2O	.21%	.22%
Zr-2 Cladding	.18%	.19%
Outer uranium tube	67.28%	67.76%
Inner uranium tube	27.58%	27.00%

The results are in good agreement with earlier calculation on clusters and heavier tube and rod elements.

[redacted]

RUPTURED SLUG TABULATION FOR August, 1962

Tube No.	Date Charged	Date Ruptured	Tube Power (KW)	Concentration MWD/Ton	Assigned Production Loss		Observations	
					MWD	Days		
3869 B	6-13-62	8-13-62	1134	404	2042	1.22	I&E-Nat.	Hot Spot
0359 H	4-4-61	8-15-62	429	1193	974	.62	I&EE-No Bumper	Hole
1285 DR	5-1-62	8-17-62	1134	948	67	.04	I&E-Bumper	Hole
0989 B	4-13-62	8-22-62	1090	1024	1777	1.06	I&E-Bumper	Unclassified
2583 D	5-2-62	8-27-62	1122	902	311	.19	I&E-Nat. Bumper	Hole
3162 C	4-16-62	8-29-62	1243	640	3047	1.73	I&E-Nat. Overbore	Split

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OUTAGES (Year) (Aug.)

Reason	B	C	D	DR	F	H	KE	KW	Total
Charge-Discharge	29.3	33.8	36.4	30.8	50.1	52.0	49.4	50.7	332.5
Maintenance	46.0	67.8	105.0	17.5	50.7	49.0	4.1	14.1	354.2
Rupture Removal	46.4		4.2	.9		13.0			64.5
Leak Testing			29.9		14.8	57.5			102.2
Tube Replacement	7.1	338.6	2.5		118.7		7.8	9.2	483.9
Project Work							24.7		24.7
Production Tests	17.4	92.6(1)	4.0		3.0	3.0	24.7	11.5	156.2
Standard Check ~~Instrument & Circuitry~~	0.3	3.2		8.1	7.2	4.7			23.5
~~Rupture Suspects~~									
Miscellaneous			0.5	5.2	10.8				16.5
Total	146.5	536.0	182.5	62.5	255.3	179.2	110.7	85.5	1558.2
Scheduled Outages									
Unscheduled Outages									

(1) Includes 32.2 hrs. for removal of a stuck overbore rupture (IP-431-A)

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

[redacted]

DECLASSIFIED

TO : Files

DATE: October 9, 1962

FROM : R. L. Plum, Chief
Reactor Operations Branch

THIS DOCUMENT CONSISTS OF [redacted] PAGES
NO. [redacted] OF [redacted] COPIES, SERIES [redacted]

SUBJECT: MONTHLY REPORT - SEPTEMBER, 1962

HAN-80948
Report #9

OR:GTO-RGR

OPERATING EXPERIENCE

Production

Reactor input production (MWD) was 0.5% below forecast; 4.8% below at the six old reactors and 4.5% above at the K's. Production for the third quarter was 0.5% above forecast.

Efficiency

Over-all time operated efficiency was 69.6% (73.6% forecast); 65.4% 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.

Power Level

There was no increase in reactor power levels.

Fuel Ruptures

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.

Power Level Limits

The primary limitation to reactor power levels for all reactors was bulk outlet temperature limits.

(*) See discussion on these ruptures under Reactor Modification Program

[redacted]

GROUP 1

[redacted]

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MAINTENANCE AND EQUIPMENT EXPERIENCE

Tube Replacement

Five hundred fifty-nine new process tubes were installed; 354 at D, 200 at H, 2 at DR, 2 at KW and one at F.

Water Leaks

Six tube and 12 Van Stone leaks were corrected. Two tube leaks were at H and one each at B, C, D and DR. Six of the Van Stone leaks were at D, 5 at B and one at DR.

REACTOR OUTAGES

Date Down	Date Up	Outage Hours	Remarks
B Reactor			
9/5	9/7	47.6	Removal of an I&E natural metal rupture from tube 1175 and leak testing.
9/8	9/10	40.9	Removal of an I&E natural metal rupture from tube 2068.
9/11	9/11	.3	Unexplained Panellit trip.
9/17	9/17	.2	Tripped when a VSR switch was accidentally bumped.
9/29	Still down		Removal of an I&E E-metal rupture from tube 3768. Charge-discharge.
C Reactor			
9/3	9/5	60.3	Removal of an overbore size I&E natural metal rupture from tube 1494. Leak testing.
9/5	9/5	1.6	Installed shield bayonet in channel 0572.
9/6	9/7	32.7	Removal of an overbore size I&E natural metal rupture from tube 2969.

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C Reactor (continued)

9/23	9/28	108.6	Removal of an I&E natural metal production test (IP-490A) rupture from tube 3680. Charge-discharge and miscellaneous maintenance.
9/28	9/28	.5	Unexplained Panellit trip.

D Reactor

8/31	9/18	424.9	Water leak. Scheduled tube replacement: 347 tubes replaced.
9/23	9/24	31.3	Leak testing.
9/25	9/27	52.2	Leak testing.
9/29	Still down		Water leak.

DR Reactor

9/10	9/12	35.2	Tripped when an injection fitting came loose from a nozzle while injecting test material (IP-471-AE) for the control of a water leak. Leak testing and tube replacement.
9/16	9/17	34.6	Removal of an I&E E-metal rupture from tube 2989.
9/22	9/23	37.3	Water leak.
9/25	9/26	36.6	Water leak.
9/28	9/30	34.9	Removal of an I&E metal rupture from tube 3086 and miscellaneous maintenance.

F Reactor

8/24	9/3	230.8	Tube replacement (185 tubes).

[redacted]

H Reactor

9/6	9/7	30.6	Miscellaneous maintenance following a Panellit trip.
9/10	9/11	34.1	Leak testing.
9/11	9/11	1.4	Repair fitting leaks on five front-face pigtails.
9/13	9/14	33.4	Removal of an I&E natural metal rupture from tube 2890.
9/19	Still down		Tripped due to the failure of a spline cap seal while removing a spline. Tube replacement is in progress.

KE Reactor

8/29	9/1	85.6	Scheduled charge-discharge.
9/6	9/8	33.9	Charge-discharge following a trip due to the failure of #3 transformer.
9/25	9/28	74.9	Scheduled charge-discharge.
9/28	9/28	.3	Unexplained low pressure Panellit trip.
9/28	9/28	.9	Unexplained low pressure Panellit trip.
9/28	9/28	.7	Tripped when VSR #22 dropped due to a defective latch.
9/28	9/29	.7	Tripped when VSR #22 dropped. Rod was tied out of service.

KW Reactor

9/3	9/4	35.8	Panellit trip when a spline cap insert flushed downstream.
9/17	9/20	79.9	Scheduled charge-discharge.
9/20	9/20	1.2	Unexplained Panellit trip while adjusting gauges for six pumps.
9/20	9/20	.4	Panellit trip due to bypassing the wrong gauge while making adjustments for six pumps.

[redacted]

RESEARCH & DEVELOPMENT - EXISTING REACTORS

Graphite Distortion

Design activities have continued on liners for control- and safety-rod channel liners. Vendor fabrication difficulties have continued to delay the receipt of 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-Ball 3X 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 C reactor has been completed. Installation of these sleeves is currently scheduled to coincide with an extended outage at C reactor late in November. Borescoping and traversing measurements have been obtained on five more VSR channels at C reactor and one additional channel was borescoped.

Detailed design drawings of a flexible VSR for C reactor for off-site procurement purposes have been completed. The 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 VSR's.

Effluent Activity

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

Reactor	P^{32}	As^{76}	Zn^{65}	Np^{239}	Cr^{51}
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

Effluent Activity (Cont'd.)

All reactor water plants continued on an alum feed rate of 18 ppm except at KW, where 20 ppm was used. The higher-than-usual (for the season) Zn^{65} and Cr^{51} release rates experienced during July at B, D and F reactors decreased materially in August and September, 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 the effluent samples.

Tube Replacement

The graphite drilling machine designed to relieve the bore of the process tube graphite blocks continued to perform acceptably with redesign of the drill. Procurement of production models will be initiated. With receipt of the steam eductors the redesign and fabrication of the vacuum system for in-pile debris removal will be complete, and major development work in support of the aluminum tube replacement program will be terminated.

K Reactor Zirconium Tube Program - Development

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 108-D Building. Two additional machines are being procured offsite, the first designed and fabricated by Pacific Steel Products Company, and the second produced by Union Machine Works. The onsite-fabricated machine and the Pacific Products machine are driven by compressed air; the Union Machine Works design utilizes hydraulic power.

Self-Supported Fuel

Two 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 break-away discharge forces were 1600 and 2400 pounds.

Other Fuel Programs

Two columns of alpha-extruded dingot fuel were discharged from B reactor on September 8, 1962 at 950 MWD/T and are undergoing post-irradiation examination.

[redacted]

Other Fuel Programs (Cont'd.)

An I&E normal rupture occurred in one of the eighteen-column test tubes (PT-IP-490-A) on September 23, 1962 in 3680-C. These tubes contain Hanford Hot Press, Sylcor Hot Press, and Hanford AlSi bonded fuel. This particular rupture was a Hanford press and in a tube with an average exposure of 567 MWD/T, operating at 1265 KW. The rupture was a side failure not associated with a hot spot or end cap.

Zircaloy-2 Process Tubes - K Reactors

A visit to Wolverine Tube Company to review the status of the fabrication of the 5200 Zircaloy-2 process tubes showed that Wolverine has material in process to fabricate over 500 tubes. The material is in the form of extrusion billets, clad and unclad extrusion blooms, and first and second step reductions. The inspection facilities are being installed and are expected to be ready by October 1, 1962.

Hazard Summary Reports

Comment issues of Volume III of the hazard summary reports for existing reactors were issued during the month by FEO. Work continues on Volumes I and II.

The rough draft of Volume II, Appendices, of the N Reactor Hazard Review is being revised for preparation of the final draft.

REACTOR MODIFICATION PROGRAM

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 (light scratches and shiny areas) to the tubes and the tubes were recharged with fuel.

Overbore Fuel Development

Three overbore elements failed during August and September, one at 640 MWD/T in 3162-C on August 29, 1962 of transverse fracture; another occurred at 700 MWD/T in 1494-C on September 9, 1962 of corrosion attack. A large number of

[redacted]

Overbore Fuel Development (Cont'd.)

damaged supports were noted on the fuel discharged from 1494-C. The third rupture occurred nine hours after startup following the second rupture outage in 2969-C. The average tube exposure here was 660 MWD/T, and the failure was classified as split end. This element and the first mentioned were from a lot declared rupture prone. Twenty-seven tubes of overbored fuel were discharged and recharged with fresh fuel in September.

NEW PRODUCTION REACTOR

KER Testing

KER-3 - Eleven N-reactor prototype fuel elements were discharged on September 6, 1962 at an exposure of 695 MWD/T. Seventy-five per cent of the exposure was in cold water, and the information from the test is of little value. KER-3 will not be recharged until two pumps are available to support loop operation at temperature.

KER-4 - The fourteen N-reactor prototype fuel elements charged into KER-4 on April 26, 1962 were discharged during the September 25, 1962 outage at an estimated exposure of 1240 MWD/T.

Test Irradiation of NPR Graphite

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

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.). Emergency conditions studied included stack flooding in conjunction with cold water injection and power excursions caused by withdrawing the horizontal rods at the maximum possible rates. It has been concluded, at least for Phase I and II operation, that the ball hopper discharge rates are adequate.

OUTAGES (Year) (9/62)

Reason	B	C	D	DR	F	H	KE	KW	Total
Charge-Discharge	46.8	53.9	56.7	35.0	19.1	42.5	54.9	40.5	349.4
Maintenance	24.2	18.1	126.4	80.9	31.1	62.5	21.8	41.3	406.3
Rupture Removal	16.8			24.5		23.6			64.9
Water Leak Testing	27.5	49.4	95.0	37.2		20.5			229.6
Tube Replacement	9.2	11.7	230.6		2.1	152.1	10.8	21.0	437.5
Project Work			.8					11.6	12.4
Production Tests	6.4	68.5	10.0	1.0		9.2	34.0	1.8	130.9
Standard Check Instrument & Circuitry	4.0	1.7	4.4				2.8		12.9
Rupture Suspects									
Miscellaneous	1.2	0.5	25.5			68.2	11.7	1.2	108.3
Total	136.1	203.8	549.4	178.6	52.3	378.6	136.0	117.4	1752.2
Scheduled Outages									
Unscheduled Outages									

RUPTURED SLUG TABULATION FOR SEPTEMBER, 1962

Tube No.	Date Charged	Date Ruptured	Tube Power (KW)	Concentration MWD/Ton	Assigned Production Loss		Observations
					MWD	Days	
1494 C	1-16-62	9-3-62	1201	710	1428	.74	I&E-N - Side Other Oversize 6000 psi Dingot
1175 B	6-13-62	9-5-62	1157	588	490	.30	I&E-N - Hot Spot
2969 C	4-5-62	9-6-62	1265	661	789	.41	I&E-N - Split Oversize 11000 psi
2068 B	7-8-62	9-8-62	1018	385	905	.55	I&E-NB - Hot Spot Leaker
2890 H	5-12-62	9-13-62	982	685	1791	1.15	I&E-NB - Side Other Leaker
2989 DR	9-10-62	9-16-62	1038	45	1457	.92	I&E-EB - Mechanical Damage 10,000 psi
3680 C	5-25-62	9-23-62	1262	567	578	.30	I&E-N - Side Other 7000 psi
3086 DR	7-16-62	9-28-62	1037	698	356	.23	I&E-E Hole IP-216-A
3768 B	7-8-62	9-29-62	1183	810	67	.04	I&E-E - Side Other

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

TO : Files

DATE: November 9, 1962

FROM : R. L. Plum, Chief
Reactor Operations Branch

THIS DOCUMENT CONSISTS OF 12 PAGES
[redacted] ES. SERIE[redacted]

SUBJECT: MONTHLY REPORT - OCTOBER, 1962

HAN-80948
Report #10

OR:GTO-RGR

OPERATING EXPERIENCE

Production

Reactor input production (MWD) was 0.7% below forecast; 12.7% below at the six old reactors and 14.6% above at the K's. The KE reactor achieved a new production record, exceeding the previous K reactor maximum by 5.6%.

Efficiency

Over-all time operated efficiency was 65.8% (71.1% forecast); 61.9% at the six old reactors and 77.6% at the K's. Efficiency was low at the old reactors due to fuel element failures and process tube water leaks.

Power Levels

There was no increase in reactor power levels.

Fuel Element Ruptures

Thirteen ruptured fuel elements, seven I&E enriched and six I&E natural, were removed from the reactors. Three of the enriched ruptures were at C, two at DR, one at [redacted] and one at KW. Three of the natural metal ruptures were at D, two at C and one at F.

Reactor Power Level Limitations

During the month the primary limitation to power levels for all reactors except H has been bulk outlet temperature limits. H reactor was on a graphite temperature limit.

MAINTENANCE AND EQUIPMENT EXPERIENCE

Tube Replacement

In the tube replacement program 784 tubes were replaced - 203 at B, 165 at DR, 317 at H, and 99 at KW - for a year-to-date total of 5655.

Water Leaks

Six tube leaks and 15 Van Stone leaks were corrected. Three of the tube leaks were at B, and one each at DR, F and H. Five of the Van Stone leaks were at B, 5 at D, 2 at DR and one each at C, F and H.

REACTOR OUTAGES

Date Down	Date Up	Outage Hours	Remarks
B Reactor			
9/29	10/1	60.2	Removal of an I&E E-metal rupture from tube 3768 (reported last month).
10/10	10/11	29.0	Removal of an I&E E-metal rupture from tube 3063.
10/12	10/12	0.6	Tripped while flushing a ball valve tube.
10/17	10/19	43.0	Leak testing and tube removal.
10/24	10/25	29.1	Panellit trip due to leak in tube 1686; tube removed.
10/26	Still down		Scheduled tube replacement.
C Reactor			
10/5	10/7	35.5	Removal of an I&E E-metal rupture from tube 2970.
10/8	10/10	39.1	Leak testing and tube removal.
10/13	10/14	40.3	Removal of an I&E E-metal rupture from tube 2879.

C Reactor (Cont'd.)

10/18	10/20	28.6	Removal of an I&E natural metal rupture from tube 3677. Charge-discharge.
10/20	10/20	1.4	Three unexplained Panellit trips.
10/20	10/21	10.5	Removal of an I&E E-metal rupture from tube 3857.
10/21	10/21	2.1	Removal of an I&E E-metal rupture from tube 3856. (Rupture not confirmed)
10/27	10/29	79.3	Removal of an I&E natural metal rupture from tube 3959.

D Reactor

9/29	10/1	55.5	Leak testing and tube replacement.
10/2	10/2	0.5	Repair faulty ball valve.
10/4	10/6	57.0	Leak testing.
10/7	10/7	0.1	Tripped due to a faulty spline cap seal.
10/15	10/17	40.6	Removal of an I&E natural metal rupture from tube 2166. Leak testing and tube replacement.
10/19	10/21	38.5	Removal of an I&E natural metal rupture from tube 3284. Charge-discharge and leak testing.
10/22	10/23	34.5	Tripped when the No. 9 HCR brake solenoid failed. Charge-discharge and miscellaneous maintenance.
10/23	10/23	0.4	Unexplained Panellit trip.
10/27	10/29	70.2	Removal of an I&E natural metal rupture from tube 3180. Charge-discharge, leak testing and tube replacement.
10/29	10/29	0.8	Tripped by the power failure relay when No. 1 motor lost synchronization.

[redacted]

D Reactor (Cont'd.)

10/29	10/30	8.2	Tripped by the power failure relay.
10/30	10/30	0.6	Unexplained Panellit trip.

DR Reactor

10/2	10/4	38.4	Removal of an I&E E-metal rupture from tube 3885.
10/4	10/4	2.3	Unexplained Panellit trip.
10/7	10/9	39.2	Removal of an I&E E-metal rupture from tube 3967.
10/12	10/24	293.7	Scheduled tube replacement and charge-discharge; 166 tubes replaced.
10/24	10/24	0.5	Unexplained Panellit trip.
10/26	10/26	0.2	Unexplained Panellit trip.
10/26	10/27	30.4	Manual trip due to temperature and pressure variation on tube 2663.
10/29	10/30	39.2	Leak testing and tube replacement.

F Reactor

10/1	10/4	88.5	Scheduled charge-discharge, tube replacement and miscellaneous maintenance.
10/8	10/9	34.4	Correction of a rear-face water leak.
10/24	10/25	38.0	Removal of an I&E natural metal rupture from tube 1677.
10/30	Still down		Water leak.

H Reactor

9/19	10/14	593.5	Replacement of 514 tubes.
10/26	10/27	38.6	Leak testing.

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KE Reactor

10/30	Still down	Tripped by a momentary loss of flow on a KER single pass tube while switching water supply. Charge-discharge and miscellaneous maintenance.

KW Reactor

10/12	10/13	44.5	Removal of an I&E E-metal rupture from tube 2260.
10/14	10/14	1.7	Unexplained Panellit trip.
10/19	10/29	244.7	Replacement of 99 tubes.
10/29	10/29	0.6	Unexplained Panellit trip.

RESEARCH AND DEVELOPMENT - EXISTING REACTORS

Self-Supported Fuel

The new charging machine was used to discharge two tubes of KVNS fuel from KW reactor during the October 20 outage. Some minor difficulties were experienced with the machine, one tube being machine discharged, the other tube was partially machine discharged and the remainder discharged with the ram seater. The green fuel from the first tube was discharged and examined. Preliminary examination showed a slight rail height reduction and minor body scratches. This tube was then recharged by hand.

Other Fuel Programs

Examination of the final monitor columns of the alpha extruded dingot uranium irradiation test discharged from B reactor was completed in the 105-C Metal Examination Facility. Detailed results should be completed in November.

Eighteen columns of Sylcor Hot Press, Hanford Hot Press, and Hanford AlSi canned fuel charged on 5/22/62 were discharged from C reactor during the report period after two failures of the Hanford Hot Press material. The first failure in tube 3680-C occurred on 9/23/62 at an exposure of 522 MWD/T. The second failure occurred in 3677-C on 10/18/62 at 650 MWD/T. The remaining material discharged averaged 640 MWD/T exposure. The first rupture occurred from two separate dime-size penetrations

Other Fuel Programs (Cont'd.)

under the self-support rails, causing no appreciable swelling of the element. The ruptured area of the second element was larger, and the mode of failure was not determined. Radiometallurgical examination of the first failure will take place as soon as the radioactivity level permits.

Dummy Patterns - K Reactor Zircaloy-2 Tubes

Flow tests have been conducted to determine optimum rear dummy train patterns for self-supported fuel columns in the K reactors. The conclusions of these tests are:

1) Self-supported perforated dummies will be necessary to prevent flow and pressure fluctuations.

2) The maximum flow rate is obtained when all dummies are self-supported. A 0.5 gpm flow loss is sustained at normal process tube operating conditions when non-supported expendables and tubular dummies are used, as compared to fuel and dummy charges in which all pieces are self-supported.

Uranium Recycle

By September 30 essentially 100% of the enriched fuel in the reactors was recycled material. The lowest percentage was 92% in H reactor.

Control Rod Strengths - Perturbation Effects

The control strength of individual vertical safety rods in the present Hanford reactors was calculated with one-group buckling theory for two cases. One assumed a normal undisturbed flux with a maximum conceivable strength of control rod, and the second assumed a perturbed flux. The results follow:

Maximum Individual Rod Strengths

Reactor	Normal Case (mk)	Perturbed Case (mk)
Old	1.7	2.5
C	2.0	3.5
K	2.0	4.5

Files

November 9, 1962

Effluent Activity Data

The table below shows average reported concentrations of selected radionuclides from reactor effluent samples taken during September, 1962. Units are 10^{-12} curies/ml.

Reactor	P-32	As-76	Zn-65	Np-239	Cr-51
B	9.5	55	No Valid Samples		
C	6.7	71	20	100	300
D	3.4	36	No Valid Samples		
DR	2.6	51	12	97	340
F	6.8	36	62	110	950
H	5.7	62	10	210	450
KE	12.4	41	77	110	820
KW	8.2	31	11	53	430

All reactor water plants operated at a nominal alum feed rate of 18 ppm. In view of increasingly positive zeta potential on raw water floc at KW with the previous alum feed of 20 ppm, a reduction to 18 ppm was tried on a test basis. KW effluent P^{32} and As^{76} concentrations decreased for the month as compared to August, and the ratio of P^{32} concentration in KW effluent to the average P^{32} concentration for the six older reactors decreased from 1.7 to 1.35. Both B and KE reactors continued to have occasional weeks of high P^{32} release.

Graphite Distortion

A simultaneous drop of a C-reactor size vertical safety rod and 3X Safety System balls in a polycrystalline graphite lined vertical safety rod channel was performed out of pile. The impact damage to the graphite liner was within acceptable limits. The order for prototype quantities of silicon carbide liner sleeves has been cancelled due to the vendor's inability to fabricate these sleeves within the specified tolerances. Twenty-eight aluminum oxide sleeves for test purposes have been successfully fabricated by another vendor.

[redacted]

Graphite Distortion (Cont'd.)

Initial testing was completed of a vertical boring machine designed to enlarge side cast iron thermal shield openings for insertion of channel sleeves. Several mechanical deficiencies as well as excessive chattering of the cutter in the thermal shield were observed. Redesign and fabrication of the new cutter drive shaft and cutters of improved materials and configuration are progressing. Additional testing will be conducted in the 195-D mockup when fabrication is completed. Testing of the alternate approach, helical milling cutters, has resulted in development of a new chain-type cutter design to replace helical cutters.

Fabrication, laboratory testing and on-reactor testing of boring bars, designed to relieve the distortion of the K reactor process tube channels has been completed. Test results, while generally satisfactory, indicate that the following two approaches to improve performance should be investigated: 1) a six-foot, tapered bar and 2) a carbide material having a higher modulus of elasticity than steel. Drive units and vacuum system performance were satisfactory. Minor changes to the vacuum system filter arrangement will be required.

Rear-Face Crossunder Lines

Hydraulic model testing of the crossunder piping systems, recently installed at several of the reactors by project CGI-884, and the associated rear risers has been completed. Operating experience had previously indicated that higher than anticipated rear-riser water levels are required to obtain the desired flow. The model test results indicated that this problem is caused by air entrainment in the water column falling down the rear riser and that no feasible corrective action can be undertaken. However, present operating characteristics of the system are satisfactory and full beneficial use of the project has been achieved.

Xenon Override

The xenon-override core at B reactor was utilized to reduce minimum down time by about six hours on October 10. A check of instrument sensitivities indicated that the sensitivities of low level instrumentation during this override startup were adequate.

REACTOR MODIFICATION PROGRAM

Zircaloy-2 Process Tubes - K Reactors

Wolverine Tube Company has encountered some difficulty in the final tube reducing step in the production of K-size zircaloy process tubes. Four tubes have been accepted by GE inspectors at the vendor's plant, and 30 additional tubes are awaiting inspection.

Overbore Fuel Development

Ten columns of overbore fuel were discharged and recharged during the 9/23/62 outage. Discharge was accomplished with the regular "C" size charging machine and a ram seater adapted to the larger tubes. All charging was done by hand. During the 10/5/62 outage four additional overbore tubes were discharged and recharged using the same techniques.

The goal exposure of the overbore tubes charged with dingot uranium has been reduced from 800 MWD/T to 600 MWD/T. At the present time all overbore tubes are charged with dingot uranium and no ingot overbore cores are expected until December. The overbore facility has been completely recharged since the August 9 outage, and all tube exposures were less than 250 MWD/T on October 20, 1962.

Radiometallurgy examination of "worm track" fuel elements from the April heat-cycle incident at C reactor has revealed the presence of beta-phase uranium, indicative of internal core temperatures over 660° C. Additional examination to determine the actual sequence of reactor events is under way.

NEW PRODUCTION REACTOR

KER Testing

Loops 1 and 2 remain out of service for modification.

Loop 3 is empty and will not be recharged until repairs can be made to the canned rotor pumps.

The 14 NAE1 elements charged into KER-4 on 4/26/62 were discharged on 9/25/62 at an average exposure of 1250 MWD/T. The fuel elements are currently being examined and measured in the 105-KE viewing basin.

[redacted]

KER Testing (Cont'd.)

Loop 4 was recharged with 14 NAE1 elements on 9/26/62, with a target exposure of 1½ times N-Reactor goal, or about 2100 MWD/T average tube exposure. This exposure should be attained about May, 1963. The charge as of 10/20/62 had reached an exposure of 215 MWD/T.

NPR Graphite Test Irradiation

Irradiation of the fourth and fifth capsules in the program of irradiation of NPR graphite in the GETR was interrupted on October 8 by a reactor outage which is still continuing.

NPR Flow Distribution

Coolant temperature distributions for the nominal NPR fuel and tube geometry have been measured with thermocouple probe trains in KER-3. These preliminary data indicate the following relationship between the maximum coolant temperature rise in each coolant channel and the bulk coolant temperature rise:

Channel	Ratio $\Delta T_{max}/\Delta T_{Bulk}$
Outer	1.15
Center	1.05
Hole	1.20

The ratio in the outer channel results from the eccentric placement of fuel elements in the tube due to needed tolerances of support height. The fuel element hole channel is purposely undercooled to provide flow to the outer channel.

OUTAGES (Year) (10/62)

Reason	B	C	D	DR	F	H	KE	KW	Total
Charge-Discharge	19.5	26.9	33.7	116.6	57.9	31.1	15.5	59.5	360.7
Maintenance	50.0	19.0	94.3	58.8	63.9	64.6	5.2	16.7	372.5
Rupture Removal	12.3	127.1	3.7		4.3			3.4	150.8
Leak Testing	32.9	32.0	100.4	62.2	23.0	14.9			265.4
Tube Replacement	100.5	8.8		159.7	36.9	247.5	5.2	156.2	714.8
Project Work	3.6			17.9				9.5	31.0
Production Tests	7.7	21.4	3.5	11.7	1.3		15.1	15.4	76.1
Standard Check Instrument & Circuitry	2.1		1.6				0.1	2.7	6.5
Rupture Suspects									
Miscellaneous	13.8	1.5	2.5	11.5				28.1	57.4
Scheduled Outages TOTAL	242.4	236.7	239.7	438.4	187.3	358.1	41.1	291.5	2035.2
Unscheduled Outages									

RUPTURED SLUG TABULATION FOR OCTOBER, 1962

Tube No.	Date Charged	Date Ruptured	Tube Power (KW)	Concentration MWD/Ton	Assigned Production Loss		Observations
					MWD	Days	
3885-DR	6-9-62	10-2-62	1016	874	297	.20	I&E-E B unclassified
2970-C	8-9-62	10-5-62	1117	316	3397	1.81	I&E-E side other
3967-DR	7-16-62	10-7-62	1056	791	351	.24	I&E-E B hole
3063-B	7-8-62	10-10-62	1181	858	965	.57	I&E-E B side other
2260-KW	9-17-62	10-12-62	1687	268	691	.17	I&E-E hot spot
2879-C	8-9-62	10-13-62	1364	413	3606	1.92	I&E-E side other
2166-D	5-27-62	10-15-62	1169	877	133	.08	I&E-N B hole
3677-C	5-25-62	10-18-62	1319	656	362	.19	I&E-N side other
3284-D	5-27-62	10-19-62	1182	868	76	.05	I&E-N B hole
3857-C	7-19-62	10-20-62	1257	659	1929	1.03	I&E-E unclassified
1677-F	8-24-62	10-24-62	1018	416	376	.22	I&E-N hot spot
3959-C	8-9-62	10-27-62	1209	404	3794	2.02	I&E-N unclassified
3180-D	6-18-62	10-27-62	1172	779	70	.04	I&E-N B hole

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

[redacted]

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TO : Files

DATE: December 11, 1962

FROM : R. L. Plum, Chief
Reactor Operations Branch

THIS DOCUMENT CONSISTS OF 2 PAGES
NO. [redacted] SERIES [redacted]

SUBJECT: MONTHLY REPORT - NOVEMBER, 1962

HAN-80948
Report #11

OR:GTO-RGR

OPERATING EXPERIENCE

Production

Reactor input production (MWD) was 4.4% below forecast; 1.2% below at the six old reactors and 8.5% below at the K's.

Efficiency

Over-all time operated efficiency was 69.4% (70.8% forecast); 70.6% at the six old reactors and 65.6% at the K's. Efficiency was low at the K's due to a two-week outage for tube replacement instead of one week as forecast.

Power Levels

There was no increase in reactor power levels. However, both K reactors reached their administrative limits of 4400 megawatts.

Ruptures

Ten ruptured fuel elements, six I&E natural and four I&E enriched, were removed from the reactors. Two of the natural metal ruptures were at D (bumpered), two at F, one at C, and one at KW. Two enriched failures were at C, one at DR (bumpered) and one at F.

Reactor Power Level Limitations

During this report period, the primary limitations to reactor power levels for all reactors except the K reactors have been bulk outlet temperature limits. Power levels at the K reactors are currently restricted administratively.

[redacted]
GROUP 1
EXCLUDED FROM AUTOMATIC DOWNGRADING

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MAINTENANCE AND EQUIPMENT EXPERIENCE

Tube Replacement

During the calendar year to date 6264 tubes have been replaced. There were 564 tubes replaced during November; 215 at B, 6 at D, 5 at DR, 4 at F, 156 at H, and 178 at KE.

Water Leaks

There seven tube and four Van Stone leaks. Three of the tube leaks were B, two at D, one at F, and one at H. Two Van Stone leaks were at D, one at B, and one at F.

REACTOR OUTAGES

Date Down	Date Up	Outage Hours	Remarks
B Reactor			
10/26	11/14	447.3	Replacement of 417 tubes.
11/14	11/14	3.7	Thermocouple repair.
11/20	11/21	28.6	Water leak. Tube replacement.
11/21	11/21	4.4	Correct front pigtail leak.
11/26	11/28	47.4	Leak testing.
11/28	11/29	12.9	Panellit trip due to a faulty rear pigtail on tube 1272.
C Reactor			
11/4	11/5	39.2	Removal of an IXE L-metal rupture from tube 1363. Charge-discharge.
11/6	11/6	0.8	Panellit trip.
11/6	11/6	1.5	Replaced the rear nozzle adapter on tube 3966 which was causing a rear-face leak.
11/14	11/17	96.0	Removal of an IXE natural metal rupture from tube 1282.

C Reactor (continued)

11/26	11/27	34.2	Removal of an I&E E-metal rupture from tube 1458. Tube removed and channel blanked.
11/29	Still down		Scheduled tube replacement.

D Reactor

11/2	11/3	35.0	Removal of an I&E natural metal rupture from tube 3266.
11/9	11/11	39.8	Leak testing and tube replacement.
11/11	11/11	0.6	Manual trip due to a short in "A" hole which gave a false period.
11/12	11/14	47.0	Water leak. Leak testing.
11/19	11/21	49.9	Water leak. Leak testing.
11/27	11/28	37.4	Removal of an I&E natural metal rupture from tube 2777. Leak testing and charge-discharge.

DR Reactor

11/13	11/15	36.0	Removal of an I&E E-metal rupture from tube 1375.
11/15	11/15	1.9	Correct front cap leak on tube 2565.
11/17	11/18	34.5	Panellit trip.
11/28	11/30	36.5	Panellit trip due to a faulty sensing line on 1164.
11/30	11/30	0.3	Tripped when wrong toggle valve was opened while checking gauge response time.

F Reactor

10/30	11/1	39.0	Leak testing.

[redacted]

F Reactor (continued)

11/3	11/5	49.7	Removal of an I&E E-metal rupture from tube 4167.
11/14	11/16	41.1	Removal of an I&E natural metal rupture from tube 1364.
11/22	11/25	66.3	Removal of an I&E natural metal rupture from tube 3867. Charge-discharge.
11/25	11/25	1.7	Repair broken sample line on crossheader 9½.

H Reactor

11/17	11/19	38.7	Water leak. Leak testing.
11/21	11/21	0.3	Tripped due to a rear pigtail failure.
11/25	Still down		Scheduled tube replacement.

KE Reactor

10/30	11/2	70.1	Concluded charge-discharge and maintenance following a trip.
11/9	11/23	367.4	Scheduled tube replacement.
11/27	11/29	38.9	Investigate high temperature on tube 0570.
11/29	11/29	0.3	Replace a front leaking pigtail on tube 0950.
11/29	11/29	0.8	Low pressure trip on single pass tube 1456 while making a flow adjustment.
11/30	11/30	0.5	Tripped by loop 4 while making manual adjustments.
11/30	Still down		Manual trip for temperature control.

KW Reactor

11/11	11/13	37.1	Removal of an I&E natural metal rupture from tube 3648.
11/14	11/16	36.3	Investigation of partial flow restriction in bottom thermal shield coolant piping.

Files

December 11, 1962

RESEARCH AND DEVELOPMENT - EXISTING REACTORS

Rear-Face Crossheader Examination

The planned program of nondestructive testing and inspection of the rear-face crossheader removed from DR reactor has been completed. The preparation of a final report on this inspection program is under way. Additional destructive and nondestructive inspection of the crossheader did not indicate any results significantly different from those previously reported. Although relatively severe stress corrosion cracking was found to be present in both the crossheader and crossheader fittings, it was not possible to establish a finite life expectancy on the crossheader at this time. No evidence of rapid deterioration of the crossheader is apparent.

105-K Zirconium Retubing Program Design

An additional five sets of gunbarrel flange retaining ring grooves have been enlarged on both the front and rear face of the KE reactor and Inconel X snap rings installed. The prototype gunbarrel grooving tool continued to function satisfactorily during the week. A decision has been made to utilize Inconel X as the standard material for all of the new retaining rings which will be installed on this program. This material was selected in preference to other materials which were evaluated due to its stress corrosion resistance and availability. The final group of 12 prototype impact extruded inlet nozzles has been received and found to be acceptable. The receipt of this additional quantity of nozzles has completed the nozzle development program and provided a basis for the fabrication of the total nozzle order. The installation specification for the retubing program has been completed and is being routed for final approval.

105-K Reactor Zirconium Tube Program - Development

On November 19, 1962, eight channels at 105-K reactor were reconditioned using a six-foot long, double tapered boring bar. Improved surface finish and increased depth of cut were accomplished but development for greater graphite removal at the most severely distorted junctions will continue. Inquiries have been made to off-site vendors for fabrication of boring bars of higher modulus material. Investigations are under way to develop a new technique of graphite removal or to reduce forces applied to the graphite during drilling operation. Contracts have been initiated with several firms requesting proposals for alternate methods. Concurrently,

105-K Reactor Zirconium Tube Program - Development (cont'd.)

concepts to stabilize the boring bar with expanding pilots are being investigated.

Fabrication of subassemblies for the four drilling machines has been completed. Final assembly has been initiated and is scheduled for completion during December.

K Reactor Retubing With Zircaloy-2 Process Tubes Procurement Status

Wolverine Tube Company shipped 40 tubes, plus five experimental tubes for mockup testing, and 400 nozzle inserts as of November 16, 1962. The primary delay in finishing tube delivery has been due to boroscoping. Progress on the 5200-tube order is about one month behind schedule.

Graphite Distortion

Testing of the redesigned joints in a flexible B-sized VSR has been completed. These tests indicated that the new joint design possesses strength characteristics equal to the existing design, yet provides a greater degree of rod flexibility. This rod will be installed in the C reactor on a test basis in conjunction with the planned installation of polycrystalline graphite VSR channel liners. The modification and testing of equipment for VSR channel enlargement continues at an accelerated pace to permit on-reactor testing at C reactor during the scheduled December outage. Model II chain-drive reamer has been equipped with limited-depth cutters and tested successfully in the mockup. The fabrication of a full set of cutters is under way. The VSR channel thermal shield boring machine is being modified to reduce cutter chatter and increase drive shaft torque capacity.

Calculations indicate that the buildup of gas, in the B_4C-filled felxible B-sized VSR's, to be installed in C reactor, will not be a problem.

Rear Crossheader Expansion Joints - H Reactor

Agreement has been reached regarding a change in the type of crossheader expansion joint to be installed on the rear face of H reactor. The prototype expansion joints now installed are of the Dresser coupling type utilizing asbestos gasket material

Rear Crossheader Expansion Joints - H Reactor (cont'd.)

as a water seal. Service experience to date with these prototypes has indicated that under current rear-face operating conditions, this type of expansion joint is unsatisfactory due to leakage. The full reactor installation will be revised to provide for the installation of a conventional metallic corrugated bellows. Design is proceeding on this revised basis.

Self-Supported Fuel Element Charging

Modification to the HAPO-designed charging machine resulting from the on-reactor testing of October 20, 1962 has been completed. Testing of the modified machine and of alternate adapter prototypes is in progress in the laboratory. Additional on-reactor tests will be conducted as reactor shutdowns occur.

Self-Support Fuel

The two columns of KVNS fuel in KW reactor, charged on October 20, have reached an average exposure of 180 MWD/T. These columns are to be discharged short of goal (in early December) in a test of the new charging machine.

Miscellaneous Fuels

A ruptured I&E natural bumper fuel element from tube 2593-D (8/27/62), classified as a hole failure, was examined. The cause of the failure was found to be a penetration of the spire wall by groove pitting (long, cigar shaped eroded areas). Four additional hole failures are currently being examined for cause of rupture.

Control Efficiency Studies

Reactivity evaluations for a small I-H demonstration loading for a H reactor indicate that the correct reactivity level can be easily achieved with five different column-pattern staggering arrangements. The main planning problems for such a test, aside from installation of zirconium tubes in the appropriate block, will be concerned with procurement, fabrication, and testing of the special fuel and target elements.

Approximately 20 "gray" splines are expected to arrive on plant shortly and to be available for production testing. These splines, for use in fine distribution control at equilibrium,

[redacted]

Control Efficiency Studies (cont'd.)

were fabricated by the normal sintering technique but with varying concentrations of boron. Another approach has been followed by a second vendor, namely to keep the boron concentration the same but to change spline blackness by varying the thicknesses of aluminum cladding and of the enclosed poison layer. Calculations were performed to estimate the relative dose rates from different cladding alloys proposed. The 6063 alloy has been specified as a cladding, based on indications that it would cause dose rates only a factor of two greater than normal and is desirable from the fabrication standpoint. Should this alloy cause unforeseen radiation problems, a return to the 1100 alloy as a cladding material might be required.

Instability Limits for Smooth-Bore Process Tubes

Heat transfer data obtained with a C-overbore process tube mockup in the laboratory indicate that current instability limits, as specified in the Process Standards, do not apply exactly to self-supported fuel elements, smooth-bore process tubes, and modified fittings. Additional data will be obtained with the K zircaloy-2 process tube geometry by May, 1963. In the interim, limits based upon the C-overbore tests will be specified for all smooth-bore process tubes.

Uranium Recycle

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

	Per Cent of Recycled Fuel In Enriched Fuel							
	B	C	D	DR	F	H	[illegible]	[illegible]
October 31 Status	99	100	100	99	99	96	100	100
October Discharge	91	100	100	97	94	93	none	100

[redacted]

Files

December 11, 1962

Effluent Activity Data

The table below shows average reported concentrations of selected radionuclides from reactor effluent samples taken during October, 1962. All units are 10^{-12} curies/ml.:

Reactor	P^{32}	As^{76}	Zn^{65}	Np^{239}	Cr^{51}
B	5.0	57	89	130	920
C	8.5	74	16	200	660
D	4.0	53	16	73	250
DR	2.2	56	26	99	340
F	9.1	40	No Valid Sample		
H	4.1	35	10	48	220
KE	8.4	39	22	70	450
KW	7.3	34	8	62	370

All reactor water plants remained at a nominal alum feed rate of 18 ppm.

Seismoscope Review

Several actions are being taken or planned to implement recommendations from a recent review of the seismoscope systems. Process Standards are being revised to omit the option of bypassing the LX trip from the seismoscope when the reactor power level is under two MW; all three pendulums at each reactor are to be set to trip at the 115 level and connected in a two-out-of-three coincidence logic; the annunciation feature of the power-failure relay will be restored at those reactors where it has been removed and investigations have been started to determine the possibility of removing some of the non-fail-safe features of the seismoscope; for example, a flexible connecting wire around the piano wire suspension for the pendulum will probably be provided.

[redacted]

REACTOR MODIFICATION PROGRAM

Overbore Fuel Development

Three columns of overbore fuel were discharged prior to goal to permit visual inspection of the fuel elements. The inspection was made to check for indications of incipient fuel failures, but none were found.

C-Overbore Conversion Ratio Measurements

Eight tubes in the center of the 44-tube block in C reactor have been selected for conversion ratio studies. Two loadings of fuel from the region have been discharged at exposures of 800 MWD/T and 400 MWD/T and a third loading is currently being irradiated to 800 MWD/T also.

Dissolution and analysis will not be done until all remaining E-N dissolution and analyses currently under way are completed.

[redacted]

(Year)
OUTAGES (1962) November

Reason	B	C	D	DR	F	H	KE	KW	Total
Charge-Discharge	43.9	40.9	33.1	47.3	44.1	30.9	62.0	6.2	308.4
Maintenance	139.4	38.4	57.6	20.7	40.0	5.2	58.5	16.1	375.9
Rupture Removal		76.3	4.1	1.5	37.1			12.8	131.8
Leak Testing	36.0		61.5	11.9	22.7	9.2			141.3
Tube Replacement	189.4	18.6	8.8	17.8	15.8	126.4	219.2	8.9	604.9
Project Work							11.8		11.8
Production Tests	2.9	10.1	35.5	1.1	0.7	4.2	42.1	1.1	97.7
Standard Check Instrument & Circuitry	0.5			9.2			5.0	28.8	43.5
Rupture Suspects									
Miscellaneous	4.7	3.4		0.4	10.9	6.2	22.3		47.9
Total	416.8	187.7	200.6	109.9	171.3	182.1	420.9	73.9	1763.2
Scheduled Outages									
Unscheduled Outages									

[redacted]

RUPTURED SLUG TABULATION FOR NOVEMBER 1962

[redacted]

Tube No.	Date Charged	Date Ruptured	Tube Power (KW)	Concentration MWD/Ton	Assigned Production Loss		Observations		
					MWD	Days			
3266 D	6/14/62	11/2/62	1153	786	146	.09	I&E N B	OIIINB	Hole
4167 F	8/24/62	11/3/62	998	593	2915	1.72	I&E E	OIIIE	Side Other
1888 C	8/9/62	11/4/62	1373	605	436	.22	I&E E	CIIIE	Hot Spot
3648 KW	9/17/62	11/11/62	1662	416	2559	.60	I&E N	KIVN	Hot Spot
1675 DR	7/16/62	11/13/62	1137	950	124	.07	I&E E B	OIIIEB	Hole
1364 F	8/24/62	11/14/62	1241	539	69	.04	I&E N	OIIIN	Side Other
1282 C	8/9/62	11/14/62	1296	523	4860	2.43	I&E N	CIII	Water Mixer Unclassified
3867 F	8/24/62	11/22/62	1085	591	78	.05	I&E N	OIIIN	Side Other
1458 C	8/9/62	11/26/62	1262	778	2178	1.09	I&E E	CIIIE	Hot Spot
2777 D	7/10/62	11/27/62	1214	783	185	.11	I&E NB	OIIINB	Hole

UNCLASSIFIED

[redacted]

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

[redacted]

TO : Files

DATE: January 10, 1963

FROM : R. L. Plum, Chief
Reactor Operations Branch

[redacted] THIS DOCUMENT CONSISTS OF [redacted] PAGES
[redacted] COPI[redacted]

SUBJECT: MONTHLY REPORT - DECEMBER, 1962

HAN-80948
Report #12

OR:GTO-RGR

OPERATING EXPERIENCE

Production

Reactor input production (MWD) was 2.2% above forecast; 12.1% below at the six old reactors and 24.3% above at the K's.

Efficiency

Over-all time operated efficiency was 73.8% (73.1% forecast); 71.8% at the six old reactors and 80.0% at the K's. Low efficiency at the six old reactors and high efficiency at the K's resulted from the deferment of a K tube outage and utilization of the time for maintenance and tube replacement work at C reactor.

Power Levels

There was no increase in reactor record power levels. However, both K reactors operated at their administrative limits of 4400 megawatts.

Ruptures

Eight ruptured fuel elements, five I&E natural and three I&E enriched, were removed from the reactors. Three of the natural metal ruptures were at D and two at B. Two enriched failures were at F and one at D. The three enriched failures and three of the natural metal failures were bumpered material.

[redacted] GROUP 1
[redacted] AND DECLASSIFICATION

DECLASSIF[redacted]
[redacted]
[redacted] Atomic Energy Act of 1954, its transmission or the disclosure of its contents in any manner to an unauthorized person is prohibited.

Reactor Power Level Limitations

During the report period the primary limits to reactor power levels for B, C, DR, and F reactors have been tube outlet temperature limits to control tube corrosion. D and H reactor power levels have been limited by bulk outlet temperature. KE and KW reactors are administratively limited.

MAINTENANCE AND EQUIPMENT EXPERIENCE

Tube Replacement

Two hundred and fifty-seven aluminum process tubes were replaced during the month; 251 at C and 6 at D, for a total of 6515 during the year.

Water Leaks

Three tube and three Van Stone leaks were corrected. The tube leaks were at B, C and H. Two of the Van Stone leaks were at D and one at F.

REACTOR OUTAGES

Date Down	Date Up	Outage Hours	Remarks
B Reactor			
12/13	12/16	74.5	Removal of an I&E natural metal rupture from tube 3465. Charge-discharge.
12/23	12/25	35.0	Leak testing. Tube 1077 was removed due to an internal leak. An I&E natural metal rupture was removed from tube 3162.
C Reactor			
11/29	12/28	680.6	Replacement of 251 tubes and maintenance work.
12/28	12/28	11.0	Thermocouple repairs.

Files

January 10, 1963

D Reactor

12/7	12/9	47.2	Removal of an I&E E-metal rupture from tube 1478. Charge-discharge.
12/14	12/15	39.2	Water leaks. Replacement of tubes 2169 and 0673.
12/15	12/15	0.5	Unexplained Panellit trip.
12/22	12/23	38.8	Removal of I&E natural metal ruptures from tubes 1064 and 3265.
12/27	12/29	28.2	Removal of an I&E natural metal rupture from tube 1077.

DR Reactor

12/24	12/24	0.3	Panellit trip when a stub ejected from a spline cap.
12/29	Still down		Scheduled charge-discharge.

F Reactor

12/7	12/10	72.6	Removal of an I&E E-metal rupture from tube 0674 and charge-discharge.
12/30	Still down		Removal of an I&E E-metal rupture from tube 0658 and charge-discharge.

H Reactor

11/25	12/2	171.2	Replacement of 156 tubes.
12/2	12/2	4.3	Correction of a loose rear-face cap.
12/6	12/6	0.3	Correction of a partially engaged front-face cap.
12/6	12/7	29.3	Tripped by low pressure on Loop 1 caused by the unexplained loss of power. Maintenance.
12/8	12/8	0.2	Manual trip due to malfunction of rate of rise instrumentation.

H Reactor (Cont'd.)

12/18	12/19	39.4	Unexplained Panellit trip.
12/22	12/23	30.9	Panellit trip due to a small piece of gasket-like material on the orifice cross wire. Charge-discharge and leak testing.
12/27	12/27	0.1	Panellit trip due to faulty rear pigtail fitting on tube 1864.
12/31	Still down		Water leak.

KE Reactor

11/30	12/1	31.5	Manual trip for temperature control.
12/2	12/2	3.7	Repair leaking flapper cap.
12/2	12/2	0.4	Tripped while making flow adjustment on single pass tube 4355.
12/2	12/2	2.9	Insufficient control rod for turn around.
12/12	12/14	50.5	Inspection of a damaged front-face connector. Charge-discharge.
12/15	12/15	2.2	Unexplained Panellit trip.
12/26	12/30	72.1	Scheduled charge-discharge.
12/30	12/30	1.1	Tripped by Loop 2 due to failure to bypass the No. 1 safety circuit during functional checks.

KW Reactor

12/3	12/6	89.7	Scheduled charge-discharge and maintenance.
12/10	12/12	50.5	Panellit trip caused by leaking Bourdon tube. Miscellaneous maintenance.

Files

January 10, 1963

RESEARCH AND DEVELOPMENT - EXISTING REACTORS

Projection Fuel

The two columns of self-supported KVNS fuel in KW reactor have a currently estimated exposure of 100 MWD/T; 532 elements have been discharged to date from the two zirconium smooth-bore tubes in KW reactor.

Self-Support Fuel Element Charging (SSFE)

On December 3, 1962, fuel elements in two Zircaloy-2 standard size, smooth bore tubes were discharged during an outage at KW reactor. No discharge-recharge difficulties were encountered. The fuel elements in tube No. 2557 were flush discharged with an approximate 200 psi pressure on the nozzle. Fuel elements in tube No. 3065 KW were displacement discharged, utilizing the HAPO-designed SSFE charging machine, with a maximum pushing force of 1200 pounds. Both tubes were irradiated to 40% of goal exposure.

A second charging cycle was performed on both tubes to permit visual examination of the fuel elements. No damage to fuel element bodies or support rails was indicated. Average time for machine-to-nozzle hookup was 60 seconds; time to charge one column was 32 seconds.

On December 27 two KE reactor Zircaloy-2 process tubes were refueled using the HAPO-designed SSFE charging machine. The machine functioned satisfactorily.

Fabrication of the two vendor-designed prototype charging machines is progressing with completion of both scheduled for January, 1963. Two hundred magnesium magazines designed for use with the SSFE charging machine are scheduled for delivery in January, 1963.

Alternate Process Development

The Hanford hot press failure from tube 3680-C is being examined in Radiometallurgy Laboratory. The element had been initially identified as having two failure areas, each under a support rail. Examination revealed four penetrations of the cladding, with each of the four ruptured areas located under a separate support rail.

K Reactor Zirconium Tube Program

Laboratory testing of the six-foot long, double tapered boring bar designed for process channel conditioning has been completed. Detail design of a production boring bar has been completed and procurement action initiated.

Investigation of alternate methods of graphite removal from process channels is continuing, with interest shown by at least three vendors. Proposal evaluation is in progress.

Zircaloy-2 Process Tube Deliveries

Two shipments of Zircaloy-2 process tubes arrived on-site during December for a total of 99 tubes delivered. Wolverine Tube Company has added personnel in order to meet the scheduled deliveries. They expect to return to the schedule by mid-March.

Effluent Activity Data

The table below shows average reported concentrations of selected radionuclides from reactor effluent samples taken during November, 1962. All units are 10^{-12} curies/ml.

Reactor	P^{32}	As^{76}	Zn^{65}	Np^{239}	Cr^{51}
B	1.7	27	57.0	83	450
C	4.8	47	15.0	105	567
D	3.9	56	7.6	184	1900
DR	3.4	60	27.0	119	525
F	6.7	35	21.0	130	1030
H	6.1	52	7.4	54	285
KE	7.5	45	21.0	116	1320
KW	6.6	32	10.0	59	387

All reactor water plants were at a nominal feed rate of 18 ppm.

Files

January 10, 1963

Pile Physics Assistance - B Reactor

The second xenon-override core was discharged this report period and recharged with normal fuel; due to a tube corrosion problem the override core will not be recharged until after the January 23 tube outage.

Graphite Distortion Problems - VSR Design

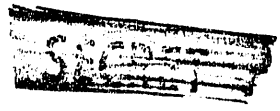
The VSR liner installation at C reactor, planned during the recent extended outage, was deferred due to delays in completion of the VSR channel enlarging tooling. Mockup testing of the cast iron boring equipment has indicated satisfactory performance. Testing has also indicated unsatisfactorily slow graphite cutting rates. New boring machine cutting heads are being fabricated in an attempt to increase tool life and graphite cutting speeds. No date has yet been set for on-reactor testing of this equipment. All flexible "B" size VSR testing and shop work in support of the planned VSR channel liner installation has been completed, with additional testing dependent upon the on-reactor installation of polycrystalline graphite liners. Detailed design drawings have been completed for a flexible "B" size VSR which will be suitable for installation as a standard vertical safety rod in all reactors. The design has been prepared for use in the procurement of replacement VSR's and spare parts.

Flexible Horizontal Control Rods

Shop fabrication of a ten-foot section of the proposed replacement flexible horizontal control rods has been completed. The HCR configuration has been designed to provide sufficient rod flexibility to accommodate current and expected graphite distortion patterns at the K reactors. Fabrication of a mockup for strength testing of this concept is under way. Preparation of specifications for procurement of components for assembly of a full-length rod section has been started. Fabrication of a full-sized rod will be deferred until successful completion of testing of the ten-foot prototype.

Reactor Process Piping Evaluation

A document (HW-75608) describing the planned program for evaluation of the adequacy and safety of the reactor inlet water process piping of the present reactors has been completed. Work is under way as outlined, with current efforts directed toward the detailed definition of proposed piping sampling and inspection locations, as well as the definition in greater detail of the inspection and



Reactor Process Piping Evaluation (Cont'd.)

testing procedures to be followed on each sample obtained. In conjunction with plant maintenance activity, samples have been obtained from several process water storage tanks and piping sections. No evaluation of the samples has yet been performed.

Evaluation of Radioactive Material - Offsite Shipping Casks

A document describing the program which will be followed in an evaluation of the off-site shipping casks currently utilized by IPD has been issued (HW-75744, unclassified). These evaluations will be performed to determine the safety and conformance with the proposed Commission regulations of casks utilized for off-site shipment of radioactive material. A shipping cask design criteria which will be utilized as a basis for this program is being prepared concurrently with the preparation of a hazards evaluation of current off-site radioactive material shipments.

Prototype High Speed Scanner

The system was removed from continuous operation for maintenance and alignment. All input switches were aligned, and first and second rank amplifiers were adjusted to optimize their performance. The system has been returned to continuous operation.

NEW PRODUCTION REACTOR

KER Loop Operation

KER-1 - In-reactor recirculation with dummy fuel elements was terminated November 27 and the dummies discharged. Out-of-reactor recirculation is in progress to evaluate problems associated with the change to ammonium hydroxide for pH control instead of lithium hydroxide.

KER-2 - In-reactor recirculation with dummy fuel elements was terminated November 27 and the dummies were discharged. Eight 17-inch NIE1 fuel elements with modified end closures were charged as authorized by PT IP-536-A, Supplement A. The objective of the test is to evaluate the irradiation behavior of N reactor inner fuel tubes at conditions equivalent to those expected in N reactor.

KER-3 - Remained shut down because of primary pump failures.

KER-4 - Testing of fourteen 23-inch NAE1 fuel elements continued. The objective of the test is to evaluate the irradiation behavior of N reactor fuel elements under conditions equivalent to or more severe than those expected in N reactor.

RUPTURED SLUG TABULATION FOR DECEMBER, 1962

Tube No.	Date Charged	Date Ruptured	Tube Power (KW)	Concentration MWD/Ton	Assigned Production Loss		Observations
					MWD	Days	
1178D	8-27-62	12-7-62	1261	736	92	.05	I&E E B OIIIEB Hole
0674F	8-24-62	12-7-62	1130	910	101	.06	I&E E B OIIIEB Side Other
3465B	9-8-62	12-13-62	1281	591	846	.49	I&E N IP-216-A OIIIN Hot Spot
1064D	7-31-62	12-22-62	1277	831	148	.08	I&E N B OIIINB Hole
3265D	7-31-62	12-22-62	1279	836	148	.08	I&E N B OIIINB Hole
3152B	9-29-62	12-23-62	1134	459	127	.07	I&E N OIIIN Unknown
1077D	8-31-62	12-27-62	1201	657	586	.33	I&E N B OIIINB Side Other
0653F	8-24-62	12-30-62	1020	1180	129	.07	I&E E B OIIIEB Side Other

(Year)
OUTAGES (1962) December

Reason	B	C	D	DR	F	H	KE	KW	Total
Charge-Discharge	29.7	35.6	63.2	25.9	12.8	19.5	56.9	43.3	286.9
Maintenance	16.6	315.4	53.6	15.9	70.7	39.0	24.7	51.7	587.6
Rupture Removal	1.4		11.6		2.8				15.8
Leak Testing	24.6	16.4	17.4		11.5	18.1			88.0
Tube Replacement	16.3	289.3	24.0	8.9		4.7	29.5	21.3	394.0
Project Work		4.0							4.0
Production Tests	20.9	1.8	7.2		2.0	27.2	30.9	14.2	104.2
Standard Check ~~Instrument & Circuitry~~		3.0	.4	2.5				6.5	12.4
Rupture Suspects									
Miscellaneous			0.5	0.3		44.4	15.4	3.1	63.7
Total	109.5	665.5	177.9	53.5	99.8	152.9	157.4	140.1	1556.6
Scheduled Outages									
Unscheduled Outages									

END

DATE FILMED

8/27/92