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IRRADIATION PROCESSING DEPARTMENT MONTHLY REPORT

APRIL 1964

HANFORD ATOMIC PRODUCTS OPERATION

GENERAL ELECTRIC

RICHLAND, WASHINGTON

[redacted]

This document consists of 66 pages.

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IRRADIATION PROCESSING DEPARTMENT
MONTHLY REPORT
APRIL, 1964

Compiled By
IPD Personnel
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RICHLAND, WASHINGTON

[redacted]

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SUMMARY

MANUFACTURING

Reactor input plutonium production for April was 419.4 KMWDs: 216.9 at the six smaller reactors and 202.5 at the two K Reactors. Tritium input production was 3230 equivalent MWDs.

Power levels at the six smaller reactors were restricted by a bulk outlet water temperature limit of 95 C. Power levels at the K Reactors were restricted by the AEC administrative limits of 4400 MW.

Over-all time operated efficiency was 67.5% (73.7% forecast): 63.8% at the smaller reactors and 78.7% at the K Reactors. Low efficiency and the underrun of the production forecast resulted from fuel element failures and the largest discharge of irradiated metal (output-tons) ever achieved during a single month. The large output tonnage resulted from fuel cycling, the rescheduling of a K Reactor outage from March to April and the utilization of failed fuel element outages for charge-discharge.

Nineteen failed I&E fuel elements were removed from the reactors: 15 of enriched uranium and four of natural uranium. Six of the enriched failures were at H, four at DR, three at C and one each at D and F. The four natural metal ruptures were at B, D, F and H Reactors. Fourteen of the enriched elements were "side hot spot" failures; one has not yet been examined. Two of the natural elements were "side hot spot" failures; two were not examined. Fourteen of these fuel element failures (11 enriched and three natural) were stuck in process tubes.

Unusual reactor start-up conditions were experienced at H Reactor April 18, following the recharging of the E-N central block. A low-level super-critical condition was experienced with six vertical safety rods remaining in the reactor. After charging additional poison the reactor was operated for about four days under close observation. Severe flux distortion indicated improperly sequenced E-N charges in a portion of the process tubes. The reactor was shut down April 23 and 171 E-N charges which had been improperly sequenced were recharged. During the subsequent start-up, conservative predictions, resulting from the unusual loading, resulted in the insertion of additional poison. Operation through month's end was normal.

Four process tube leaks, at the rear Van Stone flanges, were corrected. A total of 481 process tubes was installed.

PRODUCTION FUELS

A total of 790 tons of natural and enriched fuel elements was produced during April, 102% of forecast. This production is an all-time high.

Canning line operation was at the rate of nine lines per day. A tenth line was operated for five days by utilizing projection welding personnel. Canning line operating efficiency was 97.8% for April. Bare core inventory at month's end was 913 tons, a 1.4 months' supply. Finished fuel inventory was 1292 tons, a 2.3 months' supply, including 30 tons of bumpered dingot fuel elements. The manufacturing yields of regular and self-support fuels remained at high levels during the month. The previous record high yield for enriched fuel with elliptical rails was equaled. At month's end, about 11,000 enriched fuel elements were backlogged ahead of the elliptical rail welders.

Production of small reactor size enriched fuel with elliptical rails was resumed in April after a seven-month [redacted]. Two self-support welders were converted for initial welding of elliptical rails.

Approximately 4300 small reactor size depleted elements were canned on April 27. After necessary adjustments were made to the equipment, the run proceeded smoothly.

Fuel elements for an initial Production Test (IP-654-A) to evaluate the stability of ten-inch enriched water-quenched uranium cores (04E) were charged into D Reactor. This test consists of 16 columns containing five matched pairs of centrally positioned ten-inch test and six-inch control pieces, and four columns containing 18 test and four control pieces.

Ten columns of self-supported hot die sized fuel elements, with the support height reduced five mils to compensate for fuel diameter growth, were irradiated in C Reactor, as authorized by Production Test IP-546-A, Supplement A. The material was discharged at about 500 MWD/T goal exposure. Up to 4000 pounds pressure was required to displace the columns during discharge.

RESEARCH AND ENGINEERING

In the clean U-233 program, 2 one-ton lots of thorium oxide have been irradiated in the central zone of F Reactor for 16.4 and 10.5 days; one lot has been irradiated in the fringe area of F Reactor for 62 operating days. The fourth lot of the six-ton demonstration program was charged into the fringe zone for a goal exposure of 120 operating days.

An analytical program to resolve the uncertainty that still exists concerning the build-up of Neptunium-237 in recycled enriched uranium has been initiated.

A new Ball 3X system philosophy and circuit logic is being formulated with the intention of providing a more realistic safety role for the system and reducing the probability of false trips.

A study of the zone temperature monitor grid size for C and H Reactors has been completed and reported in document HW-82008.

FACILITIES ENGINEERING

Cost estimates and schedules for the reactor plant deactivation program have been further developed. Studies of methods and materials for a lay-away and preservation continued. Sample procedures for placing mechanical, electrical, instrument, and structural installations in stand-by condition are in preparation.

The planned deactivation of three smaller reactors has necessitated a modified approach to the problems of providing adequate emergency coolant backup to the operating reactors. The current study proposes a system which will include diesel engine-driven backup pumps at 182-B to provide emergency coolant backup to the B and C Reactors and piping modifications as required to make the 100-B/C backup system independent of the export water system.

Two different configurations of sleeves have been designed for the VSR channels at K Reactors. The sleeves will be of high strength graphite identical to that used for the sleeves at C Reactor.

Investigative effort to determine causes and corrective action of RTD corrosion was continued. An automatic Polaroid camera for recording the degree of corrosion of RTD stems has been received and is being assembled into a portable, contamination-controlled enclosure. The test loop, fabricated in the 189-D Building to simulate on-reactor operating conditions, is nearing completion. Stainless steel simulated RTD stems have completed approximately 400 exposure hours of stress chloride cracking tests. Three of the six groups of test specimens have failed. The first group to fail had been heat treated in a manner similar to that proposed by the RTD manufacturer. Alternate heat treatments appear to produce a better service life in our environmental conditions. On-reactor tests of ceramic coated RTDs are continuing.

The third self-supported fuel element charging machine built by the Union Machine Works, Inc., has been received at HAPO and is undergoing final check-out prior to on-reactor use.

Dow Chemical Company submitted the only bid for magnesium magazines to be supplied for Project CGI-103 (Fuel Element Charging and Handling System - 100-K Reactors). Since they take several exceptions on demensional tolerances, they were requested to find some local shop to provide finish machining.

RESPONSIBILITY

There was no significant change in responsibility.

FORCE SUMMARY

	Exempt	Non-Exempt	Total
General	8	2	10
Research and Engineering	89	55	144
Manufacturing	379	1300	1679
Production Fuels	100	392	492
Facilities Engineering	89	32	121
Financial	17	13	30
TOTAL	682	1794	2476

ORGANIZATION

The following organization changes were made in Manufacturing:

Effective April 1, 1964

R. J. Bursey, Manager, Supplemental Crews, became Specialist, Reactor Personnel Certification.

R. D. Miller, Specialist, D-DR Manufacturing Administration, became Manager, Supplemental Crews.

S. M. Graves, Manager, B Processing, transferred to Research & Engineering as Supervisor, Reactor Engineering.

R. C. Haynes, Analyst, D Processing, became Manager, B Processing.

G. Fiorelli, Analyst, KW Processing, was made Manager, H Processing.

E. J. Filip, Manager, DR Processing, was made Manager, KW Processing.

G. L. Madsen, Analyst, C Processing, became Manager, DR Processing.

R. F. Corlett, Manager, KW Processing, became Supervisor, Plant Equipment Engineering, Applied Reactor Engineering.

Effective April 15, 1964

F. P. Britson, Manager, Power, D-DR Reactor, was made Senior Engineer, Applied Reactor Engineering.

G. W. Wells, Manager, Power, H Reactor, became Manager, Power, D-DR Reactor.

SAFETY, SECURITY AND RADIATION EXPERIENCE

There were 101 medical treatment injuries, three security violations, no disabling injuries and no radiation incidents exceeding operational control limits.

INVENTIONS

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

Name	Date	Title
G. F. Jacky P. L. Lee	1-23-64	A Device for Rotating Symmetrical Objects in Chemical and Electrochemical Treatment Bottles
D. E. Cooley W. L. Bunch J. L. Stringer	3-25-64	Irradiation Fuel Age Determination

OC Schroeder

Acting General Manager

OC Schroeder:DLD:bm

MANUFACTURING

PRODUCTION & GENERAL

Reactor Production

Reactor input plutonium production for April was 419.4 KMWDs: 216.9 at the six smaller reactors and 202.5 at the two K Reactors. Tritium input production in the H Reactor E-N load was 2040 equivalent MWDs; incidental production in fringe poison at other reactors yielded an additional 1132 equivalent MWDs and production from a KER loop yielded 58 equivalent MWDs. Power levels at the six smaller reactors were restricted by a bulk outlet water temperature limit of 95 C. Power levels at the two K Reactors were restricted by the administrative limit of 4400 MW.

Over-all time operated efficiency was 67.5%: 63.8% at the smaller reactors and 78.7% at the K Reactors. Low efficiency at the smaller reactors resulted from fuel element failures.

Fuel Exposure

A record high in the tons of metal discharged during one month was achieved in April. There were no discharge goal exposure adjustments initiated during April. Significant quantities of non-defense plutonium were discharged from the K Reactors primarily to correct discharge cycles and to facilitate outage scheduling. The average exposures (MWD/T) of irradiated fuel discharged were:

	Smaller Reactors	KE & KW Reactors
Natural Uranium	597	807
Enriched Uranium	695	899

Reactor Personnel Certification

Three reactor operating supervisors and ten specialists completed certification requirements during April. Special follow-up classes for supervisors and specialists continued. The reactor operator certification and training program was initiated on April 1. Sixty-nine pile operators are currently participating in the formal program. The radiation monitor training program continued throughout April. A special radiation protection training program for exempt and non-exempt maintenance personnel continued on a trial basis.

REACTOR AND POWER STATISTICS — APRIL, 1964

REACTOR DATA	B	C	D	DR	F	H	KE	KW	TOTAL
INPUT PRODUCTION – PU – KMWD	42.9	54.6	21.0	38.6	37.5	22.2	86.0	116.5	419.4
" " – TRITIUM – EQUIV. MWD	296	66	90	374	306	2040	58	0	3230
POWER LEVEL – MW (MAX.)	1995	2260	1950	1965	1950	2080	4400	4400	21000
" " – MW (AVG.)	1853	2178	1823	1880	1749	1709	4189	4362	19743
TIME OPER. EFFICIENCY – %	77.1	83.6	38.5	68.4	71.5	43.4	68.4	89.1	67.5
OUTAGES – ALL CAUSES	2	3	2	5	5	5	7	1	30
OUTAGE TIME ALLOCATION – %:									
CHARGE – DISCHARGE	8.2	4.5	5.5	8.8	6.8	22.7	21.0	7.8	10.7
FAILED FUEL REMOVAL	0.4	3.7	4.9	6.0	2.2	6.6			3.0
WATER LEAKS					2.0				0.2
TUBE REPLACEMENT	2.2	1.2	24.8	9.6	0.6	18.1			7.1
OTHER MAINTENANCE	9.2	4.6	20.5	3.6	12.4	7.9	3.2	1.6	7.9
PRODUCTION TESTS		2.4	1.6		3.7		5.8	0.9	1.8
PROJECT WORK	1.9								0.2
OTHER	1.0		4.2	3.6	0.8	1.3	1.6	0.6	1.6
TOTAL	22.9	16.4	61.5	31.6	28.5	56.6	31.6	10.9	32.5
WATER LEAKS – TUBE	0	0	0	0	0	0	0	0	0
" " – VAN STONE	0	0	0	1	3	0	0	0	4
NEW T[redacted]ES INSTALLED	0	1	265	65	4	146	0	0	481
FUEL [redacted]ARGE – TONS NAT. U.	192.3	181.1	197.7	180.6	180.3	3.1	409.7	417.2	1762.0
" [redacted] – TONS ENR. U.	30.5	40.7	25.4	38.6	38.2	197.3	49.6	42.8	463.1
FUEL ELEMENT FAILURES	1	3	2	4	2	7	0	0	19
HELIUM CONSUMED – M CU FT	229.6	378.7	208.1	232.3	344.7	137.5	272.9	132.5	1936.3
POWER DATA									
RIVER WATER PUMPED – M GALS.	7568.8		5377.5		3168.4	2311.8	8652.6	8841.6	35920.7
WATER EXPORTED – M GALS.	625.4		0		0	0	0	0	625.4
WATER TREATED – M GALS.	2452.1	4490.2	2749.5	2498.7	3137.6	2309.0	8604.1	8841.6	35082.8
WATER TO REACTOR – M GALS.	2262.5	3819.3	2113.2	2232.1	2980.7	2052.0	7413.1	7909.9	31772.9
" " " – GPM (NORM)	89300	95500	88800	87700	88200	92000	207000	209500	
" " " – pH	6.80	6.60	6.63	6.64	6.65	6.63	6.68	6.66	
" " " – DICHROMATE (PPM)	1.06	1.07	1.27	1.27	1.17	1.23	1.27	1.25	
STEAM GENERATED – M LBS.	58391		67949		36958	34532	22316	19140	
LBS. STEAM / LB. OF COAL	9.11		8.62		9.31	9.40			9.02
" " / GAL. OF OIL							110.6	96.7	103.7
ELECTRICITY GENERATED – MWH							1512.0	1556.8	3068.8

REACTOR OPERATIONS

Reactor & Power Statistics

These are tabulated on page B-2.

B-C Plant

Power levels at both B and C Reactors were restricted by the 95 C bulk outlet water temperature limit.

B Reactor had two unscheduled outages in addition to being down for 90.3 hours at the start of the month to complete the tube replacement outage started in March. The first unscheduled outage (36.6 hours) was caused by a Panellit gage trip when a front cap O-ring seal failed suddenly. During this outage, 17 crossheader brackets were installed (under MJA-53), 300 front O-ring seal caps were replaced with Spirotallic gaskets, and Inconel snap rings were installed on 11 rows of front nozzles. The second unscheduled outage (37.6 hours) was to remove a failed natural uranium fuel element. Work accomplished during this outage (in addition to charge-discharge) included the replacement of front O-ring seal caps with Spirotallic gaskets on row 15 and below, the tightening of front and rear nozzles on all process tubes replaced during the March-April outage, and checking of the tripping mechanism on four Ball 3X hoppers. During the April portion of the tube replacement outage, charge-discharge of 841 tubes was performed, resistance temperature detectors were installed in each rear riser, flow capacity instrumentation was placed in the downcomer and 12 rear face gamma sample line fittings were repaired.

Three outages occurred at C Reactor, each to remove failed enriched uranium fuel elements. During the first outage (48.8 hours), the following work (in addition to charge-discharge) was accomplished: Panellit gages on three rows were replaced with Delrin bushing gages, wall thickness measurements were made on 17 process tubes, new counterweight cables were installed on the D work platform, the flux monitor controllers were overhauled, the C-1 loop was discharged and recharged, and a universal flexible rod was installed in one VSR channel. The second failure was removed during an 8.7-hour outage the following day. The third outage (60.2 hours) was caused by the failure of an enriched uranium fuel element of the same lot as the second failure, and the remaining columns of this lot of material were discharged as being rupture prone. Major work accomplished during this outage was as follows: one universal flexible rod was installed, the interior of a second VSR channel was photographed, a third VSR channel was cleared by drilling, Panellit gages on three rows were replaced with Delrin bushing gages, wall thickness measurements were made on 70 process tubes, and high velocity water flushes were completed on both high tanks.

In compliance with a change in a Process Standard, the sodium dichromate addition to process water for both B and C Reactors was reduced from 1.5 to 1.0 ppm.

D-DR Plant

Power levels at the D and DR Reactors were limited by a bulk outlet water temperature limit of 95 C.

D Reactor completed a scheduled outage initiated in March (373.4 hours this month) for tube replacement and two unscheduled outages (22.5 and 46.5 hours) caused by failed fuel elements. Principal work accomplished during the scheduled outage included charge-discharge of 875 process tubes, replacing 263 and probologging 197 process tubes, replacing snap rings on all front nozzles with Inconel rings, and installing nine rows of front adjust Panellit gages. The two failed fuel elements (one enriched and one natural) required extra pressures for removal.

DR Reactor had five unscheduled outages. Scheduled tube replacement work was completed during an outage initiated 55 hours early when an enriched fuel element failure occurred (combined outage time: 155.5 hours). Outage work accomplished included charge-discharge of 781 process tubes, probologging 55 and replacing 62 process tubes, and replacing the snap rings on 1154 front nozzles with Inconel rings. Failure of enriched fuel elements caused three additional outages (1.6, 34.9, and 33.0 hours). Fourteen gas leaks were repaired and during the last outage for removal of a fuel element failure, 86 tubes of rupture prone material were discharged. The reactor was manually scrammed when a front face water connector was found to be leaking. During this outage (2.1 hours) a second connector was found leaking and both were replaced.

On April 8, faults occurred while restoring normal electrical service to the Filter Plant. These faults caused extensive damage to the bus tie switch but did not affect normal operation of the facility nor that of the reactor which was in shutdown status at the time. Preliminary investigation indicated the difficulty stemmed from a ground fault or faults.

The No. 4 process water pump motor at the Filter Plant failed, was removed from service, and was replaced with a spare motor. Repairs were also made to the Power House emergency generator after it failed because of reverse polarity. Since the reactor was in shutdown status, operating continuity was not interrupted.

Sodium dichromate concentration in process water was reduced from 1.5 to 1.0 ppm in accordance with a revised process water standard.

F Plant

The power level at F Reactor was restricted by a bulk outlet water temperature limit of 95 C.

Five unscheduled outages were experienced at F Reactor in addition to a scheduled thorium discharge outage (43.4 hours this month) initiated in March: one to remove a failed I&E enriched fuel element (38.4 hours), one to remove a failed I&E natural fuel element and scheduled charge-discharge (86.5 hours), one because of a Panellit trip resulting from a partially closed toggle valve (0.7 hour), one to repair a faulty thermocouple on a newly charged

tube (1.0 hour), and one a Panellit trip which occurred during spline removal (34.7 hours).

Principal work accomplished during the first outage was charge-discharge of the central zone thorium loading authorized by PT IP-659-AC, "Evaluations of Thorium Oxide Loading," and locating and replacing three process tubes which were leaking at the rear Van Stone flange. Major work accomplished during the second outage was the removal of the failed fuel element using hydraulic pushing forces. Principal work accomplished during the third outage included the removal of the failed fuel element using hydraulic pushing forces, charge-discharge of 656 tubes, and wall thickness gaging of 44 tubes. Also included in the third outage was the final discharge of the central zone thorium charges and charge-discharge of the fringe zone thorium loading. During start-up preparations concluding the outage, No. 20 VSR was found to be broken 15 feet 2 inches from the top section. The bottom section was retrieved from the channel, a new rod section was installed, and the rod returned to service. Work accomplished during the final outage consisted of miscellaneous maintenance repairs.

H Plant

Maximum power levels at H Reactor were restricted by the 95 C bulk coolant outlet temperature limit.

As the E-N block charged in January reached the 95% level of exposure, seven fuel element failures (six enriched and one natural) were experienced causing three reactor outages (29.0, 9.8 and 326.8 hours). Removal of four of the seven failed elements required forces greater than normal for charge-discharge. Following shutdown for the third outage of this sequence, the reactor remained down to accomplish the work of the scheduled 14-day outage. Major items included charge-discharge of the block, probologging of 564 process tubes followed by replacement of 146 tubes, and completion of front nozzle snap ring replacement.

During operation immediately after the extended outage, flux peaking towards the front and temperature concentration at the upper portion of the reactor active zone were experienced. Investigation indicated that improper placement of the lithium-aluminum target elements in the downstream half of the charges in 171 process tubes was the source of the flux distortion. The discharge and placement of the Li-Al elements to the established sequence for this pattern (41.6-hour outage) resulted in a return to normal reactor conditions following start-up.

Two check valves were installed in the H Reactor Building raw water lines to the risers under Design Change No. 902. These valves preclude loss of high tank water in the event of an export line failure while the Groves valve is open.

Beginning April 27, liquid alum feed was substituted for bauxite on half of the filter plant in a program to determine the effect on reactor effluent radioactivity.

KE-KW Plant

Maximum power levels at both KE and KW Reactors were restricted by the AEC administrative limit of 4400 MW.

In addition to a scheduled outage (115.5 hours) for charge-discharge of fuel elements, production at KE Reactor was interrupted six times during the month. An unscheduled outage (2.2 hours) was caused by a faulty resistance temperature detector, two were caused by broken splines (0.4 hour and 26.7 hours), and one was caused by the malfunction of heat exchanger instrumentation in a high pressure recirculation loop of the associated 1706-KE-KER testing facility (81.4 hours including charge-discharge). The other two unscheduled outages (1.0 hour total) were caused by Panellit trips.

Principal work accomplished during the scheduled outage, other than charge-discharge, included installation of a new flexible vertical safety rod, repair of a bent section of a conventional VSR, replacement of a low-lift process pump motor, and repair of faulty resistance temperature detectors.

The one KW Reactor outage was a scheduled outage (78.7 hours) for charge-discharge. Major maintenance work performed during the outage included installation of a new flexible vertical safety rod and painting the rear face discharge area wall. The newly painted surface will improve lighting and provide a surface which is more easily decontaminated.

A reworked motor was installed on the No. 5 low-lift unit at the KE Process Pump House, thereby completing the planned change-out program started in 1962. The replacement motors were reworked at the vendor shops to correct an unbalanced flux condition.

Coolant water sodium dichromate feed during normal operation was lowered from 1.5 to 1.0 ppm at both KE and KW.

APPLIED REACTOR ENGINEERING

Plant Engineering

Electrical

Design Change 883 was issued. This revision provides indicating lights behind the pressure monitor panel at the K Reactors to assist craftsmen in determining if a row or column circuit is tripped. Both circuits must trip to scram the reactor, and this circuit identification reduces the potential for inadvertently tripping the second circuit.

Twelve of the 16 Industrial Television, Inc., portable television systems have been delivered to the reactor areas. Portions of the remaining four systems require repair or replacement prior to delivery. It was found that the AC power cord connections at the Vidicon Control Panel and at the Accessory Control Panel were incorrect. This left the control panel circuits unprotected (by the control panel fuses) from internal grounds and has

 [redacted]

resulted in some circuit damage. Action is being taken to correct the AC power cord connections on all sets.

Minor Design Change F64-3 was issued to facilitate the trouble-shooting of D.C. grounds in the annunciators of the field control panels for the eight process water pumps in Bldg. 190-F. A switch is provided to isolate each annunciator from the D.C. supply, and portable ground detectors are provided to reduce a communication problem.

Minor Design Change F64-4 was issued to provide annunciation on the main control room annunciator when any of the four sumps in the 117-F confinement filter building has high water. High water in the sumps during normal operation can result in filter damage.

Mechanical

Design Change 869 was issued, providing for an approved support for a K Reactor front nozzle cap that is suspect or is not fully engaged on the nozzle. Process Standard A010 governs the use of this support.

Minor Design Change M64K-JC-001-D was issued. This change provides for a low pressure gage in the helium line from the tank car to the helium in compressors in Bldg. 110-KW to aid in pumping-down the tank cars. The gage is protected by a relief valve and limited by an orifice. The system is controlled by a shut-off valve so that it will not be on the line when the pressure exceeds the capacity of the low pressure gage.

Minor Design Change F64-5 was issued detailing the installation of an in-limit cam on No. 4 horizontal control rod at F Reactor. To preclude inadvertent movement of the rod to a deep position, this cam trips the in-limit switch at the 140-inch position.

Engineering follow-up of gas leak repair was provided at D Reactor. The omega seals on this reactor have started to deteriorate, and increased leakage can be primarily attributed to this. Significant helium leak reduction is resulting from the joint efforts of Processing, Maintenance, and Plant Engineering.

Predicted flows for K Reactor coolant backup with calculated flow capacities from the K Plant crosstie system have been determined and reported in HW-81512. Results obtained in tests of diesel pump capabilities have been considered, and it is believed that (at a diesel speed of 750 rpm) flow adequacy can be maintained through CY-1964 without need for crosstie line cleaning.

Instrument

The installation and testing of replacement flux monitor amplifiers have been completed at D, DR, F and H Reactors. Over $20,000 on this Appropriation Request is being returned, as enough surplus equipment has been located to complete this installation.

Design Change 827 was issued authorizing removal of the pressure interlock from the crossunder line valve control systems at the six smaller reactors.

[redacted]

Automatic closure of these valves by abnormal pressure in the rear riser proved incompatible with process tube flow requirements during charge-discharge.

Maintenance Standards and Manuals

The current status of Equipment Maintenance Standards is as follows:

	March	April
Issued to date	94	122
Being routed for approval	43	27
In comment status	6	14
In preparation	52	46
Total	195	209

Ten Equipment Maintenance Standards were revised during April.

A service manual covering the maintenance of industrial type pH meters was assembled and distributed to the plants. A procedure for checking power calculator temperature elements also was prepared and distributed.

Spare Parts

Two full-rods and one half-rod were received, which completes this purchase order for ten full and six half horizontal control rods for the five smaller reactors.

Plant Personnel Training

Training activities at the White Bluffs' facilities were as follows:

Sixteen K Plant instrument personnel each received 16 hours of training on the Temperature Data Logging System, for a total of 256 manhours.

Material for the instrumentation portion of the Reactor Operator Certification Program was prepared and class instruction was started.

Sound-slide programs covering Spline Cap Installation, KE and KW Reactors, were approved and issued. Sound-slide programs have been issued on 74 subjects to date.

A four-hour training class on Work Sampling Theory and Application was presented to six Maintenance and Processing Operations personnel.

[redacted]

The Electrical Circuitry and Safety System Sections of the Reactor Operator Certification Program are being taught. Twenty-four hours of class presentation have been given.

Manager, Manufacturing

RS Bell:TWH:DLD:bm

PRODUCTION FUELS

ALSI SHOP

Canning line operating efficiency was 97.8 per cent, 0.8 per cent above forecast.

Manufacturing yields during April were above forecast in all categories of fuels. A record high yield was attained on a small amount of the six-inch enriched model with elliptical rails at 92.2 per cent. The average self-support welding yield remained at the high level of 98 per cent.

Production of projection fuels during April was:

	Natural U	Enriched U
Tons Produced	237	20
Finished Inventory	232	107

Acceptable Fuel Elements (Tons)

NATURAL				ENRICHED					
C	K	K5NS	Reg.	C	K	K5ES	Reg.	Bumper	Total
90.6	1.8	232.8	391.6	1.4	-	-	51.9	20.3	790.4(1)
Per Cent of Forecast									
105	-	85	146	-	-	-	67	85	102
Manufacturing Yields									
April									
96	70	90	95	-	-	-	94	92	
Forecast									
92	92	89	92	92	92	89	92	86	
Previous Month									
96	95	88	96	-	95	92	95	-	

(1) Includes 1.4 tons of upstream fuels.

Operating Conditions, Incidents, and Improvements

On April 9 at 11:00 P.M. the main 440-volt circuit breaker in the power house opened and shut off power to the electrical circuit operating the air compressors. The resultant drop in air pressure, to below operating minimum on the agitators, jacks, quench tanks, and lathes made it necessary to suspend operations until the breaker could be re-set and adequate air pressure restored to operating equipment. Six canning lines were down for thirty-five minutes before operations were resumed.

The pre-set tooling for all the lathes has been installed and is working in a satisfactory manner. All tool changes and adjustments are now made by the contour inspector except for the ream and chamfer tool which does not lend itself to the pre-set concept.

The new double-spindle welders have operated very well during the month; however, the load conveyors into both the input and output elevators to these welders have been a constant source of trouble. A new load station installed on the output elevator on April 25 is expected to correct this problem. The new loader has reduced marred surface rejects which were caused by the previous loading arrangement. A similar loader will be fabricated for the input elevator.

Autoclave Failures

There were no autoclave failures experienced in regular production during the month.

MATERIALS

Fuel Recovery

The following amounts of AlSi fuel were recovered:

	Pieces
Eight-inch Natural	8,564
Six-inch Enriched	0
Six-inch Watermix	0
Total	8,564

Hanford Test Reactor

Available reactor time was utilized as follows: 194 routine production tests were performed (154 GO NO-GO and 40 drift tests) representing approximately 40 per cent of the available time, with the remainder being utilized for special testing. Available time during April was reduced due to the reactor being shutdown for maintenance from April 8 through April 10.

Scrap

Two shipments of metallic uranium scrap were made during the month. Shipments totaled 2 tons of natural AlSi scrap and 8 tons of enriched N-Reactor scrap. A total of 672 empty core boxes with lids were also shipped in April.

FUELS ENGINEERING

Quality Control

The amount of upstream fuel accumulated since initiation of the program totals 27,457 fuel elements. Of these, 17,035 were reactor charged through March.

Rupture Experience

A total of nineteen fuel elements failed in the reactors during the month of April.

Fuel Element Type	Tube and Reactor	Exposure (MWD/T)	Rupture Classification	Failure Date	Canning Date
Enriched Nonbumper	3486-H	785	Side Hot Spot	4/3/64	11/27/63
Enriched Nonbumper	3059-H	759	Side Hot Spot	4/4/64	12/2/63
Enriched Nonbumper	2962-H	776	Side Hot Spot	4/5/64	12/19/63
Natural Watermix Nonbumper	2058-H	809	Side Hot Spot	4/5/64	10/24/63
Enriched Nonbumper	2057-H	790	Side Hot Spot	4/5/64	12/16/63
Enriched Nonbumper	2056-H	788	Side Hot Spot	4/5/64	12/20/63
Enriched Nonbumper	1785-H	785	Side Hot Spot	4/6/64	12/4/63
Enriched Nonbumper	0678-F	621	Side Hot Spot	4/6/64	6/12/63
Enriched Nonbumper	1681-C	244	Side Hot Spot	4/13/64	2/5/64
Enriched Nonbumper	3960-C	239	Side Hot Spot	4/15/64	2/4/64

Rupture Experience (continued)

Enriched Nonbumper	3257-DR	349	Side Hot Spot	4/15/64	1/16/64
Natural Nonbumper	1189-F	555	Unknown-Not Examined	4/15/64	12/26/63
Enriched Nonbumper	1958-D	485	Side Hot Spot	4/16/64	9/23/63
Enriched Nonbumper	2058-DR	357	Side Hot Spot	4/22/64	1/20/64
Natural Nonbumper	2361-D	50	Side-Not Examined	4/22/64	10/29/63
Natural Nonbumper	2772-B	419	Side Hot Spot	4/23/64	1/24/64
Enriched Nonbumper	3357-DR	376	Side Hot Spot	4/23/64	9/24/63
Enriched Nonbumper	3181-C	419	Unknown-Not Examined	4/28/64	2/4/64
Enriched Nonbumper	3788-DR	439	Side Hot Spot	4/29/64	1/20/64

The first seven failures this month occurred in H Reactor over a three-day period just prior to the scheduled discharge of the sixth E-N load. These failures are attributed to the combined effects of (1) using non-bumper fuel and (2) irradiation severity. Based on over-all experience, there has probably been some drop in the average rupture resistance of enriched nonbumper fuel; four failures, for example, have been incurred at less than 40 per cent of goal. However, most, if not all, of the failures incurred during April may have been prevented if the fuel had been bumpered. Enriched metal is being bumpered for future loads in the reactors to minimize this problem.

Uranium Technology

Because of problems experienced by National Lead in using uranium grain size test (UT-2) standards, which are identical to those in use at HAPO, their Plant was visited to determine the cause of these problems. In general, it was found that the differences between sites resulted from changes made to improve the HAPO testers without the same alterations being made on the testers at National Lead. These differences are being corrected and should be resolved in a month.

AlSi Process Development

A total of 480 K Reactor enriched (K5E) fuel elements and 380 small reactor enriched (03E) fuel elements were canned at various can-sleeve preheat and submerge times in a test designed to determine minimum cycle times consistent with present quality levels.

A production evaluation of a roughened sonotrode tip for ultrasonic welding is underway and scheduled for completion in five weeks. Preliminary test results indicate a possible major improvement in ultrasonic rail weld strengths through the use of fatty acid lubricants such as stearic and palmitic. Further tests are scheduled in the pilot plant to fully evaluate the effect of these lubricants on rail weld strength.

Alternate Process Development

Twelve columns of hot die size fuel elements were prepared and charged in C Reactor under Production Test IP-665-A to evaluate the effect of changing end bonding from resistance to induction heating. Ex-reactor tests indicate that end bonding may be a major process variable affecting the growth behavior of hot die sized fuel during irradiation. Induction end bonding, originally investigated as a method of increasing throughput, is expected to improve the in-reactor stability of hot die sized fuel. Bonding time was reduced from 4 minutes, 30 seconds to 1 minute, 10 seconds while total heating time was reduced from 10 minutes, 15 seconds to 4 minutes, 10 seconds by induction end bonding. The reactor test charges contain matched induction end bonded, resistance end bonded, and AlSi control fuel elements.

Fabrication of ten columns of hot die sized fuel elements clad in 8001 aluminum alloy tubing components is underway for irradiation in C Reactor under PT-IP-677-A. Tubular components were fabricated from eight foot lengths of tube stock cut into 10 1/2 inch lengths. The external cladding was crimped to mate with base cap OD, while the internal tubing was flared to fit the base cap ID. Fuel assembly techniques were modified to accommodate the tubing components.

Processing of hot die sized fuel clad in tubing components was quite similar to that of fuel assembled in integral spire-cans with the following exceptions:

1) Dipping of the components was replaced with a brush-application of the lubricant on the external surface. The internal surface was not lubricated, since lubrication of the internal die plug produced equivalent results.

2) Induction end bonding was modified to insure acceptable cap to core bonding by increasing pressure holding time to two minutes and reducing pressure to 3.5 T/square inch.

3) Both ends of the pieces were faced and welded. A step-cut was used to lower weld height.

A total of 620 natural uranium cores were plated for the hot die size cladding test. Process performance continued to be satisfactory, with an over-all core reject rate of 11.6 per cent, including 6.8 per cent for cracks in the uranium surface. Other reject causes were as follows:

Rack Malfunctioning	2.6%
Process Behavior	1.4%
Operating Errors	0.8%

Plate thickness on the middle seven inches of the cores was controlled between 0.0008 and 0.0012 inches on the external surfaces and between 0.0012 and 0.0014 inches on the internal surfaces. This thickness was essentially the same as for previous production test runs.

Alternate Product Development

Pu-240 Program: Sixteen tons of small reactor (03D) depleted uranium cores were received and canning was completed in the AlSi Shop in April. Heat treat warp and chemistry data were used as a basis for segregating this material. Cores from four ingots will not be canned because of abnormal heat treat warp and from another ingot because of high surface hydrogen. Duplex canning bath parameters were optimized at one to two seconds core agitation in the AlSi layer prior to submersion in the lead layer. This condition produced the highest average per cent UAl_3 compound layer and fewer cracks in the end bonds.

Approximately 100 K Reactor (K1D) depleted cores were received and canned to optimize duplex bath parameters for this model. Receipt of the remaining K1D cores (approximately 15 tons) on order for processing and irradiation is expected early in May.

U-233 Program: Because of difficulty in procurement, an order for two tons of thorium metal cores has been revised to two tons of thorium oxide densified by the "Sol Gel" process. Delivery is expected by the end of May. As planned, this material will be canned in Hanford Laboratory facilities for irradiation in a K Reactor.

A cost study was completed for various thorium oxide target element production plant capacities and irradiation requirements. Cost curves were developed for capital equipment, manpower, and essential materials as a function of production rate. In addition, a proposal was submitted for canning 7.5 to 15 tons of thorium oxide for irradiation.

Orders have been placed with National Lead for three tons of "O" size and three tons of "K" size enriched (1.25 per cent U-235) cores. These cores will be used to evaluate "driver" elements for target element loadings. Core fabrication is awaiting firm dimension specifications.

Equipment Design and Development

Equipment layouts were firmed up for a mechanized hot die sizing line in the 306 Pilot Plant. Bids were received for metal cleaning and finishing equipment. The sizing press and hydraulic unit on order are scheduled for delivery in June.

Major pieces of equipment are on order or purchase requisitions are being prepared for the conversion of 3732 Building to a pilot plant for canning thoria target elements. Delivery of a radiological hood is expected by June 1, and the absolute filter exhaust system is to be completed by June 15. All other equipment is scheduled for delivery in eight to ten weeks.

Demonstration of a prototype automatic rail feeder has been completed on the pilot plant ultrasonic welder with favorable results. Provisions are being made to equip the AlSi Shop welders with automatic feeders by September 1964. An automatic rail weld shear tester was also demonstrated in conjunction with the pilot plant welder and the design has been released to procure production units.

An automatic support rail sizer for K Reactor self-supported enriched (K5ES) fuel elements was tested and placed in operation in the production line adjacent to a previously installed unit for K Reactor self-supported natural (K5NS) fuel elements. Automatic rail height gauges were also ordered for each of these fuel models this period. Delivery is scheduled in June 1964.

PLANT FACILITIES

Status of Active Construction Projects

CAF-961 - Consolidated 303 Area Services Facility - Phase I

No word has been received of Washington AEC's action on the local AEC's request for furds for the construction of the 3720 Building (laboratory and machine shop). Feasibility of a north entrance facility in Phase II of the project has been reviewed in the light of current information on production cut-back, diversification, and General Electric Company phase-out as the prime contractor and Revision 2 of the project proposal is being prepared.

CAF-979 - Pilot Scale Plating Equipment - 300 Area

Work resumed on March 18, 1964, in the 3716 Building and included the assembly of equipment in the building and procurement of limited materials while the project proposal was being revised. On April 7, 1964, the General Electric Company forwarded to the AEC recommendations for change to the project schedule and justification for the increase of project funds to assist the AEC in their revision of the project proposal. On April 24, 1964, the Construction Service Contractor again stopped work because of lack

of authorized funds. The design for this project was prepared on the basis of equipment installation by the CPFF contractor and Title III services by the General Electric Company.

CAI-994 - Utilities Extension - 300 Area

The sewer lines within the 300 Area fence are essentially complete and ground stabilization over the excavated area is underway. Compliance with contract specifications for both the bedding of the pipe and the backfill of the ditches has been questioned by General Electric Company representatives. Sewer lines and sanitary water lines have been laid along the south side of parking lot. The progress on the job was delayed during the month when the contractor removed most of his equipment from the job site to do some emergency work elsewhere. Interference with parking lot traffic has been held to a minimum so far.

CAI-107 - Boiler Replacement for Additional Steam Generating Capacity - 384 Building - 300 Area

Title II design by Vitro Engineering Company has been commented upon and approved for compliance with the Design Criteria by the General Electric Company. Invitations to bid are being prepared by the AEC and are scheduled for issuance May 6, 1964, with the bid opening May 27, 1964. The shipping date of the boiler is scheduled for August 15, 1964.

CAI-120 - Utilization of PRTR Waste Steam in 300 Area Distribution System

Design being performed by the architect-engineer, Bouillon, Griffith, Christoferson, and Shairer, of Seattle was scheduled for completion April 20, 1964. It is reported to be a little behind schedule. The project is managed by the AEC.

Equipment Modification

Loss of canning line efficiency attributed to equipment malfunction is approximately 1.1 per cent; an increase over the 0.8 per cent experienced in March. There were seven shifts during which there was no downtime recorded and the only long outage was due to a low air pressure condition originating at the powerhouse. Approximately 50 per cent of the equipment malfunction time was required for duplex and canning basket replacement.

The design for speeding up the double spindle automatic welders has been completed. The only operating problems with these welders encountered during the month were of a minor electrical nature.

Utilities

The control unit for the emergency electrical generator was received

April 22, 1964. The installation of the power unit and the control unit is underway by the Construction Service Contractor.

A purchase order was placed for the new 800 cfm air compressor. The original bids for a reciprocating type were too high so rebids were requested to include a rotary compressor. Although a lower bid resulted for a rotary compressor, an even lower reciprocating bid was obtained and the order has been placed.

All utility demands were met during the month with the exception of compressed air. An electrical failure in the 384 Building caused two compressors to shut down. The system dropped from 90 psi to 70 psi for a period of about 35 minutes. When the electrical fault was cleared, pressure was restored immediately. This outage resulted in the canning line lost time mentioned previously.

Overhaul of No. 5 Boiler is approximately 30 per cent complete and has been given third party inspection.

Approximately 2600 tons of coal was used from the coal pile during the month preparatory to placement of oil tanks for the new boiler. There was no significant problem burning the old reserve coal and all reclaim equipment operated satisfactorily.

Statistics

	April	March
Maximum steam generated (M lbs/hr)	113	126
Total steam generated (M lbs)	53,267	59,528
Total condensate returned (M lbs)	18,127	22,541
Coal consumed (tons)	2,728	2,826
Evaporation rate	9.76	10.53
Efficiency - actual	81.5	82.0
Efficiency - optimum	84.9	85.4
Import Water (M gals)	108.5	99.6
Peak water flow (gpm)	5,400	4,700
Peak water consumed in 24 hours (M gals)	4.1	4.0
Compressed air produced (M scf)	68,108	54,918

Plant Services

Major jobs completed during the month included the fabrication of a large plate rack for Hot Die Sizing Pilot Plant; fabrication of an elevator unloader for the double spindle welders; fabrication and assembly of parts for two automatic shear testers for 313 Building; overhaul of No. 5 boiler; installation of an electrical supply line to provide an alternate source of current to the 384 Building air compressors; interior alterations to the 3702 Building; specially

designed storage cabinets built and installed in 3760 Building; and the preparation of display panels for the 308 Building and the Visitor's Center.

One hundred and sixteen hours of training were given during the period of March 21, 1964, through April 20, 1964. This is exclusive of time spent by craftsmen for preparation on DeVry courses. DeVry courses currently in progress include pulse and digital circuits, semi-conductors, and the electronics refresher. Laboratory sessions will be presented to supplement the DeVry course material. There are 48 craftsmen (electrical and instrument) enrolled in these courses.

W N Mobley

Manager - Production Fuels

WN Mobley:WKW:gl

RESEARCH AND ENGINEERING

PROCESS AND REACTOR DEVELOPMENT

REACTOR FUELS

On April 1, 1964, 19 central zone columns of high density (80 per cent of theory) thorium oxide target elements were discharged from F Reactor with an equivalent exposure of 16.4 reactor operating days. During the same reactor outage, a second group of 19 high density thoria columns was charged. These elements were discharged on April 16, 1964, during an unscheduled reactor outage with an exposure equivalent of about 10.5 reactor operating days. Eighteen of 20 low density (65 per cent of theory) thoria columns were discharged from the fringe zone tubes of F Reactor after 65 reactor operating days. These tubes were recharged with low density thoria elements for a planned irradiation period of about 120 days. The two tubes not discharged will give data on extended fringe zone irradiations.

Depleted Uranium

A production test is being prepared for the irradiation of depleted uranium in both a smaller reactor and a K Reactor. To date, 4,957 smaller reactor-size cores and 112 K-Reactor fuel cores have been received, and it is anticipated that the depleted loading will be charged by June 1964 and irradiated until near midyear 1965.

1.25 Enriched Fuel

The use of fuel elements enriched to 1.25 w/o U-235 has been proposed to support target loadings and an order was placed for the enriched metal. For adequate heat transfer, the fuel design proposed for the K Reactors would require process tube coolant flow rates somewhat greater than those currently being obtained. The preliminary results of an experimental program to investigate the hydraulic characteristics of the K process tube and fitting geometry at the higher flow rates indicate that the current hardware is compatible with the flow increase.

REACTOR ENGINEERING

Earthquake Studies

Seismic vibration measurements are being planned which would be initiated by a series of blasts in the reservation. Vibration measurements in reactor structures will be made to determine response to disturbances of a seismic nature. These tests will be carried out in conjunction with Shannon & Wilson, Inc.

The Alaskan earthquake of March 27, 1964, was felt at Hanford with an intensity exceeding MM-2 but not reaching MM-4. No reactors were scrammed, but high sensitivity alarms were received on seismoscopes in five of the eight reactors.

STATUS REPORT OF PRODUCTION TESTS

Test No.	Type Metal	Tubes	Reactor	Goal Exposure	Current Exposure	Remarks
IP-216-A	Normal prod. natural and enriched fuel elements.	76	All	Normal variable goal.		Provides for monitoring the performance of a sample of all normal production material to assist in development of a Quality Index for production fuel. Test is continuous.
IP-272-A	I&E self-supported fuel.	69	C	Variable plus 200.		Provides for testing of CIVN model fuel in C Reactor ribless zirconium tubes.
[redacted]P-381-A and P-431-A	I&E self-supported fuel over-bore size.	62	C	800 MWD/T		Provides preliminary qualitative data regarding irradiation behavior of larger fuel element designs.
IP-607-A	Oil-quenched enriched uranium elements.	15	F	600 MWD/T	605 MWD/T	Second step in evaluating irradiation effects on dimensional stability of oil-quenched enriched uranium. Elements charged during outage of January 14, 1964. Fuel columns discharged April 4, 1964.

STATUS REPORT OF PRODUCTION TESTS (cont'd)

Test No.	Type Metal	Tubes	Reactor	Goal Exposure	Current Exposure	Remarks
IP-648-AC	Thorium oxide target elements.	20	F	120 operating days	4 operating days	First phase of irradiation of thorium in a six-ton demonstration load. Eighteen columns discharged and recharged during April 16, 1964, outage. At the time of discharge, the elements had an accumulated exposure equivalent to 62 operating days.
IP-659-AC	Thorium oxide target elements.	19	F	14 operating days		Central zone portion of the six-ton demonstration load. First group of elements discharged and second group charged on April 1, 1964. Exposures at time of discharge were 16.4 and 10.5 operating days, respectively.
IP-546-A, Supp. A	Hot-die-sized diffusion-bonded elements.	10	C	500 MWD/T	470 MWD/T	Elements charged during February 26, 1964, outage to provide additional irradiation experience.

REACTOR PHYSICS

Neptunium-237

A program of obtaining Np-237 buildup data from recycled enriched uranium has been started. Six ingots of fuel are scheduled to be canned in identifiable lots. Two samples from each ingot have been sent to the Chemical Laboratory for U-236 and U-235 analysis. The U-235 of each ingot will be independently checked by Oak Ridge. Isotopic analyses following irradiation will be performed on duplicate dissolver samples by CPD and HL. The intent of the test is to resolve the uncertainty that still exists in Np-237 yield from recycled uranium.

The recent large scale neptunium yields being recovered in CPD are being investigated. For E-metal, the yield varies considerably and has been as high as four grams per ton of uranium. This yield is for an average exposure of approximately 850 MWD/T. The theoretical yield in virgin E-metal at this exposure is 3 to 3.2 g/t.

U-236 values reported recently in E-metal are running about 180 to 190 ppm. Two years ago the values were 130 to 150 ppm. This is evidence that the plant is now receiving some second-cycle metal. Theoretically, the U-236 content (assuming 1.2 per cent blend material) should be 120 ppm for once-recycled metal and $\sim$200 ppm for twice-recycled metal.

Thulium-170

A preliminary study has been made for the production of 1 kw isotopic heat source of Tm-170. The study assumed that flux trapping methods would be used. Based on computer runs and past experience with thorium target loads in the center of a reactor tube, a flux of about 1.1×10^{14} should be attainable for the Tm_2O_3 test element proposed by Boeing if the amount of Tm_2O_3 per unit length is halved.

Ball-3X Logic

As a logical outgrowth of the recent extensive philosophy reviews of the Ball-3X safety system, a new 3X safety circuit logic is being formulated. The key statements of this new philosophy are as follows: (1) The IPD production reactors require a backup safety control system which is separate and independent from the primary safety control system. (2) A fraction of the backup safety control system shall be actuated automatically upon loss of power to the reactor pumps if such loss of power is coincident with a failure of a critical fraction of the primary safety control system. (3) The entire backup safety control system shall be actuated automatically upon sudden loss of coolant (indicative of a pipe break) if such coolant loss is coincident with a failure of a critical fraction of the primary safety control system or is coincident with a low-sensitivity (MM-4) seismic trip.

The proposed philosophy together with possible circuit logic are preliminary and are still being carefully evaluated. The intent of the new philosophy is to provide a realistic safety role for the 3X system and to materially reduce the probability for false trips.

RADIOLOGICAL ENGINEERING

Radiation Control Experience

The following table summarizes the radiation exposure experience for critical IPD classifications through 13 weeks of the 1964 badge year:

Classification	Total Dose	No. of Employees	Average Dose/ Employee	Extrapolated Year End Average	No. of Employees Over 3R Extrapolated Exposure
Radiation Monitors	65886 mR	77	856 mR	3424 MR	59
Processing Operators	184643	239	773	3092	142
Pipefitters	94608	106	893	3572	71
Millwrights	83094	85	978	3912	56

Radiation Occurrences

Distribution by Reactor and Component

	B	C	D	DR	F	H	KE	KW	Totals
Processing	2	2	2	1	3	1	2	1	14
Maintenance			2	6	4				12
Special Outage Services	1	–	–	–	–	–	–	1	2
IPD Total	2	2	2	7	6	1	2	2	24

Vertical columns do not necessarily add up to the indicated totals, because, in some cases, a Radiation Occurrence is chargeable to more than one component.

Effluent Activity Data

The table below shows the average concentrations of selected radionuclides from reactor effluent samples taken during March, 1964. All units are 10^{-12} curies/ml.

Reactor	As^{76}	P^{32}	Np^{239}	Zn^{65}	Cr^{51}
B	150	12.9	300	10.8	330
C	120	17.2	260	18.3	750
D	80	14.5	130	14.7	520
DR	130	11.9	210	20.1	880
F	170	14.8	240	7.3	550
H	50	12.8	120	12.6	340
KE	50	9.0	70	7.9	150
KW	60	9.2	70	4.9	120

There were no significant changes in the treatment of coolant during the month of March, 1964.

PROCESS TECHNOLOGY

PROCESS STANDARDS

HW-46000 B, Process Standards - Reactor

Four revised standards were issued during the report period. These were:

Process Standard A-070 - "Thermal and Biological Shield Cooling Water"

The minimum low pressure alarm setting was specified as 35 psig and the maximum loop pressure was raised to 200 psig at the elevation of the lowest thermal shield cooling tube.

Process Standard C-020 - "Power Level Monitoring"

Use of the subcritical monitor is now required on all hot startups. Other subcritical monitor requirements added in this revision include: 1) a response check prior to a scram recovery attempt; 2) calibration and gain checks before each cold startup and during prolonged outages; and 3) subcritical monitor or equivalent device in service at all times during an outage. The power level was raised at which the first halt is made for a temperature map.

Process Standard F-010 - "Process Material"

The table of minimum flow versus time after shutdown was extended to high tube powers.

Process Standard G-010 - "Distortion of Graphite Moderator, Process Tubes and Reactor Shields"

Bowing measurement requirements were revised to obtain currently significant information. Probing and shield motion requirements were deleted.

HW-46000 D, Process Standards - Reactor

Two standards, A-070 and C-020, were revised as described under HW-46000 B, above.

HW-46000 F, Process Standards - Reactor

Four revised standards were issued during the report period: A-070, C-020, F-010, and G-101. These revisions were identical to those described under HW-46000 B, above, except probing requirements had previously been deleted from the F manual.

HW-46000 H, Process Standards - Reactor

Five revised standards were issued during the report period. Revisions to four of these standards, A-070, C-020, F-010, and G-010, were essentially identical to those described under HW-46000 B, above. The fifth revised standard was:

Process Standard A-010 - "Process Piping"

This complete rewrite specifies the action to be taken after detection of a faulty front- or rear-face component.

HW-46000 K, Process Standards - Reactor

Four revised standards were issued during the report period. These were:

Process Standard A-010 - "Process Piping"

This revision was identical to that described under HW-46000 H, above.

Process Standard C-020 - "Power Level Monitoring" and G-010 - "Distortion of Graphite Moderator, Process Tubes and Reactor Shields"

Revisions to these two standards were essentially identical to those described under HW-46000 B, above.

Process Standard K-040 - "Recirculation Operation - Fissionable Material Charged"

The coolant pump delta pressure trip setting was reduced 15 per cent.

HW-79800, Nuclear Safety Specifications - Production Fuels

HW-79800, "Nuclear Safety Specifications - Production Fuels," was issued during the report period. The manual provides criticality control specifications for Production Fuels Section.

PROCESS CHANGE AUTHORIZATIONS

Fourteen Process Change Authorizations were issued during the report period: eight to permit deviation from Process Standards - Reactor, HW-46000; four to permit deviation from Process Standards - Water Plant, HW-27155, Rev. 1; one to permit deviation from Process Equipment Standards, HW-41000; and one to permit deviation from PHTA IP-26-I. These were:

PCA #4-26 - "Graphite Temperature Limit - C Reactor"

Authorization was given for continued operation with graphite temperatures 25 C above the cold startup limit provided in-limit temperatures were achieved within 2-1/2 hours.

PCA #4-27 - "Steam-Driven Export Pump Outage - B Area"

Valving the 182-B building off the export system was authorized provided one D Area reactor was shut down; the D, H, and F steam-driven export pumps were on automatic with one of the three supplying normal export flow; procedures existed for restricting 200 Area and N Area export water flow within 15 minutes after a BPA power interruption.

PCA #4-28 - "Shipment of Eighteen Natural U Pieces from DR to C Reactor"

Shipment of irradiated slugs two days after discharge was authorized provided shipment by well car was completed in less than eight hours.

PCA #4-29 - "Graphite Temperature Limits - KW Reactor"

This process change authorized up to three days in which to get the graphite temperature within limits provided no helium reductions were made and efforts to promote in-limit operation were made as rapidly as the reactivity status permitted.

PCA #4-30 - "Emergency Cooling Water Requirements - KE-KW Reactors"

An extension of PCA #3-72 was authorized to accommodate extensive standards' revisions being made as a result of Design Change #772. PCA #3-72 provided requirements on V-72 valve operation and crossatie line flushing.

PCA #4-31 - "Panellit Gauge Identification - C Reactor"

An extension of PCA #3-135 was authorized to allow additional time for installation of the Panellit trip identification system. PCA #3-135 authorized use of a fuse device to identify Panellit gauge trips.

PCA #4-32 - "Steam-Driven Export Pump Outage - 100-D Area"

Removal of the D Area steam-driven export pump for necessary repairs was authorized provided the other three export turbines were automatically available and procedures existed for restricting 200 Area and N Area export water flow within 15 minutes after a BPA power interruption.

PCA #4-33 - "Restraining Device - Solka-Floc Fitting - DR Reactor"

Authorization was given to continue operating with a "hold-on" device installed on the Solka-Floc fitting on tube 3376 provided the cracked Solka-Floc fitting was replaced on the next minimum outage.

PCA #4-34 - "Reactor Front-Face Crossheader Check Valve Test - B Reactor"

The process change authorized testing front crossheader check valves at 75 psig while the reactor flow was through the crossunder line.

PCA #4-35 - "Dump Valve Functional Test Failures - KER 2 and 3"

Specialized requirements were provided in this PCA to authorize resumption of recirculation operation on KER loops #2 and #3 following a dump valve failure on loops #2 and #3.

PCA #4-36 - "Low Flux Monitor Readings - B Reactor"

Operation with two of four flux monitors reading between three and four major divisions on the least sensitive range was authorized by this process change.

PCA #4-37 - "High O_2 After Reactor Startup - B Reactor"

Low power level operation with O_2 content above the limit was authorized provided no increase in power level was made until O_2 content was decreased below the limit.

PCA #4-38 - "Steam-Driven Export Pump Outage - D Area"

Provisions of the PCA were identical to those for PCA #4-32, above.

PCA #4-39 - Flux Monitor Low Trips - K Reactors"

Extension of PCA #3-59 was authorized to provide time to obtain approval of a revised standard. PCA #3-59 provided supplemental requirements on flux monitor low-trip settings to aid in preventing an inadvertent ball drop.

TEMPORARY NUCLEAR SAFETY SPECIFICATIONS

TNS #5-64 - "Processing Solutions, Handling and Storage of Sludge Containing 1.008 w/o U-235 Enriched Uranium"

This TNS voids TNS #4-64. The requirements of TNS #4-64 were repeated with an additional specification that permits one tank to contain a limited residual of 0.947 w/o enriched uranium. TNS #4-64 provided specifications for criticality control during the processing of 1.008 w/o U-235 enriched uranium solutions and the handling, storage, and shipping of the resulting sludge.

PROCESS ASSISTANCE

One engineer audited conformance to Process Standards on all Processing Operations' shifts by making 28 inspections at each reactor during the report period.

FUEL FAILURE EXPERIENCE

Failure Date	Tube Number	Lot Number	Type of Material	Tube Power at Failure (kw)	Exposure MWD/T	Type Failure
4/3/64	3486-H	KY-589-B	I&E E (0.94%)	1326	785	SH
4/4/64	3059-H	KY-912-B	I&E E (0.94%)	1255	759	SH
4/4/64	2962-H	KY-604-B	I&E E (0.94%)	1267	776	SH
4/4/64	2057-H	KY-595-B	I&E E (0.94%)	1273	790	SH
4/5/64	2056-H	KY-578-B	I&E E (0.94%)	1322	788	SH
4/5/64	2058-H	KD-075-B[1]	I&E N	1309	809	SH
4/5/64	1785-H	KY-572-B	I&E E (0.94%)	1320	785	SH
4/6/64	0678-F	KY-497-B	I&E E (0.94%)	1249	62	SH
4/13/64	1681-C	KC-284-A	I&E E (0.94%)	1357	244	SH
4/15/64	3960-C	KC-285-A	I&E E (0.94%)	1270	239	SH
4/15/64	1189-F	KZ-044-B	I&E N	1261	555	UN
4/15/64	3257-DR	KY-606-B	I&E E (0.94%)	1283	349	SH

[1] Six-inch internally and externally cooled natural uranium element with attached water-mixer spool.

Failure Date	Tube Number	Lot Number	Type of Material	Tube Power at Failure (kw)	Exposure MWD/T	Type Failure
4/16/64	1958-D	KY-517-B	I&E E (0.94%)	1362	485	SH
4/22/64	2058-DR	KY-603-B	I&E E (0.94%)	1223	357	SH
4/22/64	2361-D	KZ-763-C	I&E N	1257	50	SN
4/23/64	2772-B	CZ-058-U	I&E N	1278	419	SH
4/24/64	3357-DR	KY-537-B	I&E E (0.94%)	1202	376	SH
4/28/64	3181-C	KC-285-A	I&E E (0.94%)	1373	419	UN
4/29/64	3788-DR	KY-603-B	I&E E (0.94%)	1265	439	SH

Legend:

I&E E - This is the symbol for internally and externally cooled production reactor fuel elements with uranium cores enriched in U-235. The fuel is irradiated in ribbed process tubes. The weight per cent U-235 in the core material is stated.

I&E N - This is the symbol for internally and externally cooled production reactor fuel elements of natural uranium. The fuel is irradiated in ribbed process tubes.

First Character

S	Side	Failure occurred on the side of the fuel element.
U	Unknown	Location of failure is not known.

Second Character

H	Hot-Spot	Failure caused by accelerated high temperature corrosion attack.
N	Not Examined	Failure has not been examined.

OPERATIONAL PHYSICS

PILE PHYSICS PLANT ASSISTANCE

All reactors operated either at the bulk temperature limit (smaller reactors) or the bulk power limit (K reactors) while at equilibrium during the report period. Flattening efficiency was near the preceding twelve months' average, but nonequilibrium losses were in general higher than average, largely due to a high frequency of ruptures. A new monthly production record was established at the KE Reactor.

Upon startup of H Reactor on 4-17-64, a rising period was achieved prematurely with six VSR's still in the reactor; the estimated difference between the indicated and calculated reactivities was approximately eight mk. From initial calibration measurements it was judged that temporary poison geometry effects had resulted in excessive shadowing; additional supplementary poison was loaded and reactor operation begun. Following observation of reactivity and flux distortions during four days' operation without temporary poison, it was concluded that a significant number of E-N columns in the upper half of the reactor were probably charged with excessive target element displacement downstream. The reactor was shut down on 4-23-64, and the offending 171 columns were replaced with the originally intended configuration.

The KW and DR Reactors have initiated a programmed inward movement of the enrichment ring (and thus a decrease in flat zone size) in independent efforts to optimize operating efficiency and total control status.

SUMMARY OF OPERATIONAL DATA OF PHYSICS INTEREST
FOR THE MONTH OF APRIL, 1964

Reactor	B	C	D	DR	F	H	KE	KW
ECT in April (1)	1490	1645	1505	1550	1490(3)	1545	2510	2370
12-Month Average ECT	1490	1655	1510	1535	1500	1525	2480	2450
Equil. Scram Time (2)	15-20	20-22	14-16	17-19	15-20	20-25	20-25(4)	20-25(4)
Recording Time:								
From:	3-21	3-17	3-21	3-24	3-20	3-19	3-19	3-20
To:	4-21	4-12	4-20	4-21	4-21	4-22	4-20	4-21

(1) Effective Central Tubes: This value is defined as pile power level divided by the average power of the ten most productive tubes in the reactor.

(2) This is defined as the maximum time in minutes which may elapse between scram and first indication while still permitting a successful scram recovery.

(3) This slightly lower value reflects the minor "deflattening" effect of the E-Q block (PT IP-659-AC; see F Reactor report below).

(4) Equilibrium scram recoveries are not attempted at the K Reactors.

B Reactor - C. E. Hughey

A shortage of 15 mk reactivity, observed at startup on 4-4-64, was attributed to a large amount of water in the graphite stack resulting from a major tube replacement campaign during the outage; subsequent drip-leg water collection (about 1100 gallons during a four-day period) substantiated this conclusion. Operation was difficult during the initial drying-out period due to the resulting flux distortion, and shift physics coverage was provided to assist in the process. However, after the reactor reached equilibrium with the stack dry, operation was quite stable.

C Reactor - J. R. Heald

Subsequent to the startup of 3-27-64, operation was smooth and continuous during the report period.

A program for upgrading process pumps by rewinding the motors will be carried out during the summer months; the coolant flow reduction of five per cent resulting from taking one pump out of service at a time should cause no significant physics problems.

D Reactor - R. L. Miller

The reactor was down for tube replacement for over two weeks in the middle part of the report period, following a long run with stable operation. During the subsequent startup, however, there were two unscheduled shutdowns, a rear-face pigtail leak, and a potential graphite temperature problem. The latter involved the persistence of high temperatures in the location of graphite stringer number 3484, in a region of the reactor not otherwise near limits; a requested PCA was not required, however, as maximum graphite temperatures were brought back within limits by rod manipulation prior to expiration of the normally allowed interval following startup.

DR Reactor - S. M. Skidmore

The shutdown on 4-15-64, due to an enriched element rupture, terminated (two days early) a continuous run of 27 days' duration. Flattening efficiency was excellent throughout the run.

In keeping with a recommendation by the Process Physics Studies specialist on reactor efficiency (and based upon operational flux traverses), the enrichment ring is presently being moved inward by 1-2 lattice units. The move is expected to enhance total control and operating control flexibility and to save slightly on E-metal requirements with little or no loss in flattening efficiency.

Two minor operating adjustments were instituted at the request of the assigned physicist as a means of decreasing the rupture potential in near-side enrichment columns. The rod pattern was changed to eliminate B and 9 (upstream rods) from the operating configuration, and 33 near-side enriched charges

were displaced 16 inches upstream. The resulting upstream flux peaking should satisfactorily reduce the rupture potential.

F Reactor - G. C. Masche

With the exception of two unscheduled shutdowns due to fuel element ruptures (one natural and one enriched) operation was quite smooth, and power level was limited only by bulk outlet temperature during most of the report period. Slight modifications in the equilibrium rod pattern have been instituted as a step toward reducing rupture potential by peaking the flux slightly upstream.

A minor design change (F64-5) detailed the placement of a cam on number 4 half-rod, which engages the all-in limit switch when the rod is positioned at 140 inches; this prevents the inadvertent full insertion of the rod, which could conceivably cause a temperature excursion due to the reactivity increase. This restriction enhances nuclear safety by helping to ensure that the rod is always in its optimum position for total control during outages.

A supplement to PT IP-659-AC, which authorized the loading of the E-Q (Thorium Oxide) core, was put into effect during the outage of 4-15-64. This supplement specified the charging of striped charges of Bismuth and Li-Al to replace some of the Q columns scheduled for discharge, thus effectively preventing the premature discharge of over 100 columns of E-metal.

H Reactor - E. L. Conner

A high rupture potential prompted the decision to discharge the E-N central blocks slightly ahead of schedule. During the ensuing outage, 1500 columns were recharged and 146 tubes were replaced. On the subsequent startup, a supercritical state was achieved with six vertical safety rods remaining in the reactor. Checks on VSR-worth variations were made, and the reactor was shut down for the charging of additional poison; after approximately 50 splines were charged, the reactor was again started up.

Distribution control requirements plus extensive flux traversing during subsequent operation indicated a severe flux peak in the top-front portion of the reactor, sufficient to result in a 5-10 mk error in evaluating poison worth. Several possibilities to explain such a distortion were considered; the most probable appeared to be a charging error which effectively placed excessive poison (in the striped E-N charges) downstream of center, leaving a quadrant (the top-front) with an excess of enriched fuel.

An outage was taken on 4-22-64 to investigate the charge makeup in the selected tubes; the expected nonconservative placement was discovered to exist, and the affected 171 columns were discharged and recharged with the proper configuration.

KE Reactor - G. D. Baston

The first half of the report period was characterized by stable operation and excellent flattening efficiency, the shutdown on 4-1-64 terminated a

34-day run of continuous operation, during which a monthly production record was established of uninterrupted operation at the maximum allowable level for a 31-day month.

Startup efficiency following the scheduled outage was limited by three unscheduled shutdowns due to RTD failure and spline breakage. The third shutdown of the series required hot startup methods and was adversely affected by a minimum of excess reactivity available for control rods and a resulting significant flux distortion. The recovery attempt was finally relinquished and the reactor shut down for a minimum cutage. The subsequent startup was uneventful, and subsequent operation was smooth.

KW Reactor - A. W. Medcalf

Flattening efficiency has been lower than normal due to a planned reduction in enrichment inventory. Startup efficiency has, on the other hand, shown a marked improvement. A PCA for operation with high graphite temperatures was necessary for a short time due to an incorrect interpretation of the normal startup allowance; the offending stringer was brought back into limits within seven hours, however, with maximum graphite temperature never more than 20C outside normal limits.

PROCESS PHYSICS STUDIES

Reactivity and Safety Control Studies

During the H Reactor run of April 19-22, special analog cases were run for calculating the H Reactor total control status. Longitudinal flux traverse data were used to establish empirical bucklings in the overly-reactive region in the top-front of the reactor. These studies indicated that total control conditions were satisfied with the 45-rod H Reactor VSR pattern in the distorted loading configuration which existed at that time.

A study of K4E and C3E fuel types for use as C Reactor enrichment indicates that the nominal increases in enrichment and total control requirements because of the greater localized water-loss effect could be feasibly handled in the C Reactor.

Computer survey studies with the 9-ANGIE program are being normalized to K Reactor startup information. Calculated results have been close to observations for the unenriched cases; the next step will be comparison of enriched reactor computations with startup case observations. Preliminary compilation of a program for calculating reactivity transients, both long and short term in up to 15 regions, has been accomplished; refinement of this code, named TRANSCRIT, with the intent of eventual routine plant assistance use, is planned as time permits during the next several months.

A report on the ZTM grid size study for C and H Reactors has been completed as HW-82008. Log-N period calculations are proceeding using the Trip 005 program in which various excursion cases may be run against varying startup sensitivities.

Control Efficiency Studies

The second core load and the first fringe load (excluding two columns) of Thoria were discharged from F Reactor during the outage of 4-15-64. The core block was slightly less reactive than anticipated (probably due to the shortened charges), but no operating problems were encountered.

Startup losses for the first quarter of 1964 averaged 0.227 equilibrium day (0.232 for the five smaller reactors and 0.221 for the C and K Reactors) compared to 0.27 (0.25 and 0.28) for the same period in 1963. Nonequilibrium loss calculations have been revised in order to obtain more consistent data. In place of the cutoff for nonequilibrium losses at the first midnight following attainment of 97 per cent of previous equilibrium level, the cutoff will be made at the exact time the power level reaches the 97 per cent value. This change will also affect level-operated efficiency values slightly.

Shield Attenuation Studies

Gold foils were replaced in the far side biological shield observation plugs at D and DR Reactors. The previous foil at D was lost, and access to the monitoring plug at DR had been blocked by the DR gas loop.

ICARIUS, a program to calculate theoretical shield leakage data, has been modified so as to permit variance of the deterioration coefficient of the basic equations and thus to match the observed data. The program has also been set up to machine-plot the results directly onto graph paper.

TESTING

IRRADIATION TESTING

Irradiations - Sample and experiment irradiations were handled as follows:

Reactor	Test Hole	Facility	Request No.	No. of Samples	Material-Purpose
F		Process Channel	HAPO-098	40	Graphite (burnout rate determination)
C	Y	Bare Channel	HAPO-177	5	Graphite (irradiation damage study)
KW	2A	Quickie	HAPO-184	20	Washington Designated Program
KE	2D	Quickie	HAPO-184		Washington Designated Program
KW	3674	General Purpose	HAPO-222	1	Uranium (swelling test)
KW	2A	Quickie	HAPO-223	1	Cobalt (radiography source)
KW	3A,3C	General Purpose	HAPO-236	3	Zirconium (creep rate study)
KE	2D	Quickie	HAPO-252	2	Arsenic (tracer isotope production)
KE	2D	Quickie	HAPO-254	1	Thorium (activation analysis)
C	A	Bare Channel	HAPO-259	1	Inconel (fast neutron damage study)
KW	4B	Snout	HAPO-273	2	Wave Guide (candidate neutron detector evaluation)
KE	2D	Quickie	HAPO-271	2	Sodium (tracer isotope production)
KE	2A	General Purpose	HAPO-278	1	Lithium (high temperature evaluation)
KE	2A	General Purpose	HAPO-291	1	Zirconium (hydriding corrosion rate)
C	2B	Bare Channel	HAPO-292	2	Sugar-graphite (VSR channel sealing material evaluation)
C		Overbore Tube	HAPO-283	2	Thorium (evaluation of U-232 production)
KW	4B	Snout	HAPO-297	1	Boron-graphite (Fermi reactor graphite evaluation)
KW	3D	General Purpose	HAPO-301	1	Chemonuclear Test Loop
KE	2D	Quickie	HAPO-302	1	Zeolites (neutron damage study)
KE	0065	General Purpose	NAA-115	1	Uranium-zirconium (SNAP-8 fuel element study)
KW	0065	General Purpose	ORNL-184	35	Beryllium-nitride (C^{14} production)
KE	2D	Quickie	Reed College	4	Tissue (cancer research study)

Borescoping Activities - In-reactor channels were examined with a borescope as follows:

Reactor	Channel	Motion Picture Record	Purpose*
C	VSR #28	No	2
D	VSR #34	No	2
D	VSR #24	No	2
B	VSR #21	Yes	1
B	VSR #32	Yes	1
B	VSR #15	Yes	1

*1 - HCR-VSR channel problem
2 - Maintenance support

Vertical Bowing - Vertical displacement measurements were taken as follows:

Reactor	Channel or Tube	Comparison to Previous Data
KW	Y-2	Down 0.16 at 24' since 11-63
D	4674	Down 0.02 at 20' since 1-64
H	4674	Down 0.10 at 19' since 1-64
B	4574	Down 0.02 at 19' since 1-64

Spline Traverses - Front-to-rear flux distribution data were taken as follows:

Reactor	No. of Tubes
C	7
F	15
H	41
KW	8

C-1 Loop Operation - (High Temperature Aluminum Corrosion Studies, PT-IP-623-D) - Test No. C-1-2 was completed and discharged. Test No. C-1-3 was charged and operated a few days at reference conditions before the loop transferred to process water coolant. This test was discharged because corrosion in process water would mask the corrosion in high purity water. Test No. C-1-4 was charged and is now operating at reference conditions of 500 F and low pH.

COMPONENT TESTING

Irradiated IPD Fuel Examination, 105-C Facility - Examinations were completed on fuel elements from 40 tubes requiring 6575 individual examinations.

No. of Tube Charges	Production Test
20	IP-216-A, Evaluation of Performance of Normal Production I&E Fuel Elements
1	IP-476-A, Irradiation of Fuel Elements in Tube 2952 KE
10	IP-572-A, Effect of Eccentricity on the Irradiation Behavior of KVNS Fuel Elements
9	IP-610-A, Evaluation of Induction Heat Treated Fuel Cores

Nine fuel elements from PT IP-546-A, Irradiation of Hot-Die-Sized Diffusion-Bonded Fuel Elements, were shipped to Radiometallurgy for further detailed examination. Photographs were taken of failed fuel (ruptures) at C, F, and H Reactors.

Irradiated N-Fuel Examination, 105-KE Facility - Profile measurements were done as follows:

Number of Elements	Kind	Measurement Status	Tube and Discharge Date	
13	Outer	Completed	KER-4	1-23-64
3	Outer	Completed	KER-3	6-18-62
13	Inner	In progress	KER-4	1-23-64

Irradiated Process Tube Measurement

Wall Thickness Gauge (eddy-current type) - WTG

Reactor	No. of Tubes Measured	Report No.	HW No.
B	22	14	81448
C	42	15	81639
D	168	16	81707
H	556	17	81951
C	17	18	81952
Total	805		

Sector Gauge (eddy-current type) -SG

Reactor	No. of Tubes Measured
B	11
C	4
D	28
H	3
Total	46

Ex-Reactor Visual, Weight, and Micrometer Measurement

Reactor	No. of Tubes	Tube Samples Measured	Reason Examined
B	4	144	2 - sector gauge calibration 1 - leaking 1 - corrosion evaluation
F	2	63	sector gauge calibration
KW	1	36	evaluation of tube condition requested by Processing

Panellit System Programs

Gauges repaired, calibrated by Maintenance	- 15	
Gauges meeting calibration criteria	- 12	(80%)
-previous month	-	(83%)
In-board Bourdon coil examination	- 2004	
Non-leaking coils	- 2004	(100%)
-average rate past two years	-	(99.8%)
Gauges receiving failure analysis	- 38	
2B-X1 switch examination	- 603	
-acceptance rate	- 572	(95%)
-previous month	-	(94%)
Gauges received from vendor and examined	- 590	
-acceptance rate	- 551	(93%)
-previous month	-	(91%)
Gauges received from Central Maintenance and examined	- 472	
-acceptance rate	- 399	(96%)
-previous month	-	(93%)
Interconnecting lead examination	- 750	
-acceptance rate	- 700	(93%)

Six hundred forty two gauges were removed from panels for new gauge installation and prepared for shipment to the vendor as exchange gauges.

COOLANT TESTING

KER Loop Operation

KER-1 - Testing of four stainless-steel-clad crud probes and four 17-inch NIE1 fuel elements as authorized by PT IP-601-D was completed with the

discharge of the loop April 1. The loop was recharged with eight 12-inch KSE5 fuel elements and a thermocouple train assembly as authorized by PT IP-544-A. The objective of this test is to evaluate the swelling behavior of Zr-2 clad thick-walled enriched uranium tubular elements at high uranium temperatures. The loop pressure was lowered to 460 psig and tube outlet temperature to 150 C April 10 because of a piping leak between the pressurizer and the vent control valve. The charge described above was replaced with an identical charge on April 27.

KER-2 - Testing of four NIE1 fuel elements, two 18-inch lithium-aluminum target elements and one Zr-2 clad thorium-uranium crud monitor as authorized by PT IP-536-A, Supplement D, IP-584-D, Supplement A, and IP-644-D was completed with the discharge of the loop April 1. The loop was recharged with eight 12-inch KSE5 fuel elements as authorized by PT IP-544-A.

KER-3 - Testing of thirteen 26-inch co-producer elements as authorized by PT IP-645-D continued. The objective of this test is to demonstrate and characterize multi-product production by the irradiation of simulated N Reactor co-product fuel assemblies. The loop is being operated at temperature and pressure conditions authorized by PT IP-638-D.

KER-4 - Testing of a Zr-2 clad thorium-uranium crud monitor and ten 23-inch NAE1 fuel elements as authorized by PT IP-644-D and IP-477-A was started. The loop was charged April 1 and is being operated on single-pass until the pressurizer is replaced. The objective of this test is to demonstrate and evaluate the design of the proposed N Reactor fuel surface crud monitor.

Single-Pass Tube Operation - 1706-KE

Tube	Production Test	Water Supplied	Corrosion Inhibitors & Chemical Additions	pH
SP-1 (2952)	IP-476-AL	Process	1.8 ppm dichromate	6.6
SP-2 (3050)	IP-604-A	Service	2.0 ppm sodium nitrite 1.0 ppm silicon dioxide	6.6
SP-3 (4355)	IP-520-A	Pilot plant*	1.8 ppm dichromate	6.6
SP-4 (4456)	IP-520-A	Pilot plant*	1.8 ppm dichromate	6.6
SP-5 (4557)	IP-604-A	Service	2.0 ppm sodium nitrite 1.0 ppm silicon dioxide	6.6
SP-6 (4863)	IP-604-A	Service	2.0 ppm sodium nitrite 1.0 ppm silicon dioxide	6.6
SP-7 (4963)	IP-449-A	Deionized	None	
SP-8 (5063)	IP-449-A	Deionized	None	

*Began adding 20 ppm ferric sulfate at the pilot plant head house March 18 as an additional flocculating agent. The balance of the flocculating agent is aluminum sulfate and pH is controlled by adding sulfuric acid.

KE Reactor Outage Time Requirements

No unscheduled outages were charged to production testing. A total of 5.5 outage hours was charged to production tests as listed below:

Production Test	Description	Hours
IP-544-A	Charge-discharge KER-1 and KER-2 Repair rear gasket leak on KER-1	4.5
IP-644-A	Charge KER-4	1.0

Out-of-Reactor Facility Operation

TF-1 - Testing continued for obtaining cyclic corrosion data on the effects of the alkaline permanganate-inhibited sodium bisulfate decontamination process on an NPR process tube-to-nozzle rolled joint specimen. Prefilming operating conditions are 1650 psi, 300 C and pH 10.0 adjusted with ammonium hydroxide.

TF-2 - Testing to evaluate crevice corrosion beneath Zircaloy-2 fuel element supports and testing of NPR steam generator tubing was completed April 22.

TF-3 - Testing to evaluate crevice corrosion beneath Zircaloy-2 fuel element supports was completed March 27.

TF-4 - Testing to obtain cyclic corrosion data on the alkaline permanganate-inhibited sulfamic acid decontamination process continued. Prefilming operating conditions are 1600 psi, 300 C and pH 10.0 adjusted with ammonium hydroxide.

TF-7 - Fretting corrosion testing of various materials continued. Operating conditions are 277 C, 1125 psi and pH 10.0 adjusted with lithium hydroxide.

The test sections contain the following material:

1. A PRTR fuel element for fretting corrosion studies
2. Two dummy Zircaloy-2 clad elements for uniform corrosion testing of supports
3. Two NIN1 fuel elements for uniform corrosion testing
4. One KSE3 fuel element for uniform corrosion testing
5. Two 26-inch co-producer elements for support fatigue testing
6. A sample holder containing stressed samples of Admiralty metal and 70-30 cupro-nickel alloy for intergranular corrosion testing
7. One Zircaloy-2 specimen for caustic attack testing
8. Stainless steel and Inconel coupons to be prefilmed for decontamination testing

TF-20 - Testing to determine the effects of heat transfer on aluminum corrosion in process water and the cause of resistance temperature detector corrosion and the effectiveness of various coatings continued. Operating conditions are 120 C, 9.5 gpm flow and pH 6.0.

Legend - Fuel Elements

NIE1 - N Reactor, inner tube, enriched, first model
NAE1 - N Reactor, assembly - tube and tube, enriched, first model
NIN1 - N Reactor, inner tube, natural, first model
KSE3 - KER Loops, single tube, enriched, third model
KSE5 - KER Loops, single tube, enriched, fifth model

O. H. Greager
Manager, Research and Engineering

FACILITIES ENGINEERING

DESIGN ENGINEERING

Vertical Safety Rods - Graphite Distortion

Two different configurations of sleeves have been designed for the VSR channels at K Reactors. The sleeves will be of high strength graphite identical to that used for the sleeves at C Reactor. A purchase order has been processed for procurement of two sets of prototype sleeves.

Boroscoping of VSR channel No. 41 at C Reactor revealed that material obstructing the channel was composed of Ball 3X balls imbedded in metallic matrix. A sample of the metal was obtained and analyses showed the major constituent to be lead with a .01 to 1 per cent bismuth, iron, molybdenum and nickel. Studies were initiated on the feasibility of modifying tools and equipment at C Reactor and fabrication of new equipment, where necessary, in preparation for sleeving at the K Reactors.

Process Piping System Studies

These studies include metallurgical and radiographic examination of selected material samples of the various process water systems, as well as visual inspection of pipeline interiors, supports, and hangers, dye-penetrant examination, and vibration and stress analysis.

A development test describing the removal of circular plugs and spool pieces from process piping in 100-B Area for preparation of metallurgical test specimens has been approved and issued. Installation of strain gages and vibration detection equipment at 100-D has been initiated.

Power Recovery Study

Study I report document, HW-81667, was issued. The results of these studies indicate that economic feasibility of conversion of an existing Hanford reactor to power generation is strongly dependent upon the market for electric power and the isotopes that are produced. Conversion is generally feasible, but additional testing and development work will be required to firmly establish the technical problems involved.

Study II of the power recovery program involves the application of modified heat recovery concepts to the basic power recovery system. The purpose of these modifications is to reduce the capital and unit power costs. The two most promising concepts being studied are (1) in-reactor boiling with 30 per cent steam quality at the reactor outlet, and (2) nuclear superheat.

Zirconium Tube Installation - K Reactors - Design

The problems previously experienced in obtaining satisfactory impact extrusions for producing the 600 aluminum inlet nozzles have been resolved. Seventy-eight suitable extrusions have been produced and the supplier indicates ability to furnish nozzles as required to meet the scheduled reactor outages in July.

100-K Reactor Coolant Backup System

Investigations to determine the effects of corrosion on the adequacy of coolant backup flow continued. As a means of overcoming the friction due to corrosion, tests were run to determine feasibility of increasing coolant flows by an increase in diesel pump speed. Results indicate that flow increases up to four per cent may be expected without detriment to pump or driver. Further evaluation is in progress.

Small Reactors - Emergency Coolant Backup Systems

The proposed deactivation of three smaller reactors has necessitated a modified approach to the problems of providing adequate emergency coolant backup to the operating reactors. The current study proposes a system which will include diesel engine-driven backup pumps at 182-B to provide emergency coolant backup to the B and C Reactors and piping modifications as required to make the 100 B/C backup system independent of the export water system. Additional steam turbine-driven pumping units will be installed at 182-B and 182-D to ensure dependable water supply to the 200 Areas and, in the case of the additional pumping capacity at 182-D, to provide a secondary water supply to the 182-B reservoir.

Radioactive Materials Shipping Cask Design

This program was initiated to evaluate design of presently used radioactive materials shipping casks with respect to proposed government regulations concerning such shipments. The design of existing casks has been evaluated, and deviations from the proposed regulations are described in Document HW-77771, "Evaluation of HAPO 13 and HAPO 14 Casks for Off-Site Shipment of Radioactive Isotopes."

Deactivation of Auxiliary Facilities

Information has been developed for a project proposal associated with deactivation of DR, F, and H Reactors. The Hanford Laboratories Animal Farm facility at 100-F Area, and the administrative and shop facilities at 100-H Area would be retained in service after the reactors are deactivated. This would require the provision of heat by package boiler units. Sanitary water would be supplied by converting the export line from D Area to a sanitary water line.

 [redacted]

EQUIPMENT DEVELOPMENT

Self-Supported Fuel Element (SSFE) Charging

The third SSFE charging machine built by the Union Machine Works, Inc., has been received at HAPO and is undergoing final check-out prior to on-reactor use. Additional work will be required to standardize the three machines. Development effort has been terminated except for occasional consultation with Manufacturing Section.

Prototype High Speed Scanner

System repair necessitated by the March 5 power supply failure has not been completed due to slow delivery of replacement parts.

K Reactor Resistance Temperature Detector (RTD) Corrosion

Investigative effort to determine causes and corrective action of RTD corrosion were continued. An automatic Polaroid camera for recording the degree of corrosion of RTD stems has been received and is being assembled into a portable, contamination-controlled enclosure. The test loop, fabricated in the 189-D Building to simulate on-reactor operating conditions, is nearing completion. The system will be ready for initiation of testing when minor piping runs are completed. Stainless steel simulated RTD stems have completed approximately 400 exposure hours of stress chloride cracking tests. Three of the six groups of test specimens have failed. The first group to fail had been heat treated in a similar manner as that proposed by the RTD manufacturer. Alternate heat treatments appear to produce a better service life in our environmental conditions. On-reactor tests of ceramic coated RTDs are continuing.

Intermediate Range Neutron Monitoring

The intermediate range thermal neutron flux monitoring chamber installed in F Reactor on December 6, 1963, has operated without system failures. Preliminary studies have been initiated to determine if two-inch O.D. gamma compensated thermal neutron sensitive ion chambers can be fabricated for use with the system. If successful, three chambers could be installed in the same reactor side hole. This arrangement has the two-fold advantage of chamber exposure to nearly identical flux field and a significant reduction in the number of holes required for chamber installation.

Dose Rate Telemetry

A specification delineating requirements for a prototype dose rate telemetry monitoring system has been completed and procurement action initiated. Additional development effort will be contingent upon receipt of the prototype system.

Design Test Service

The N-Reactor program utilized 911 hours of engineering effort for design test service.

[redacted]

PROJECT ENGINEERING

CGI-103, Fuel Element Charging and Handling System, KE and KW Reactors

Two of the four fuel magazine hoists have been installed on the "C" platform in 105-KW. The final charging machine was received.

Dow Chemical Company submitted the only bid for magnesium magazines. Since they take several exceptions on dimensional tolerances, they were requested to find some local shop to provide finish machining. When this order is placed, all engineered equipment for the project will have been ordered.

CAI-105, Modifications for Use of Bauxite, KE and KW Water Plants

Recent efforts of the Production Subsection in Manufacturing have resulted in discovery of alternate bauxite sources which will permit substantial savings in raw material costs. The Al_2O_3 content, the active ingredient essential to our process, is somewhat higher than in the case of our present bauxite source. Its use will necessitate modification of our equipment design.

A revision to the Design Criteria has been made, reflecting the basis for our changed equipment requirements. The Design Criteria document has been approved by the Project Representatives and has been routed to the Design Council for approval prior to submittal to RLOO-AEC.

CAI-108, Emergency Storage Basin Coolant

Design for 100-K and 100-B/C Areas has been completed by the Vitro Engineering Company and approved by GE-HAPO for compliance with the requirements of the Design Criteria. Design of the facility for 105-D has been resumed and drawings have been revised to remove those portions of design pertaining to 105-DR.

Project Proposal, Revision 1, prepared by RLOO-AEC April 15, 1964, and approved April 30, provides that authorization be reduced to Titles I and II design for 100-B, C, D, KE, and KW, with the intent that the project may be reactivated at some future date.

CGI-125, Replacement and Improvement of Fixed Gamma Radiation Monitoring Instrumentation - Existing Hanford Production Reactors

A procurement specification and requisition for purchase of the required logarithmic radiation monitor have been submitted to RLOO-AEC for procurement action.

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

All design drawings have been issued except for two, completion of which is contingent on reissue of design tests being performed on prototypical rear face piping connections for pressure and temperature sensing devices for safety circuits.

Installation of conduit is proceeding on the 27-foot level, 1706-KER. Shop fabrication of the neutron monitor moderator tanks is in progress.

Load cells were delivered to Byron-Jackson April 15 for testing of canned rotor Pump No. 560 for determination of failure mechanics.

CGI-861, Expansion of Electrical Distribution Systems, 105-B, D, and F

Final Acceptance was obtained on April 3.

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

The last 1500 HP motor, No. 6-19V2039, was removed from No. 5 low lift pump and shipped to Westinghouse for a general overhaul. It will be used for a spare.

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

Final Acceptance was obtained on April 3.

CAI-940, Installation of Oil-Burning Facilities in Lead Boiler, 184-B

RLOO-AEC has not acted on revised criteria and drawings submitted in March.

Project Proposal, Revision 3, prepared by RLOO-AEC April 15 and approved April 30, provides that authorization be reduced to Title I design, with the provision that the project may be reactivated at some future date.

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

The brake order was placed and sufficient brakes for one reactor are expected by early July. Negotiation of an order for sprockets, delayed until detailed cost data could be obtained from the prospective vendor, was completed April 28.

A project proposal revision reducing the scope from eight to five reactors, reducing the estimate from $1,800,000 to $1,200,000 and extending the directive completion date from June 30, 1964 to December 31, 1965, has been approved by RLOO-AEC.

MJA-42, Interior Painting, Process Water Storage Tanks, B, F, H, DR, and C

The first coat has been applied to the No. 1 tank at 190-B, and the No. 2 tank at 183-C was drained and scraped.

MAJ-47, Pressure Monitor Modification and Repair, 105-B, D, DR, and F

	Gages Installed		Yet	
	Period	To Date	To Do	Available
105-B	--	1994	Complete	29
105-D	368	1525	475	59
105-DR	--	[redacted]	Complete	51
105-F	84	[redacted]	102	53
	452	7391	577*	192

[redacted]

*The Commission was requested to effect a reduction of 96 in the number of gages to be supplied in view of the pending shutdown of reactors.

AR-P-25041, Portable Television Equipment for Eight Reactors

The four faulty zoom lenses, which had been returned to the vendor, were repaired and returned to HAPO.

All power leads to this equipment had been installed backwards by the vendor. This caused the ruin of one pan and tilt control, which was returned to the vendor for repair. The power lead installations in all other units were corrected on site.

Project Proposals Submitted to RLOO-AEC

CGI-960, Rev. 1 , "C" and "D" Work Platform Safety Improvements, Five Reactors.

Directives Received

EQT-003, Mod. 1, Modification for Use of Bauxite, KE and KW Water Plants, CAI-105.(Authorized total project funds - $270,000.)

CPFF Construction Service Contractor-Liaison

Issued six new work orders and supplemented four old jobs, for a total of $172,577 to J. A. Jones Construction Company.

Plant Forces Work Review

The Labor Standards Board approved five jobs for assignment to plant forces, estimated to cost $848,573.

 [redacted]

REACTOR PLANT DEACTIVATION

Expenditure patterns were developed by quarters for deactivation activities, both capital and expense. These were transmitted orally to RLOO-AEC.

The critical path schedule was further developed and was revised and re-issued April 23, 1964. Arrangements were made to obtain assistance from Applied Reactor Engineering in maintaining the schedule up to date.

Criteria have been developed for fire protection to be provided for facilities after their deactivation.

General format for deactivation procedures, both for the standby condition and for abandonment, has been selected. Sample procedures in each of the major disciplines -- mechanical, electrical, instruments, and structural -- are in preparation.

The Randolph Engineering Company which expressed an interest in providing services in connection with our deactivation program, has not replied to our letter of March 27, 1964, stating that our interest is limited to consulting services. Shell Oil Company, Combustion Engineering, and Puget Sound Naval Shipyard have provided information on layaway methods and preservative materials.

Manager, Facilities Engineering

RT Jessen:dgm

[redacted]

[redacted]

FINANCIAL

ACCOUNTING

An analysis of the recently completed K reactor zirconium tube program which outlined the Department accomplishments in minimizing cost and production loss was prepared. The completed retubing and associated maintenance work in the K reactors was accomplished at a cost of approximately $5.2 million, about $2.3 million under the initial estimate. Major factors contributing to this reduced cost were:

1. Reduced personnel requirements due to effective decontamination of rear face hardware.

2. Increased utilization of manpower through planning and scheduling the use of special outage crews between K tube outages.

3. Lower procurement cost for zirconium tubes.

4. Reduced maintenance materials cost for gunbarrels, gas seal work, nozzles and other components primarily due to reduced spoilage through development of improved techniques for disassembling and installing hardware and tubes and by emphasis on craft training.

5. Completion of program about 25 percent ahead of schedule.

Physical inventory of fixed property on memo records for 108-B, 185-B and 186-D were completed. Inventory results have been included into the mechanized plant and equipment record system. All IPD fixed and movable plant and equipment is now recorded on the mechanized system.

AUDITING

During the month revisions of eight Department and four HAPO OPGs were issued. The new HAPO OPG 4.3, Use of Federal Standard No. 186, covering the marking of valves, fittings, flanges and unions used in nuclear reactor systems was issued. Because purchase routines are affected, the attention of Section Managers was directed to certain provisions of the OPG 4.3.

[redacted]

[redacted]

AUDITING (CONTINUED) [redacted]

The following revisions or new issues of Government instructions were reviewed:

AEC Manual Chapters	19
AEC Procurement Instructions and Regulations	3
Federal Procurement Regulations	3

A review was made of the payroll folders of the Department nonexempt employees whose job classification requires the signing of the Employee Patent and Confidential Information Agreement. Action was taken to obtain signed agreements for sixty-one employees.

R. E. Thomas
for Manager-Finance

RW McMichael:WKH:slb

SIGNIFICANT REPORTS ISSUED

Number	Class'n	Author	Date	Title
HW-80789	Conf.	WR Thorson	3-5-64	Reactor Plant Electrical Facilities Modifications, General Equipment Projects
HW-81333	Unclass.	LB Brinkman JE Boyd	3-30-64	Auxiliary Process Pump - 183-B
HW-81331	Unclass.	LB Brinkman PF Mercier	4-10-64	DT IP-664-AE, Removal of Circular Plugs & Spool Pieces from Process Piping for Metallurgical Testing 100-B Area
HW-81806	Unclass.	LB Brinkman	4-14-64	Project Representatives Meeting No. 1, Project CAI-976, Fence Relocation 100-B and 100-D Areas
HW-80603	Secret	BW Herrman	3-16-64	Budget Facilities Description - Intermediate Range Instrumentation
HW-81192	Conf.	PH Hutton	3-12-64	Budget Facilities Description By-Product Horizontal Control Rod - All Reactors
HW-81476	Secret	BW Herrman	3-24-64	Meeting Minutes - Intermediate Range Instrumentation - Program Representative Meeting No. 1, March 20, 1964
HW-81641	Unclass.	PH Hutton	4-8-64	Status - HCR System Renovation - All Reactors
HW-80940	Unclass.	HF Jensen RG Geier	2-19-64	PTA-IP-662-AE, Chemical Clearing of Thermal Shield Coolant Piping, H Reactor
HW-81517	Unclass.	JM Goff, Jr.	3-27-64	DT-1199 - RTD Cable Qualification Test (Markel-916)
HW-81588	Unclass.	JM Goff, Jr.	3-30-64	DT-1199 - Report of Qualification Testing for RTD Cable, Prestolite Reels 1 - 3 (GE-9025, Catalyst No. 1)
HW-81552	Unclass.	JM Goff, Jr.	3-30-64	DT-1199 - Report of Heat Aging Test for RTD Cable - Prestolite Catalyst II (1,000 Ft. lot)

Number	Class'n	Author	Date	Title
HW-81656	Unclass.	RK Smith	4-3-64	DT-1150, Rev. 1, Final Report - 105-K Reactor Flexible HCR Fatigue Test, Ten-Foot Section
HW-81769	Unclass.	M Pociluyko	4-14-64	DT-1085 - Addendum NPR Inlet Valve Reverse Flow Test; Report of Test Data
HWS-5991 Rev. 3	Unclass.	GL Erickson	3-5-64	Procurement Specification for A Logarithmic Radiation Monitor
HW-82008	Secret	WL Stiede	4-27-64	Zone Temperature Monitor Study Grid Size for C and H Reactors
HW-82059	Secret	WN Mobley	4-24-64	Production, Receipts and Inventories
HW-80604	Secret	WN Mobley	4-21-64	Production Forecast, April 1964 through December 1965
HW-82041	Secret	WN Mobley	4-24-64	Bismuth Procurement
HW-82040	Secret	WN Mobley	4-24-64	Special Size - Lithium Aluminum Rod
HW-82062	Secret	WN Mobley	4-24-64	Uranium Delivery Schedule
HW-82011 RD	Secret	HC Money	4-24-64	Production Assumptions and Schedules
HW-81001 C	Secret	WN Mobley	4-3-64	Irradiation Processing Department, Production Fuels Section Monthly Report for March 1964
HW-80660	Secret	HC Money	4-1-64	Monthly Historical Report, Materials
HW-81623	Secret	WN Mobley	4-1-64	Uranium Deliveries, Third Quarter FY 1964
HW-81615	Secret	JT Stringer M Lewis JE Minor	4-7-64	Report to the Working Committee from the General Electric Company-Hanford

 [redacted]

Number	Class'n	Author	Date	Title
HW-80516	Unclass.	GF Jacky PL Lee	1-23-64	Report of Invention--A Device for Rotating Symmetrical Objects in Chemical and Electro-Chemical Treatment Baths
HW-78869	Conf.	CA Strand	1-14-64	End Closure of Hot Die Size Diffusion Bonded Fuel Elements
	Conf. Undoc.	JT Stringer TW Ambrose	3-26-64	Budget for FY-66 and Revision of FY-65, IPD, 02 R&D
	Unclass.	GA Huff	4-20-64	Interim Report No. 3, "T" Section K5 Fuel Self-Support
HW-81512	Conf.	LD Gustafson	3-31-64	Predicted Flows for 100-K Coolant Backup
HW-81723	Unclass.	JD Ryan	4-8-64	Inner Coating of Solids Feed Tanks (this affects the 190-C and 190-H Buildings and the valve pits of the remaining reactor buildings)
HW-81748	Unclass.	LD Gustafson	4-7-64	PRCF Irradiated Fuel Handling Study and Analysis
HWS-7265	Unclass.	WD Hamilton	4-15-64	Procurement Specification for Strap-on RTDs

TRIPS

Name	Firm & Location	Date	Purpose
JW Ballowe	GE-MTSO Huntsville, Ala.	4/6-7/64	Job interview discussion.
BW Herrman	GE-MTSO Huntsville, Ala.	4/5-8/64	Job interview discussion.
R Sherrard DF Arnold	Astrodata, Inc. Anaheim, Calif.	3/30 - 4/1/64	Technical review of progress on Contract DDR-179.
W Dalos	GE Switchgear Dept. Philadelphia, Pa.	4-9-64	Discuss NRD circuit breaker trip problem.
CA Munro	California Test Labs Los Angeles, Calif.	4/6-7/64	RTD Cable problem - testing.
CA Munro	Frank L. Markel & Sons Norristown, Pa.	4-11-64	RTD cable problem - testing.
PB McCarthy	Union Mach. Works, Inc., Seattle, Wash.	3-31-64	Acceptance tests on the third SSFE charging machine.
HC Copeland EJ O'Black NH Skarshaug	Puget Sound Naval Shipyard Bremerton, Wash.	4-2-64	Review deactivation methods used by US Navy.
JM Fox, Jr.	Chicago Bridge & Iron Chicago, Ill.	4-21-64	Discussion of brittle fracture of carbon steels and metallurgy of high temperature materials.
JM Fox, Jr.	Nuclear Materials & Propulsion Operation Cincinnati, Ohio	4-22-64	Same.
RT Jaske	Univ. of Calif. Lawrence Rad. Lab. Davis, Calif.	4/21-23/64	Attend Third Plowshare Symposium - Symposium on engineering with nuclear explosives to obtain data supporting reactor safety analysis.
FAR Stainken	Oregon State Ass'n. of Plumbing & Heating Contractors, Salem, Oregon	4/2-3/64	Present speech, "The Challenge of Atomic Energy."

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Name	Firm & Location	Date	Purpose
RT Jessen	General Electric Co. San Jose, Calif.	4/23-25/64	Business discussions.
LE Kusler	New York, N.Y.	4/27-30/64	Attend meeting of Amer. Soc. of Mechanical Engrs.
	Mound Laboratory Miamisburg, Ohio	5-1-64	Discuss proposed test irradiations.
WK Woods	US-AEC/Div. of Prod. Washington, D.C.	4/21-27/64	U-233 discussions.
	Pickard-Warren-Lowe Washington, D.C.	4-28-64	U-233 discussions.
	Nuclear Fuel Services Washington, D.C.	4-28-64	U-233 discussions.
	George L. Weil (Private Consultant) Washington, D.C.	4-28-64	U-233 discussions.
	Nuclear Utilities Services, Inc. Washington, D.C.	4-28-64	U-233 discussions.
	Tech. Staff of Joint Comm. on Atomic Energy Washington, D.C.	4-28-64	Describe Hanford program on U-233.
	NASA-Lewis Research Center Cleveland, Ohio	4-30-64	U-233 discussions.
	Argonne National Lab. Lemont, Ill.	5-1-64	U-233 discussions.
SC Linn	Miller Electric Co. Appleton, Wisconsin	4/6-8/64	Discuss DC, TIG, and MIG aluminum welding techniques and welding power supplies.
SC Linn	Sheffield Corporation Dayton, Ohio	4/9-11/64	Witness acceptance test of precision gaging equipment being procured under Contract DDR-171.
WF Stevenson	Western Regional Quality Control Conf. Portland, Oregon	4/8-11/64	Official representative of Richland Chapter and assist in presentation of technical paper.

Name	Firm & Location	Date	Purpose
JJ Wick	Western Regional Quality Control Conf. Portland, Oregon	4/8-11/64	Attended conference.
CJ Denton FW Knight	Bremerton Naval Shipyards Bremerton, Wash.	4-17-64	Observe and review both technical and organizational control of Naval nondestructive testing program.
CJ Denton FW Knight	Society for Non-destructive Testing Seattle, Wash.	4/17-18/64	Learn of SNT's plans for tester operator licensing. View ultrasonic transducer assembly films by vendor of HAPO transducers.
JT Stringer	Mallinckrodt Chemical Works St. Louis, Mo.	4/27 - 5/1/64	Attend Fuel Element Development Working Committee meeting of which he is member.
FW Grubb	Boeing Company Seattle, Wash.	4/13-14/64	Review performance of Frieden collection data equipment.
JD Schaffer	ALCOA, Seattle, Wash.	4/9-10/64	Component quality.
JD Schaffer	Conrad Corp., Tacoma, Wash.	4-10-64	Quality survey. Current quality and design problems.
HE Berg	ALCOA, Edgewater, New Jersey	4-10-64	Discuss current quality and manufacturing topics.
HE Berg	Shop Management Course Crotonville, N.Y.	4/13-17/64	Attend course.
LD Gustafson	U.S. Navy, Seattle & Bremerton - Commander Schumacher, Pacific Reserve Fleet	4-2-64	Consultation on deactivation and layaway of equipment as related to reactor plant deactivation.
RD Ellingson	Graphic Art Fields Portland, Oregon	4-17-64	Attend a demonstration and workshop.
CR Myers	Mississippi Test Support Operation Huntsville, Alabama	3-30-64	For an interview on a recent job offer.

Name	Firm & Location	Date	Purpose
A McDonald	Tingling and Powell Co., Spokane, Washington	4/1-3/64	To inspect 3500 HP motor removed from 190-C for rewinding in Tingling and Powell service shop.
CF Quackenbush	Materials Task Force of the Committee of Nuclear Piping - ASA-B31, Code for Pressure Piping in Pittsburgh, Pennsylvania	4/22-23/64	Attended meeting.
KW Greager	General Electric 1964 Western Region Methods & Work Measurement Conference Phoenix, Arizona	4/7-10/64	To present a paper entitled "Audio Visual Training and Instruction".
JC McKay	General Electric Co. Appliance Park Louisville, Kentucky	4/6-8/64	Attended the American Power Conference.
GW Wells	Chicago, Illinois	4/14-16/64	Attended the American Power Conference.
ER Keplinger	Dow Chemical Co., Kennewick, Washington	4-24-64	Investigate possible change in chemical addition to boiler feed water.
PM Hurley PG McDougal	General Electric Co., Pass Christian, Mississippi	4-3-64	For interview regarding positions with Mississippi Test Support Operation.

VISITORS

Name	Firm & Location	Date	Purpose
AF Lillie DB West DR Hogle BB Gillies	Atomics International Canoga Park, Calif. " " " " " "	4/1-11/64 4/1-11/64 4/1-9/64 4/5-11/64	Test installation and startup.
D Thompson KC Hoffman R Singer	Brookhaven Nat'l Lab. Upton, Long Island New York	4/20-21/64	Discuss modifications of Brookhaven Reactor.
J Fields D McMacken	Shell Oil Co. San Francisco, Calif.	4-16-64	Discuss preservative material and methods developed by and available from Shell Oil.
WB DeLong	Du Pont, Wilmington, Delaware	4-1-64	Discuss behavior of metallic fuels.
W Miller ME Harris JK Landauer CR Henry	Lawrence Radiation Labs, Livermore, Calif.	4-1-64	Tour of AlSi Pilot Plant.
JL Leyton AK Hackenborth	Alco Products Co., Auburn, N.Y.	4-9-64	Discuss technical details of the emergency generator equipment.
T Conners	Travelers Indemnity Co., Seattle, Wash.	4-17-64	Third party inspection of No. 5 boiler and autoclave in 313 Building.
MJ St. Clair	Advanced Alloys Palo Alto, Calif.	4-15-64	Wafer process development.
DH Tuel	Wyandotte Chemical Co., Seattle, Wash.	4-20-64	Cleaning compounds.
JJ Schneider	Wyandotte Chemical Co., Los Nietos, Calif.	4-21-64	Cleaning compounds.

DATE
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01/22/93