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IRRADIATION PROCESSING DEPARTMENT MONTHLY REPORT

MARCH 1964

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IRRADIATION PROCESSING DEPARTMENT
MONTHLY REPORT
MARCH, 1964

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SUMMARYMANUFACTURING

Record reactor input plutonium production for March, 518.9 KMWDs, exceeded the April, 1963 maximum by 16.4 KMWDs. The March record included 287.9 KMWDs at the six smaller reactors and 231.0 at the two K Reactors. Tritium input production was 6718 equivalent MWDs.

The AEC administrative power level limits of 2090 MW at the five smaller reactors and 2310 MW at the C Reactor were removed March 4, 1964. Power levels at these six reactors were limited during the remaining portion of the month by a bulk outlet water temperature limit of 95 C. The following record high power levels were achieved: 2090 MW at B, 2360 at C, 2050 at D, 2010 at F and 2110 at H.

Power levels at the K Reactors were limited by the AEC administrative limits of 4400 MW.

Over-all time operated efficiency was 78.2% (77.1% forecast): 75.9% at the smaller reactors and 85.3% at the K Reactors. At month's end, KE Reactor had completed 35.0 days of continuous operation which resulted in the first 100% time operated efficiency for this reactor.

Seven failed I&E fuel elements were removed from the reactors: five of enriched uranium and two of natural uranium. Two of the enriched failures were at H and one each at C, DR and F. The two natural failures were at B and DR. Five of the failed elements were "side hot spot" failures, one was "side unclassified" and one was not examined. The two natural metal and three of the enriched failures were stuck in process tubes.

Five process tube leaks, at the rear Van Stone flanges, were corrected. A total of 1431 process tubes (including 625 zirconium) was installed.

PRODUCTION FUELS

A total of 715 tons of natural and enriched uranium fuel elements was produced during March, 112% of forecast.

Canning line operation was at the rate of ten lines per day for 15 operating days of the month and at nine lines for the remaining seven days. Operators on temporary loan from N Reactor Fuels Section manned the tenth line for one week. Projection welding personnel operated the tenth line for two weeks. Canning line operating efficiency was 98.5% for March.

Bare core inventory at month's end was 846 tons, a 1.3 months' supply. Finished fuel inventory was 1651 tons, a 2.5 months' supply, including 50 tons of bumpered dingot fuel elements.

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The manufacturing yields of regular and self-supported fuels increased to new highs, with records established on both the six-inch and eight-inch regular fuels and on the six-inch self-support model.

Work in process at month's end remained at the levels experienced in recent months. About 10,000 self-support fuel elements were backlogged ahead of the ultrasonic welders at month's end.

Debugging of the automatic rail feeding equipment was started in conjunction with the new two-footed, semi-automatic shear tester. The shear tester is designed to test two opposing rail welds at the same time. Other than expected adjustments, the shear tester performed very well.

Five columns of hot die sized fuel elements and five columns of alternated hot die sized and AlSi control fuel elements have been irradiated to about 60% of goal (500 MWD/T). The height of supports on both the test and control pieces was reduced five mils to allow for possible diameter growth similar to that previously experienced in hot die sized material.

Fabrication of 13 tons of small reactor size (O3D) depleted uranium cores was completed at National Lead and final shipment was made in March. Approximately 100 depleted cores received in an earlier shipment have been canned in the pilot plant to optimize process parameters. Delivery of the remaining 15 tons of depleted cores (K-Reactor model KLD) on order is scheduled for late April.

Canning of four tons of thoria in Hanford Laboratories' facilities for irradiation testing under the U-233 program was completed. A decision has not been reached on the source of two tons of thorium metal on order.

RESEARCH AND ENGINEERING

The clean U-233 program continues, and a one-ton lot of thorium oxide was charged into the central zone of F Reactor for about two weeks of exposure. This was the second lot of the current six-ton demonstration program; operating and physics characteristics have been close to prediction.

The outer ring of six Ball-3X channels has been removed from service at the K Reactors because of graphite stack conditions in the peripheral regions. An optimum location has been developed for the enrichment rings at these reactors, and satisfactorily accommodates total control requirements with little or no effect on operating economics.

Current project and plant activities on low-level period, linear rate-of-rise, and geometrically representative high-level fixed-trip instrumentation were summarized in document HW-80907.

FACILITIES ENGINEERING

Preliminary engineering work is under way to provide scope and cost estimates for capital cost items associated with reactor deactivation.

The two prototype self-supported fuel element charging machines continue to function satisfactorily doing displacement charge-discharging operations at the K Reactors. Higher-than-goal exposed fuel was successfully displacement discharged. The third charging machine has been completed and is undergoing tests in the vendor's plant.

The all-magnesium fuel magazines performed satisfactorily during on-reactor testing at 105-KW. Procurement of 1300 additional magazines has been initiated.

The attempt to clear VSR Channel 41 at C Reactor of accumulated debris in preparation for thermal shield enlargement was not completed due to a deep bed of 3X balls in the bottom of the channel. This precluded drilling the anticipated graphite obstructions.

An inspection has been made of all reactor charge platform grating installations. The installations appear entirely satisfactory, and the gratings currently provided are withstanding equipment loads without distortion or excessive wear.

Phase I of the study to investigate the feasibility of converting a Hanford type reactor for power recovery is nearing completion and the report document is in preparation.

RESPONSIBILITY

There was no significant change in responsibility.

FORCE SUMMARY

	<u>Exempt</u>	<u>Non-Exempt</u>	<u>Total</u>
General	7	2	9
Research and Engineering	88	55	143
Manufacturing	382	1309	1691
Production Fuels	99	392	491
Facilities Engineering	89	31	120
Financial	<u>18</u>	<u>13</u>	<u>31</u>
TOTAL	683	1802	2485

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ORGANIZATION

The following organization changes were effective March 1, 1964:

R. S. Bell, Manager, KE-KW Reactor, was appointed Manager, Manufacturing.

A. R. Maguire, Manager, D-DR Reactor, became Manager, KE-KW Reactor.

C. N. Gross, Manager, F Reactor, became Manager, D-DR Reactor.

S. L. Nelson, Specialist, Reactor Personnel Certification, was made Manager, F Reactor.

A. P. Vinther, Manager, H Processing, became Manager, H Reactor, replacing W. W. McIntosh who was appointed Manager, Reactor Plant Deactivation, during February, 1964.

G. J. Rogers, Acting Manager, Applied Reactor Engineering, transferred to Hanford Laboratories.

Effective March 9, E. R. Astley completed his special assignment and resumed his duties as Manager, Applied Reactor Engineering.

Effective March 12, W. J. Ferguson completed his duties as a member of HAPO's Negotiating Committee and resumed his duties as Manager, B-C Reactor.

SAFETY, SECURITY AND RADIATION EXPERIENCE

There were 130 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.

<u>Name</u>	<u>Date</u>	<u>Title</u>
R. R. Cone	3-24-64	A Reliable Trip Comparator Suitable
M. L. Peterson		for Reactor Safety Circuit Use

OC Schroeder:DLD:bm

Acting General Manager

MANUFACTURINGPRODUCTION & GENERALReactor Production

Reactor input plutonium production for March was 518.9 KMWDs: 287.9 at the six smaller reactors and 231.0 at the two K Reactors. March input plutonium production represents an all-time monthly production record exceeding the April, 1963 maximum by 3.3%. Tritium input production in the H Reactor E-N load was 5380 equivalent MWDs; incidental production in fringe poison at other reactors yielded an additional 1240 equivalent MWDs and production from a KER loop yielded 98 equivalent MWDs.

The AEC administrative power level limits of 2090 MW at the five smaller reactors and 2310 MW at the C Reactor were removed March 4, 1964. Power levels at these six reactors were limited during the remaining portion of the month by a bulk outlet water temperature limit of 95 C coupled with some conservatism in approaching the temperature limit. The following record high power levels were achieved: 2090 MW at B, 2360 at C, 2050 at D, 2010 at F and 2110 at H.

Power levels at the K Reactors were restricted by the AEC administrative limit of 4400 MW.

The KE Reactor operated all month at its maximum permissible level, thereby establishing a new K Reactor monthly input production record. The previous K Reactor record, established by KW Reactor in January, 1964, was exceeded by 0.2%. The monthly input production record for one of the smaller reactors (other than C), held by D Reactor since December, 1963, was increased 5.2% by that reactor in March. However, a new production record was achieved by H Reactor during March exceeding the D Reactor maximum by 4.2%.

Over-all time operated efficiency was 78.2%: 75.9% at the smaller reactors and 85.3% at the K Reactors. At month's end the KE Reactor had completed 35.0 days of continuous operation which resulted in 100% time operated efficiency for March. This represents the highest T.O.E. at KE Reactor since July, 1955 and the first 100% monthly time operated efficiency at this reactor.

Fuel Exposure

There were no discharge goal exposure changes initiated during March. Material discharged from KW Reactor exceeded the target exposure significantly and will be separated into weapons and non-defense categories. The average exposures (MWD/T) of irradiated fuel discharged were:

	<u>Smaller Reactors</u>	<u>KE & KW Reactors</u>
Natural Uranium	606	877
Enriched Uranium	898	989

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REACTOR AND POWER STATISTICS - MARCH, 1964

REACTOR DATA	B	C	D	DR	F	H	KE	KW	TOTAL
INPUT PRODUCTION - PU - KMWD	32.5	59.4	56.6	40.3	40.2	58.9	136.5	94.5	518.9
" " - TRITIUM - EQUIV. MWD	226	70	251	388	305	5380	98	0	6718
POWER LEVEL - MW (MAX.)	2090	2365	2055	2015	2015	2110	4400	4400	21450
" " - MW (AVG.)	2030	2237	1996	1943	1954	2042	4402	4314	20918
TIME OPER. EFFICIENCY - %	51.7	85.7	91.5	66.9	66.3	93.1	100.0	70.7	78.2
OUTAGES - ALL CAUSES	2	5	2	2	2	2	0	1	16
OUTAGE TIME ALLOCATION - %:									
CHARGE - DISCHARGE	2.5	7.4	1.4	6.7	4.3			10.6	4.1
FAILED FUEL REMOVAL	2.6	1.0		0.9	0.8	4.4			1.2
WATER LEAKS	2.7	1.0	2.6						0.8
TUBE REPLACEMENT	35.7	0.8		18.1	15.0			16.7	10.8
OTHER MAINTENANCE	2.3	3.3	2.7	1.1	4.1	2.5		1.4	2.2
PRODUCTION TESTS	0.3	0.4	0.1	2.1	2.2			0.4	0.7
PROJECT WORK									
OTHER	2.2	0.4	1.7	4.2	7.3			0.2	2.0
TOTAL	48.3	14.3	8.5	33.1	33.7	6.9		29.3	21.8
WATER LEAKS - TUBE									
" " - VAN STONE	2	1	2						5
NEW TUBES INSTALLED	456	1		149	152			673	1431
FUEL CHARGE - TONS NAT. U.	193.5	181.5	197.6	179.7	174.7	3.1	414.9	420.4	1765.4
" " - TONS ENR. U.	29.1	40.7	25.3	39.5	42.8	198.4	44.9	40.1	460.8
FUEL ELEMENT FAILURES	1	1		2	1	2			7
HELIUM CONSUMED - M CU FT.	315.9	432.6	403.6	216.1	214.8	134.0	162.4	124.2	2003.6
POWER DATA									
RIVER WATER PUMPED - M GALS.	7307.0		6562.4		2657.7	3894.7	9665.7	5847.6	35935.1
WATER EXPORTED - M GALS.	654.1								654.1
WATER TREATED - M GALS.	2571.0	4079.8	4346.2	2086.2	2627.7	3892.0	9615.1	5847.6	35065.6
WATER TO REACTOR - M GALS.	2692.4	3388.9	3513.7	2487.3	2483.0	3674.9	8631.8	5291.0	32163.0
" " " - GPM (NORM)	89200	97500	88800	87700	88300	92000	206800	208500	
" " " - pH	6.80	6.70	6.61	6.64	6.64	6.64	6.59	6.95	
" " " - DICHROMATE (PPM)	1.48	1.39	1.45	1.45	1.34	1.39	1.55	1.35	
STEAM GENERATED - M LBS.	64398		73084		39785	35984	21246	15600	
LBS. STEAM / LB. OF COAL	9.26		8.89		9.26	8.98			9.08
" " / GAL. OF OIL							99.9	93.0	96.8
ELECTRICITY GENERATED - MWH							1472.8	1176.0	2648.8

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Reactor Personnel Certification

One reactor operating supervisor and three reactor specialists completed certification requirements during March. An accelerated operator certification training and testing program and a radiation monitor training program began March 13. A special radiation training program for exempt maintenance personnel began March 15.

REACTOR OPERATIONS

Reactor & Power Statistics

These are tabulated on page B-2.

B-C Plant

A record high power level of 2090 MW was reached at B Reactor on the 95 C bulk outlet temperature limit. During the early part of the month, C Reactor's power level was restricted by the administrative limit of 2310 MW. With the limit relaxed, a record power level of 2360 MW was attained on the 95 C bulk outlet temperature limit.

B Reactor had two outages: one to remove a failed I&E dingot fuel element (54.5 hours) and a scheduled outage (305 hours at month's end) for process tube replacement. During the failed fuel element outage, some charge-discharge of fuel elements was performed, two leaking process tubes (Van Stone failures) were replaced and the reactor was given a helium leak check for additional water leaks. Major work accomplished during the scheduled outage (other than charge-discharge) was as follows: 454 process tubes were replaced, the rear face hardware was decontaminated, the rear high tank supply line to the reactor was mechanically descaled, downcomer and rear crossover pipe was inspected, three rows of front-adjust Panellit gages were installed, and a graphite burnout sample was replaced in channel 3461.

Five outages occurred at C Reactor: one caused by a low-low flow trip on the C-1 loop (0.2 hour), one because of a high water pressure trip on two HCRs (0.3 hour), one to remove a failed I&E enriched fuel element (35.1 hours), one manual trip due to false tube outlet temperature data (0.3 hour), and a scheduled outage (70.4 hours) for charge-discharge. During the failed fuel element outage, twenty-three rear face bellows were foamed to test newly developed foaming equipment and a universal flexible rod was installed in a VSR channel. Principal work accomplished during the scheduled outage (other than charge-discharge) was as follows: 123 process tubes were pressure tested, hardness tests were made on five horizontal control rods, and debris was removed from a VSR channel.

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The following Design Changes were completed during the month:

- D.C. 797 - Resistance temperature detectors installed in each rear riser at B Reactor to monitor the bulk outlet water temperature.
- D.C. 894 - A dip tube and pressure taps installed at B Reactor to monitor capacity of the downcomer for future water flow increases.
- D.C. 719 - An annunciator alarm installed at B Reactor to facilitate improved trip settings of the flux monitor low trip controller.
- D.C. 762 - The B-C Reactor flux monitor intertie was converted to an ungrounded AC power supply system to eliminate potential unscheduled outages.
- D.C. 764 - Provided increased CO₂ purge and make-up capacity at C Reactor to decrease losses and reduce graphite burnout rates.
- D.C. 863 - The C-1 Loop electrical circuits were modified to eliminate two potential causes of loss of cooling water to test fuel elements.
- D.C. 876 - Direct reading pressure gages installed on each HCR to provide more accurate pressure readings.

On March 5, the No. 1 incoming electric line on the export system tripped-out, the surge suppressors cycled, and No. 1 export steam turbine came on to correct the loss of water pressure.

No indication of the earth tremor on March 27 was observed at B or C Reactors.

D-DR Plant

D Reactor attained a new input production record in March, exceeding their previous record by 2796 MWDs. Power levels at the D and DR Reactors were limited by bulk outlet temperatures of 95 C.

D Reactor had two unscheduled outages, one (57.3 hours) because of a broken outside water line which flooded the electrical switchgear room and another (6.1 hours in March) when a failed rear Parker fitting caused a reactor scram. Outage work accomplished during the first outage included charge-discharge of fuel elements, helium leak testing and a front face snap ring inspection. No attempt was made to recover from the scram because of an outage scheduled to start the following day.

DR Reactor had two unscheduled outages, 35.8 hours and 210.3 hours, initiated by failed fuel elements. The second outage was continued for tube replacement. Major outage work included charge-discharge, replacement of 149 process tubes, replacement of the No. 7 horizontal control rod, recirculation of 3X system balls in seven hoppers and a complete front face hardware and snap ring inspection.

The earth tremor of March 27 was recorded at DR Reactor by a high sensitivity seismoscope trip and ten minutes of galvanometer oscillation. No indication was observed at D Reactor.

Two underground pipe lines failed early in the month. A ten-inch fire and sanitary water line failed near the D Reactor Building, flooding the electrical switchgear room, valve pit, work area corridor and instrument shop. The line was repaired with a Dressler coupling. The reactor was shut down because of potential power loss, however normal power was maintained. A sodium dichromate transfer line failed at a weld at a location near the Main Pump House. Approximately 1,000 gallons of the chemical were lost to the soil before discovery of the leak.

A Fisher diaphragm valve was installed on No. 3 condenser turbine in the Reservoir and Pump House to effect automatic start in event of a power failure. The installation reduces the present steam turbine idling requirements and thereby saves approximately \$26,000 annually in steam costs.

F Plant

A new power level record of 2010 MW was established at F Reactor with a bulk outlet temperature limit of 95 C. A new daily reactor input production record of 2009 MWDs was also established.

Two outages were experienced during the month. The first, a scheduled outage (247.6 hours) for tube replacement and charge-discharge of fuel elements, was initiated 12 hours early when an I&E enriched uranium fuel element failed. The second outage (3.0 hours in March and to be completed in April) was for scheduled charge-discharge of thorium elements in accordance with PT IP-659-AC, "Evaluation of Thorium Oxide Loading" (a production test which permits evaluation of U-233 production in a central zone configuration).

Principal work accomplished during the first outage included removal of the failed fuel element using hydraulic force, charge-discharge of 782 tubes, process tube wall thickness measurements (139 tubes), replacement of 152 process tubes, loading 19 charges of thorium and 105 enriched uranium support charges (PT IP-659-AC) in the central zone of the reactor, replacement of a coupling seal on the main effluent line, installation of eight rows of new Panellit gages, and replacement of the four-inch water supply line in the far (west) emergency water tank.

The Filter Plant began using bauxite from a new source of supply on March 27. Early results showed the new material yielded approximately 35% more coagulant and cost about 35% less per ton than the material formerly used.

The 450 HP motor on the No. 14 pump in the River Pump House was reinstalled on March 2. The motor was shipped offsite for examination and was returned February 27. Slight overheating of the motor stator was observed on several short trial runs but no off-standard conditions have been noted since the motor was placed in normal service on March 27.

Earth tremors on March 27 resulted in a high sensitivity trip on the Seismoscope at 7:43 p.m. Galvanometer fluctuation was also observed.

H Plant

A new record level of 2110 MW was achieved following the relaxation of the bulk outlet water temperature limit from 93.5 C to 95.0 C and the removal of the AEC administrative limit of 2090 MW. This new level and H Reactor's input production (MWDs) for the month established new record highs for one of the five smaller reactors.

Two unscheduled outages (24.8 and 26.7 hours) were caused by failures of I&E enriched uranium fuel elements. Following removal of the charges, using normal procedures, the remaining outage time was used for maintenance work. Major items were the repositioning of temperature monitor thermocouples to improve response, replacement of the horizontal control rod emergency power circuit breaker coil on "A" bank, and replacement of the resistance temperature monitors for the thermal loop cooling water system.

To maintain maximum coolant flow during intervals between block discharges, the reactor was purged with diatomaceous earth on a weekly frequency with beneficial results.

Boilers Nos. 2 and 3 in the Power House were inspected. Several tube leaks were located in the mud drums. Repairs were made by re-rolling the tubes. One tube having a probable tube wall crack was cut off at the mud and steam drums and seat plugs were installed to seal off the tube openings at the drums.

Earth tremors on March 27 resulted in a high sensitivity trip on the seismoscope and galvanometer fluctuations at 7:49 p.m. Galvanometer fluctuations were again observed at 10:54 p.m.

KE-KW Plant

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

A new monthly input production record for a K Reactor was achieved by KE Reactor exceeding the previous record set by KW Reactor in January, 1964, by 0.2%. The former KE Reactor production high of October, 1962, was exceeded by 9.1% and the second highest combined monthly production for the K Reactors was also achieved.

There were no outages at KE Reactor. Power level was maintained at the AEC administrative limit the entire month.

On March 10, KW Reactor concluded a 25-day scheduled outage for process tube replacement. The other interruption to production was a 1.7-hour outage to repair a faulty resistance temperature detector. During the extended outage, a total of 673 process tubes (625 zirconium, 48 aluminum) was installed. This work fulfills the planned K Reactor zirconium process tube replacement and

related channel treatment and tube hardware modification programs commenced in early 1963. Under the improvement program, a total of 2351 and 2358 zirconium process tubes was installed at KE and KW Reactors, respectively. In addition, 304 new aluminum tubes were installed at KE Reactor and 293 at KE.

Other major outage work accomplished at KW Reactor included installation of three new Geminol sheathed graphite stringers (2 front-to-rear, 1 side-to-side), inspection of all front face nozzle snap rings (with repositioning as necessary), repair of faulty resistance temperature detectors, and routine charge-discharge of fuel elements.

A high sensitivity seismoscope trip occurred at both reactors at 7:49 p.m. on March 27. At the same time, KW Reactor experienced a pick-up chute high water level trip caused by water movement.

A submersible pump at the KE river pumping station failed on March 27. Preliminary investigation indicates the failure was caused by an electrical fault. The unit was removed from the pumpwell and, at month's end, arrangements were under way for disassembly, inspection, and repair. This is the first removal of one of the submersible river pumps for repair.

A new addition, approximately 450 X 400 feet, to the area contaminated material burial ground was completed. The modification will provide facilities for improved burial ground management.

APPLIED REACTOR ENGINEERING

Plant Engineering

Electrical

Design Change 772 was issued providing for alteration of secondary pumping system control circuits in 100-K Area such that (1) the number of emergency electric low-lift pumps is increased from two to four, and (2) the steam low-lift pump starts only after the failure of two or more emergency electric low-lift pumps, and when a boiler overload will not result. Procurement of offsite materials was started.

Design Change 851 was issued. This revision provides for the addition of Ball 3X system conduit clamps and supports at KE and KW Reactors to reduce the potential for damaging the flexible conduits and wiring at the top of these reactors and causing balls to be dropped.

A Design Change covering the installation of trouble indicating lights on the front work platform for the photocells, tightwires and scanner, is being written for all reactors. Lights will give the platform operator a quick way of observing any malfunction of the platform safety devices.

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Mechanical

Assistance has been rendered all reactor operations regarding front nozzle lug ring dislocation during charging. It was determined that the condition of the retaining ring grooves was preventing complete seating. The solution entails complete groove cleaning and reassembly with Inconel retaining rings and the universal stainless steel lug ring. The nozzle groove recutting prototype was tested at F Reactor, and standard models were used during the DR and B Reactor outages to clean the snap-ring groove and eliminate the nozzle lug ring displacement.

A new adapter was designed so that the H Reactor type of special tooling for reaming rear face Parker fittings may be used also at B Reactor. A quantity of H Reactor nozzles are available as a result of the recent rear face hardware change. These nozzles are identical to B, D, F, and DR outlet nozzles except for the thermocouple hole. The drilling of this hole to permit use on F Reactor has been approved, and a Minor Design Change authorizing installation at B, D, and DR has been prepared.

Engineering assistance was provided in clearing vertical safety rod channel 49 of KW Reactor so that the flexible rod could be placed in operational status.

An audit of pressure vessels and pressure piping is being conducted in 100-B Area to determine compliance with the Irradiation Processing Department Pressure Systems Guide.

Measurements were taken and sketches prepared for slug guards on the near side of the discharge area at KW Reactor. These guards are intended to replace damaged units, and to cover spots which might catch and hold a discharged fuel elements in an inaccessible location.

Instrument

A prototype system for the flushing of rupture monitors was built and was tested successfully at H Reactor. This system, which is intended for use at all of the smaller reactors, makes it possible to flush the monitor equipment without any possibility of contaminating the normal filtered water system.

Tests were performed and a report was issued (HW-81275) showing the effect of various leak rates in the impulse lines of the reactor crossheader instrumentation which indicates differential pressure.

Sketches were prepared and an estimate was procured to cover the reactor operating console revisions that will be necessary to install the cathode ray tube for the high speed scanning project at KW Reactor.

Industrial

The Processing Manpower Planning Guide was discussed with reactor management. Its advantages and limitations based on trial application at D Reactor were described and copies of the guide were made available for distribution.

Development of photographic techniques to supplement as-built drawings is in progress. Photographs were taken in the Main Pump House of 100-F Area by the Photography Operation and screened negatives are presently being made by the Printing Operation. Some positive-negative film for the 4x5 Polaroid camera and a 4x5 photo screen have been procured which will allow production of screened negatives in the reactor areas as needed.

A number of illustrative slides were prepared for use in a Central Maintenance Operation paper on "Planning and Scheduling Multi-shop Manufacturing Activities" to be presented in Phoenix, Arizona.

Engineering Studies and Analyses

As requested by the Facilities Engineering Operation, studies are under way to develop recommendations for the control of corrosion in deactivated reactor areas.

Engineering Requests initiated by Manufacturing are being re-assessed as to need and priority. Evaluation has been partially completed for the cancellation of five such Requests, the estimated cost of which totaled \$195,000. Re-evaluation by the originators is being requested on eleven others for possible cancellation or revision.

Maintenance Standards and Manuals

The current status of Equipment Maintenance Standards is as follows:

	<u>February</u>	<u>March</u>
Issued to date	86	94
Being routed for approval signatures	48	43
In comment status	5	6
In preparation	<u>60</u>	<u>52</u>
Total	199	195

Sixteen Equipment Maintenance Standards were revised during March.

New Maintenance service procedures and manuals were issued as follows:

A revision of the C Reactor Vertical Safety Rod mechanical service manual.

A mechanical-electrical Maintenance Instruction for K Reactor charging machines.

Spare Parts

Fifty-two assembled universal flexible vertical safety rods have been received. Twenty-six of these have been installed in reactors, 14 are being held at plants

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for installation, and 12 are in Spare Parts. Jigs and fixtures are prepared for the assembly of unassembled rod components when received.

Plant Personnel Training

Training activities at the White Bluffs facilities were as follows:

The Transistor Electronics classes for instrument and electrical shift maintenance personnel were completed.

The Temperature Data Logging System classes were started for K Plant craftsmen. This is a sixteen-hour course.

A 3-hour training class covering C Reactor gas bellows was conducted for the Special Outage Service and C Reactor personnel. Twelve personnel attended.

A preliminary plan and schedule for providing Value Analysis Training for Drafting Operation personnel were developed and submitted to the Facilities Engineering Section for consideration.

Manager, Manufacturing

RS Bell:TWB:DLD:bm

PRODUCTION FUELS

ALSI SHOP

Canning line operating efficiency was 98.5 per cent, 1.5 per cent above forecast.

Manufacturing yields during March were above forecast in all categories of fuels. Record high yields were attained in the six- and eight-inch regular models and in the six-inch self-support category. The average self-support welding yield remained at the relatively high level of 97 per cent.

Production of projection fuels during March was:

	<u>Natural U</u>	<u>Enriched U</u>
Tons Produced	75	57
Finished Inventory	434	139

Acceptable Fuel Elements (Tons)

<u>NATURAL</u>				<u>ENRICHED</u>					<u>Total</u>
<u>C</u>	<u>K</u>	<u>K5NS</u>	<u>Reg.</u>	<u>C</u>	<u>K</u>	<u>K5ES</u>	<u>Reg.</u>	<u>Bumper</u>	
95.4	90.5	73.1	284.3	-	32.0	57.3	82.2	-	714.8 ⁽¹⁾

Per Cent of Forecast

112	108	48	146	-	213	249	119	-	112

Manufacturing Yields

March

95	95	88	96	-	95	92	95	-

Forecast

91	91	87	91	91	91	87	91	-

Previous Month

96	-	91	93	94	-	89	95	

(1) Includes 6.2 tons of upstream fuels.

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Operating Conditions, Incidents, and Improvements

The lower hearth failed on a metal recovery induction furnace early in the month. The molten metal from the hearth penetrated to the coil and resulted in coil failure. A rebuilt hearth was installed and baked in for a three-week period. A new coil was installed and charging of the furnace with metal began on March 26.

Installation of the pre-set tooling for the facing lathes was completed. This pre-set tool concept has been extremely successful on all tooling except the ream and chamfer tool holder. Pre-set tooling has not yet proven out on this one tool holder, because of the very small depth of cut necessary combined with the slight eccentricity of the fuel elements.

The new self-support welder table has been performing very well. The second new welder table installation on 2B rail welder was completed and in operation by month end. Table installation on the third welder should be completed by April 15th.

Beginning with the March 23 self-support run (K5N), all material has been shear tested using the new two-footed, semi-automatic shear testers. Performance to date has been very good.

Autoclave Failures

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

MATERIALS

Special Products

Production of five-inch I&E target elements for the April E-N load at H-Reactor was completed early in the month. Other than minor reclamation work, all six-inch lithium-aluminum rod stock was placed in process during March.

Fuel Recovery

The following amounts of AlSi fuel were recovered:

	<u>Pieces</u>
Eight-inch Natural	16,812
Six-inch Enriched	0
Six-inch Watermix	0
Total	16,812

Hanford Test Reactor

Available reactor time was utilized as follows: 210 routine production tests were performed (158 GO NO-GO and 52 drift tests) representing approximately 50 per cent of the available time, with the remainder being utilized for special testing.

Inventories

Bare Core Inventory	846 tons
Finished Fuel Inventory	1651 tons
Work in Process	323 tons

Scrap

Four shipments of metallic uranium scrap were made during the month. Shipments totaled 11 tons of natural AlSi scrap and 27 tons of enriched N-Reactor fuel scrap. A total of 834 empty core boxes with lids were also snipped in March.

FUELS ENGINEERING

Quality Control

The amount of upstream fuel accumulated since initiation of the program totals 26,923 fuel elements. Of these, 17,010 were reactor charged through early March. Accumulation of graded fuel continues at the rate of about 2,000 pieces per month. This material originates as about one-third each low rail height, bond tester and marred surfaces.

Rupture Experience

A total of seven fuel elements failed in the reactors during the month of March.

<u>Fuel Element Type</u>	<u>Tube and Reactor</u>	<u>Exposure (MWD/T)</u>	<u>Rupture Classification</u>	<u>Failure Date</u>	<u>Canning Date</u>
Enriched Nonbumper	2888-H	425	Side Hot Spot	3/1/64	12/18/63
Enriched Nonbumper	2167-F	847	Unknown - Not Examined	3/4/64	7/31/63
Enriched Nonbumper	2876-C	499	Side Hot Spot	3/5/64	11/15/63
Natural Nonbumper (PT-610)	3975-DR	646	Side Hot Spot	3/9/64	7/17/63

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Rupture Experience (continued)

Natural Nonbumper Dingot	2181-B	445	Side Hot Spot	3/11/64	12/10/63
Enriched Bumper	2464-DR	1044	Side Unclassified	3/11/64	5/17/63
Enriched Nonbumper	3773-H	547	Side Hot Spot	3/14/64	12/24/63

Of the seven failures, five were in regular production material and two were in nonstandard material. One failure in nonstandard material was a dingot rupture in B Reactor. The other was an induction heat treated side hot spot failure in DR Reactor; this failure was in a striped column (alternate induction heat treated and control pieces) irradiated to an exposure of 646 MWD/T under PT-610-A.

Four of the regular production failures were in nonbumped enriched fuel and one in bumped enriched fuel. The nonbumped failures occurred at exposures between 53 and 120 per cent of goal. The bumped failure occurred at 141 per cent of goal.

Uranium Technology

Material requests were submitted for 3500 small reactor (04E) and 1500 K Reactor (K6E) ten-inch enriched cores, including 200 six-inch control cores for each ten-inch core model. These requests were issued to expedite the evaluation of long fuel elements. Delivery of the cores is expected in June.

Examination of an induction heat treated fuel element failure, which was being irradiated under a production test (IP-610-A) in DR Reactor, showed the failure mechanism to be of the typical "hot spot" variety. Eighteen fuel elements from the tube containing the rupture were measured in an effort to determine if there might have been a large difference in the dimensional stability of the induction heat treated test pieces and the salt bath heat treated control pieces. Warp and diameter change of both categories appeared typical of regular production, but the large amount of variation observed made it impossible to draw any firm conclusions from these limited data. The remaining nine tubes in this test have been discharged and are being measured.

Canning of 65 tons of induction heat treated small reactor (03N) cores was completed in March. This material will be reactor charged under PITA-IP-29-I. National Lead has been asked to discontinue the induction heat treating of 20 tons of cores per month temporarily until the evaluation of PT-610 is completed.

Analysis was completed of heat treatment induced warp in a heat treat variables test. This test was used to evaluate the effects of quench media,

transfer times, quench temperatures, and core blank sizes for both ingot and dingot uranium. Also ingots containing 250 ppm Fe plus Si were compared with those containing 100 ppm Fe plus Si. It was originally planned that this material would be irradiated and the irradiation-induced warps and diameter changes analyzed; however, due to some unknown variable in the processing of this material, all of the test categories had excessive warp. Because of the warp, sufficient cores could not be machined for an irradiation test. Therefore, a program was undertaken to analyze the warp induced during heat treatment. The following results have been obtained:

1. No differences between ingot and dingot, or between the 250 ppm and 100 ppm iron plus silicon could be detected.
2. Lower quench temperatures gave less warp for both water- and oil-quenched cores.
3. For water-quenched cores, a substantial improvement was observed by heat treating in a hollow instead of a solid form.
4. Although delay time had no effect on the water-quenched material, longer delay times for oil-quenched material were beneficial.
5. For water-quenched cores, the larger core blank sizes yielded less warp. The opposite was true for oil-quenched material.

AlSi Process Development

Analysis of can-sleeve preheat and submerge heating rate test data indicated a shorter canning cycle is feasible. However, the precision of the heating rate data was not good enough to predict an exact cycle. Pilot Plant testing is required to determine the effects of shorter cycle times on fuel quality.

Studies conducted to evaluate various projection rail weld interface treatments which might improve ultrasonic welding capabilities have shown some promise. It has been determined that sodium hydroxide (a constituent of soap) is detrimental, even in very small concentrations (0.1%) to ultrasonic welding. This tends to explain the unpredictable results with the original soap solution lubricant. An experimental program to evaluate the use of fatty acids (butyric, caproic, caprylic, capric, stearic, etc.) derived from soap solutions has been initiated. A preliminary test indicates that these acids will provide higher weld strengths than the presently used three-in-one oil.

Demonstration of the integral spire-can concept for component design is the first phase in the development of tubing components for the AlSi process. A 1,000 piece test of standard versus integral spire-can components is nearly complete and the analysis indicates the quality capabilities of the new design to be equal or better than those of the standard contour base design.

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Alternate Process Development

The fabrication of fuel elements for PT-IP-665-A was completed during the month. This test is designed to compare the in-reactor behavior of resistance and induction end bonded hot die sized pieces with matched AlSi control pieces.

An induction end bonding technique was developed to replace the original resistance end bonding operation. With the new method, the cap-core interfaces are bonded at the same temperatures, but the temperature at the mid-point of the fuel elements is markedly reduced. Formerly an end bonding pressure of approximately four tons per square inch was applied for four minutes, 30 seconds. The new technique applies lower pressure (approximately one ton/sq. in.) for three minutes and high pressure (four tons/sq. in.) for one minute and ten seconds. Total heating time for end bonding is reduced from about ten minutes and fifteen seconds to four minutes and ten seconds.

A four rib "C" size die was fabricated and tested in the sizing press. Some galling of the fuel support ribs was noted, which will require further surface treatment of the die. The rib height and configuration were acceptable. Work is proceeding on a comparable eight rib die to produce both four and eight integral rib fuel for hydraulics testing.

Alternate Product Development

Pu-240 Program: Fabrication at National Lead of the "O" size portion (13 tons 03D) of the depleted uranium core order for the high Pu-240 program was completed and shipped in March. The large grain size problem occurring in the February report was actually a grain size (UT-2) tester problem. National Lead was not using the proper standards for calibrating the testers and consequently were obtaining erroneously low voltages. Using the proper standards, all of the 03D cores were acceptable. Fabrication of the fifteen tons of K-Reactor (KLD) depleted cores will be completed and shipped to HAPU by the end of April.

U-233 Program: Hanford Laboratories has completed the canning of four tons of thoria for irradiation testing. Information concerning quantities of target elements produced and density achieved is tabulated below:

<u>Number of Elements</u>	<u>Density*</u>	
	<u>Average</u>	<u>Standard Deviation</u>
595	78.8%	0.89%
595	79.3%	0.56%
660	65.9%	0.41%
660	66.1%	0.34%

*Values as determined by 305 reactivity tests.

A study shows that it is feasible to assemble I&E thorium metal cores in solid cans and make sound closures at a satisfactory yield. This study was made to determine if Savannah River reclaimed I&E thorium metal cores could

be used to fill a current HAPO order for two tons of thorium metal. A decision on the source of this material has not been reached.

Approximately three tons of "K" size and three tons of "O" size enriched (1.25% U-235) cores are being ordered for evaluation as "driver" fuel elements for future target loads. Calculated service conditions for these elements indicate that the central metal temperatures may exceed 360 C, above which uranium swelling may be a potential failure mechanism. Since Savannah River studies indicate that swelling (intergranular cavitation) may be controlled by optimum heat treatment and additions of iron, silicon, and aluminum, a test has been designed to attempt to characterize the effects of these variables. In this test, iron, silicon, and aluminum will each be tested at 50, 175, and 300 ppm, and each composition will be heat treated by both the salt-water quench and the salt-oil quench methods. The basic test design requires 15 ingots, but since it will be replicated, the total of 30 ingots will be required. National Lead has estimated the fabrication of this material can be completed twelve weeks after receipt of order.

Equipment Design and Development

Design and fabrication of a modified "T" section self-support rail stamping die were completed during this period and test quantities of supports were delivered for testing. Load deflection tests are in progress.

A prototype automatic self-support rail feeder was installed on the Pilot Plant ultrasonic welder and tested. The feeding system and automatic welder are currently certified, and an initial 10,000 piece production test is underway. Only minor modifications to the feeder have been required to provide trouble-free operation. Testing of an automatic shear tester is also in progress on the Pilot Plant welder.

An appropriation request for \$39,100 was approved to equip the 3732 Building with a radiological hood, absolute filter system, and minor process equipment to develop techniques for the assembly of thorium oxide target elements. Bids are due March 25, 1964, on the radiological fume hood and bids for the absolute filter exhaust system are due March 27, 1964. This facility is currently scheduled to be completed by August 1964.

PLANT FACILITIES

Status of Active Construction Projects

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

With the approval of the 3720 Building (laboratory and machine shop) drawings for compliance with Design Criteria on March 24, 1964, the total design for the currently authorized scope of this project is now complete by the Architect-Engineer. On March 24, 1964, the local AEC forwarded to Washington a request for approval of funds for construction of the new 3720 Building only; the 313 Building addition has been excluded. Phase II of the original consolidated facilities study had

reviewed the feasibility of a north entrance facility to the 303 Exclusion Area but did not consider the effect of such factors as production cut-back, diversification, or General Electric Company phase-out as the prime contractor. The feasibility of a north entrance facility is now being reviewed in the light of the impact of these recent developments.

CAF-973 - Steam Distribution Line Modifications - 300 Area

All work authorized to the Construction Service Contractor covering General Electric Company exception have been completed.

CAF-979 - Pilot Scale Plating Equipment - 300 Area

Completed design drawings were delivered to the Construction Service Contractor on March 16, 1964, for another estimate of equipment installation cost. The initial estimate by this contractor would have overrun the currently authorized project funds. Pending receipt of the new estimate and the anticipated project proposal revision, authorization was received to assemble the equipment in the 3716 Building and procure limited materials. Work was resumed March 18, 1964.

CAI-994 - Utilities Extension - 300 Area

Excavation for the sewer lines within the 300 Area fence have been completed and the sewer lines are laid. Backfilling of the ditch is underway with periodic compaction tests of the backfill being made by Vitro Engineering who is performing Title III services. Excavation for manholes in the parking lot has been completed and also for the sewer line along the south side of the lot. Construction work is progressing on schedule.

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

Vendor drawings for the boiler were received March 16, 1964, and commented upon by the General Electric Company, Vitro Engineering, and the AEC on the same day. These comments were telephoned to the vendor the following day, March 17, 1964. Delivery date for the boiler is still scheduled for August 15, 1964.

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

Preliminary design drawings were submitted for review by the Architect-Engineer, Bouillon, Griffith, Christoferson and Shairer. Comments were forwarded to the AEC on March 5, 1964. Design completion is scheduled for April 20, 1964.

Equipment Modification

Loss of canning line efficiency due to equipment malfunction is about 0.8 per cent as compared with 1.1 per cent experienced during February. The longest

period of downtime was a fifty minute loss for replacement of broken belts on the fume exhauster of one line. The remaining outages were in the five to ten minute range.

Modification of the mechanical handling systems which will increase the speed of the double spindle welders has been designed and is scheduled for completion about April 1, 1964. This modification will make it possible for two welders to handle normal production and provide one for full standby. A new photocell mount installation has completely eliminated the misalignment malfunction.

Utilities

The power unit for the emergency electrical generator was received on site March 23, 1964, and the control unit is yet to be received. Installation of the power unit is proceeding without delay.

Number 3 boiler was overhauled and has been given third party inspection. The number 5 boiler will be taken off the line for inspection and overhaul.

Statistics

	<u>March</u>	<u>February</u>
Maximum steam generated (M lbs/hr)	126	118
Total steam generated (M lbs)	59,528	67,458
Total condensate returned (M lbs)	22,541	26,054
Coal consumed (tons)	2,826	3,213
Evaporation rate	10.53	10.50
Efficiency - actual	82.0	81.7
Efficiency - optimum	85.4	85.0
Import sanitary water (M gals)	99.6	106.7
Peak water flow (gpm)	4,700	5,000
Peak water consumed in 24 hours (M gals)	4.0	4.3
Compressed air production (M scf)	54,918	56,232

Plant Services

Major jobs completed during the month included the inspection and overhaul of No. 3 boiler; fabrication of 100 new fuel element pallets; renovation of two acid scrubbers on the No. 3 etch machine in 313 Building; reversed the tank shields in the Chem Bay of 333 Building; fabrication and installation of a new 18 foot stainless steel draft box for the top section of the splash shields also in the Chem Bay of 333; fabrication of sleeve box handler for 313 Building; modification of three ultrasonic welder transducers.

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Two hundred and eleven (211) hours of training were presented during the period of February 21, 1964, and March 20, 1964. Instrument craftsmen have completed the DeVry course on semi-conductors and the course in basic electricity is in progress. The DeVry course on pulse and digital circuits will be started the first week in April.

Manager - Production Fuels

WN Mobley:WKW:gl

RESEARCH AND ENGINEERING

PROCESS AND REACTOR DEVELOPMENT

REACTOR FUELS

Thorium Oxide Target Fabrication

The Hanford Laboratories have completed canning of the four tons of thorium oxide target elements for production testing. One ton of low density (nominal 65 per cent of theoretical) and one ton of high density (nominal 80 per cent of theoretical) are now being irradiated in F Reactor. The other ton of each density is complete and will replace that now being irradiated when the desired goal is reached. Some difficulty was encountered in obtaining the desired degree of compaction for the high density lots due to the nonuniformity of the sol-gel material on hand.

REACTOR PHYSICS

Neptunium-237

All of the enriched fuel in the reactors continues to be identified as recycle material. This metal is known to contain varying amounts of virgin metal. This material contains no deliberate addition of virgin stock but scrap material which goes into making up the ingots contains varying dilutions of recycled uranium.

Clean U-233 Irradiation Tests

Spline traverses in two fringe tubes in F Reactor indicate that the average thermal flux in the thoria targets is $1.5 \times 10^{13} \text{ n cm}^{-2} \text{ sec}^{-1}$ for an adjacent enriched E-column power of 600 kw. Calculations had previously predicted a flux of 1.36×10^{13} . The difference will not affect the irradiation time to 1 ppm U-232, but it will increase the U-233 yield by about ten per cent.

The one-ton central zone thoria test was charged March 15, 1964, into F Reactor and will be discharged about April 1, 1964. An enrichment-to-target ratio of 5.2 was used which is apparently close to the desired value in that no noticeable distortion in the reactor flux across the loading has been noted. Spline traverses are to be taken late in March to determine the absolute flux level and, consequently, the proper irradiation time.

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STATUS REPORT OF PRODUCTION TESTS

<u>Test No.</u>	<u>Type Metal</u>	<u>Tubes</u>	<u>Reactor</u>	<u>Goal Exposure</u>	<u>Current Exposure</u>	<u>Remarks</u>
IP-216-A	Normal prod. natural and enriched fuel elements.	84	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.
IP-381-A and IP-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	400 MWD/T	Second step in evaluating irradiation effects on dimensional stability of oil-quenched enriched uranium. Elements charged during outage of January 14, 1964.
IP-610-A	Induction heat-treated fuel core.	10	DR	600 MWD/T	640 MWD/T	Provide data for evaluating dimensional stability of induction heat-treated fuel cores. Test elements charged on December 26, 1963. Fuel columns discharged during March 10, 1964 outage.

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STATUS REPORT OF PRODUCTION TESTS (cont'd)

<u>Test No.</u>	<u>Type Metal</u>	<u>Tubes</u>	<u>Reactor</u>	<u>Goal Exposure</u>	<u>Current Exposure</u>	<u>Remarks</u>
IP-648-AC	Thorium oxide target elements.	20	F	78 operating days	37 operating days	First phase of irradiation of thorium in a six-ton demonstration load. Elements charged during January 14, 1964, outage.
IP-659-AC	Thorium oxide target elements	19	F	14 operating days	5 operating days	Central zone portion of the six-ton demonstration load. Elements charged during the March 6, 1964, outage.
IP-546-A, Supp. A	Hot-die-sized diffusion-bonded elements	10	C	500 MWD/T	170 MWD/T	Elements charged during February 26, 1964, outage to provide additional irradiation experience.

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RADIOLOGICAL ENGINEERINGRadiation Control Experience

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

<u>Classification</u>	<u>Total Dose</u>	<u>No. of Employees</u>	<u>Average Dose/Employee</u>	<u>Extrapolated Year End Average</u>	<u>No. of Employees Over 3R Extrapolated Exposure</u>
Radiation Monitors	37745 mR	77	503 mR	3270 mR	42
Processing Operators	117128	246	476	3094	141
Pipefitters	54548	106	515	3348	52
Millwrights	49227	85	578	3757	47

Radiation Occurrences

Thirteen Radiation Occurrences were reported during the period. Twelve cases involved skin and/or personal clothing contamination. The other occurrence involved an irradiated fuel element which was inadvertently removed from the front of a process tube and dropped into the pit below with personnel about 40 feet away. The tube contained a ruptured fuel element and the crew was engaged in removing what they thought was the last perforated aluminum dummy from it by inserting a retrieving device, attaching a rope and pulling on it from the work area floor.

Distribution by Reactor and Component

	<u>B</u>	<u>C</u>	<u>D</u>	<u>DR</u>	<u>F</u>	<u>H</u>	<u>KE</u>	<u>KW</u>	<u>Totals</u>
Processing			1				4		5
Maintenance			1			1			2
Special Outage Service							3	3	6
IPD Total	0	0	2	0	0	1	7	3	13

Effluent Activity Data

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

<u>Reactor</u>	<u>P32</u>	<u>AS76</u>	<u>Zn65</u>	<u>Np239</u>	<u>Cr51</u>
B	12.1	150	10.2	290	330
C	17.6	130	15.8	250	830
D	18.1	80	13.7	130	500
DR	10.3	120	17.7	170	1020
F	13.5	170	15.1	230	610
H	9.1	40	9.5	70	330
KE	5.0	30	8.3	30	80
KW	9.7	90	10.5	14	280

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

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PROCESS TECHNOLOGY

PROCESS STANDARDS

HW-41000, Process Equipment Standards

One standard was deleted from this manual during the report period. This was:

Process Equipment Standard D-040 - "Period Instrumentation"

The requirements of this standard have been incorporated in Process Standard C-020 and Equipment Maintenance Standard No. 107.

HW-46000, Process Standards - Reactor

One standard was deleted from all of the areas' manuals. This was:

Process Standard C-010 - "Prevention of Excessive Slug Rupture Rates"

The requirements of this standard are no longer useful.

HW-46000 B, Process Standards - Reactor

One revised standard was issued during the report period. This was:

Process Standard C-040 - "Graphite Temperature Limits"

The required number of graphite thermocouple stringers was increased to eight. Extensive failures of the originally installed filler block thermocouple necessitated this change.

HW-46000 H, Process Standards - Reactor

One revised standard was issued during the report period. This was:

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

The minimum loop coolant pressure at the elevation of the highest cooling tube was lowered from 40 to 35 psig to allow a greater spread between operating and alarm pressures while still assuring an adequate margin between alarm pressure and minimum allowable pressure.

HW-77800, Process Standards - Hanford Test Reactor

One revised standard was issued during the report period. This was:

Process Standard A-010 - "Reactor Startup and Power Level Monitoring"

This revision requires checking the No. I and No. II flux monitors on alternate days.

PROCESS CHANGE AUTHORIZATIONS

Seven Process Change Authorizations were issued during the report period: six to permit deviation from Process Standards - Reactor, HW-46000; and one to permit deviation from Process Equipment Standards, HW-41000. These were:

PCA #4-19 - "Graphite Thermocouple Stringer Replacement - D Reactor"

The three-month period allowed for replacement of a failed stringer was extended until the next minimum outage.

PCA #4-20 - "Foundation Temperature - KE Reactor"

Approximately one-half day additional time was authorized for achieving the minimum foundation temperature limit.

PCA #4-21 - "Horizontal Bowing Measurements - All Reactors"

This process change authorized postponement of horizontal bowing measurements at all reactors until July 1, 1964, to allow additional time for evaluation of modified measuring equipment and for scheduling work.

PCA #4-22 - "Flux Monitor Low Trips - K Reactors"

An extension of PCA #3-59 was authorized to permit additional time for evaluation of laboratory data. PCA #3-59 provided supplemental requirements on flux monitor low-trip settings to aid in preventing an inadvertent ball drop.

PCA #4-23 - "Graphite Temperature Limit - C Reactor"

Authorization was given for continued operation with graphite temperatures 15 C above the limit for startup provided in-limit temperatures were achieved within two hours.

PCA #4-24 - "Panellit Gauge Accuracy Requirement - B Reactor"

An extension of PCA #3-56 was authorized to provide additional time for installation of reworked gauges. PCA #3-56 authorized operation with Panellit gauges that do not fully meet the required accuracy provided the high-trip limit is reduced 10 psi.

PCA #4-25 - "Filtered Water Removal, Confinement Fog Spray - C Reactor"

Removal of the fog-spray system from service was authorized to accomplish necessary repairs provided all process tubes remained capped and the maximum time this system was out of service did not exceed eight hours.

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TEMPORARY NUCLEAR SAFETY SPECIFICATIONSTNS #4-64 - "Processing Solutions, Handling and Storage of Sludge Containing 1.008 w/o U-235 Enriched Uranium"

This TNS provides 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 18 inspections at each reactor during the report period.

FUEL FAILURE EXPERIENCE

<u>Failure Date</u>	<u>Tube Number</u>	<u>Lot Number</u>	<u>Type of Material</u>	<u>Tube Power at Failure (kw)</u>	<u>Exposure MWD/T</u>	<u>Type Failure</u>
3/1/64	2888-H	KY-580-B	I&E E (0.94%)	1290	425	SH
3/4/64	2167-F	KY-527-B	I&E E (0.94%)	1388	847	UN
3/5/64	2876-G	KC-260-B	I&E E (0.94%)	1542	499	SH
3/9/64	3975-DR	KZ-74E-A ¹	I&E N	1232	646	SH
3/11/64	2464-DR	KY-463-V	I&E EB (0.94%)	1278	1044	SU
3/11/64	2181-B	OZ-C08-B	I&E N	1377	445	SH
3/14/64	3773-H	KY-602-B	I&E E (0.94%)	1296	547	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 percent 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.

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

¹The element which failed was a test piece from Production Test IP-610-A, Evaluation of Induction-Heat-Treated Fuel Cores.

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.
 U Unclassified No other character logically applies to the failure.

DECLASSIFIED

OPERATIONAL PHYSICSPILE PHYSICS PLANT ASSISTANCE

Over-all operating continuity for the eight production reactors was fair during the month; flattening and startup efficiency remained slightly below the yearly average at most reactors, reflecting a seasonal tendency to minimize enrichment inventories during the cold-water months.

A production test loading (PT IP-659-AC) of thorium oxide plus supporting enrichment (E-Q) was charged into F Reactor about mid-month, with observed operating and physics characteristics being about as predicted.

Recent studies performed in conjunction with Process Technology indicate an optimum location for the near and far portions of the K enrichment rings at about 2-3 lattice units in from their present positions, with top and bottom locations unchanged. This will satisfactorily accommodate total control requirements in the case of leaving the outer six Ball 3X channels out of service at each reactor, with little or no change in net return.

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

Reactor	B	C	D	DR	F	H	KE	KW
ECT in March (1)	1485	1625	1480	1570	1505	1535	2485	2240
12-Month Average ECT	1495	1655	1510	1530	1500	1520	2475	2480
Equil. Scram Time (2)	15-23	20-22	14-16	17-19	15-20	20-25	20-25*	20-25*
Recording Time								
From:	2-20	2-18	2-19	2-21	2-18	2-19	2-19	2-19
To:	3-20	3-16	3-20	3-23	3-19	3-19	3-19	3-19

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

- (1) Effective Central Tubes: This value is defined as pile power level divided by the average power of the ten most productive tubes in the reactor.
- (2) This is defined as the maximum time in minutes which may elapse between scram and first indication while still permitting a successful scram recovery.

B Reactor - C. E. Hughey

Flattening and startup efficiencies were slightly below the previous year's average; however, a new high power level was attained shortly after the "previously attained high" level limit was raised.

Operational flux flattening efforts were hindered by sticking problems with splines and with one half-rod (#8); this problem also contributed to startup losses.

C Reactor - J. R. Heald

Operation was sporadic during the report period, with slightly lower-than-average flattening efficiency (ECT) but improved startup losses (NEL). Power level was limited by bulk outlet temperature. Scram recovery was attempted following three unscheduled shutdowns; two recoveries were successful, but one was terminated after six hours by a rupture.

D Reactor - G. D. Baston

A large fringe discharge (in conjunction with a plantwide reduction in goal exposure) early in the report period contributed to reduced flattening efficiency and increased startup losses, but equilibrium operation was quite stable and easily controllable. The PCCF system has been reduced to six operable ball valve tubes.

DR Reactor - S. M. Skidmore

Operating continuity was quite good during the report period; a scheduled shutdown on 3-9-64 terminated a 33-day run. A DR record for daily production was achieved on 3-1-64. A slight increase in startup losses was offset by better-than-average flattening.

F Reactor - G. C. Masche

Despite two enriched-element ruptures, over-all efficiency was good, as evidenced by an improvement in all three standard measures of efficiency (ECT, NEL, and prediction errors). The physicist has suggested that the use of partial length splines be minimized to avoid rear flux peaking, which was observed in the general area of the two ruptures. Nineteen columns of thorium oxide plus 104 columns of supporting enrichment were charged under PT IP-659-AC; initial observations indicate physics characteristics about as predicted, with a slightly lower-than-expected heat generation rate.

H Reactor - E. L. Conner

A continuous 31-day run was terminated on 2-22-64; operation since that time has been intermittent due to several enriched-element ruptures. Consequently, partial spline usage has been suspended (to minimize downstream flux peaking) and an internal (administrative) limit has been imposed on power level in an effort to reduce the rupture rate. The possibility of modifying the E-N distribution to more strongly favor upstream peaking is also being considered.

KE Reactor - D. G. Albertson

Operating continuity during the report period was excellent; only one shutdown (minimum outage) interrupted operation. A general plan for maintaining a near-constant rod configuration by heavy splining (constant helium) during the early part of the run, and helium adjustment (constant

spline inventory) during the high-exposure portion has apparently been quite successful; operation was pleasingly stable over the entire period. Thermal shield temperature limits were approached (within three degrees) but were readily reduced by a slight increase in helium concentration.

Total control aspects due to removal of the outer six Ball 3X channels from the safety circuit can be satisfactorily accommodated under expected operating conditions by moving the near- and far-side portions of the E-ring 2-3 lattice units inward; flattening efficiency will be cut by about 100 ECT, but net return will be relatively unchanged.

KW Reactor - A. W. Medcalf

An unusually low excess reactivity at the samarium minimum (attributed to a 2000-tube discharge) resulted in an extended period of low ECT with accompanying high graphite temperatures; a three-day extension was given on the allowable time for operating above limits, and the situation was back to normal within that time.

As part of the optimization effort in choosing a new location for the enrichment ring to better accommodate the loss of the six outer Ball 3X channels, shorter E-column lengths and space-dependent xenon distribution effects are being studied. Also, an attempt is being made to better evaluate the reactivity effects of the ten side-to-side test channels in KW and compensating enrichment geometry requirements.

PROCESS PHYSICS STUDIES

Reactivity and Safety Control Studies

Operational Physics personnel assisted at N Reactor with rod calibrations in the full load during the latter half of February.

Current project and plant activities on all three phases of coverage indicated by the instrumentation criteria study - low-level period, linear-rate-of-rise, and geometrically representative high-level fixed-trip - were summarized in HW-80907.

A study on the feasibility of using octant monitor holes for Log-N (low-level period) chambers was documented as HW-80889. Provided that substitute monitoring indications could take the place of octant chamber readings, it was concluded that readings from chambers located in these holes would be sufficiently redundant for safety circuit dependence in the low-level range.

Reproduction of the revised accountability tables, HW-50300, was delayed pending procurement of reproducing masters and red-bordered paper. These materials are now available, permitting publication to proceed.

Control Efficiency Studies

Nineteen columns of thoria elements were charged into the F Reactor under Production Test IP-659-AC. The reactivity effect of these columns is compensated by approximately 100 surrounding E-metal columns. Reactivity and heat generation effects have been sufficiently close to predictions that F Reactor operating efficiency has been near normal.

The experimental equipment for the D Reactor automatic flux distribution control test was transferred from the D Control Room to the Facilities Engineering Equipment Development Laboratory following successful completion of production testing. Preparation of the final report on PT IP-578-C, Part II, Phase II, is now underway. Both local graphite temperatures and local tube temperatures were observed to stay within a one per cent span during the one-day automatic control test.

Operating Physics Training

A number of presentations were made on total control technical bases to supervisors and specialists in the Reactor Certification Program. The presentations covered material on total control in the IPD hazards document. The class members were given a sample calculation in order to obtain a feel for the absolute magnitude of the reactivities and times involved.

A review program for operators preparatory to their testing was initiated on March 13. Training of additional pile operators is expected to commence following completion of the current review program.

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TESTING

IRRADIATION TESTING

Irradiations - Sample and experiment irradiations were handled as follows:

<u>Reactor</u>	<u>Test Hole</u>	<u>Facility</u>	<u>Request No.</u>	<u>No. of Samples</u>	<u>Material-Purpose</u>
B		Process Channel	HAP0-098	20	Graphite (burnout rate determination)
F		Process Channel	HAP0-098	20	Graphite (burnout rate determination)
DR		PCCF	HAP0-172	1	Effluent water (reduction of radioisotopes in river)
KW	2B	Bare Channel	HAP0-177	15	Graphite (irradiation damage study)
KW	2A	Quickie	HAP0-184	25	Washington Designated Program
KE	2D	Quickie	HAP0-184		Washington Designated Program
KW	3A, 3E, 2D	General Purpose	HAP0-236	5	Zirconium (creep rate study)
KW	4B	Snout	HAP0-249	1	Graphite-stainless steel (irradiation damage study)
C	B	Bare Channel	HAP0-250	1	Ceramics (rod channel liner material study)
KE	2D	Quickie	HAP0-252	1	Arsenic (tracer isotope production)
KW	2D	General Purpose	HAP0-268	1	Fenwal eutectic (PRTR detector evaluation)
KE	2D	Quickie	HAP0-274	1	Barium (tracer isotope production)
D	E	Leak detection	HAP0-277	1	Leak detection facility (reactor leak detector study)
C	B	Bare Channel	HAP0-292	1	Sugar-graphite (rod channel sealing compound evaluation)
KW	2C	General Purpose	HAP0-297	1	Boron-graphite (Fermi reactor graphite evaluation)
KE	2D	Quickie	Reed College	1	Tissue (cancer research study)

Vertical Bowing - Vertical displacement measurements were taken as follows:

<u>Reactor</u>	<u>Channel</u>	<u>Comparison to Previous Data</u>
KW	HCR Channel #2	No previous data

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

<u>Reactor</u>	<u>Channel or Tube</u>	<u>Motion Picture Record</u>	<u>Purpose*</u>
KW	VSR #49	Yes	1
KW	HCR #2	Yes	1
DR	Process Channel 2569	No	2
DR	Process Channel 2765	No	2
DR	Process Channel 2362	No	2

*1 - HCR-VSR channel problem

2 - Maintenance support

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

<u>Reactor</u>	<u>No. of Tubes</u>
B	7
C	5
D	5

C-1 Loop Operation - (High Temperature Aluminum Corrosion Studies, PT-IP-623-D) - Test No. C-1-2 has been operated at reference conditions (current maximum temperature 500 F), except for short periods during equipment malfunction. Pressure and temperature controller problems required reducing loop temperature while repairs were made. One of the two pumps was removed from the loop due to an electrical ground to the case in the motor windings; test continuity was unaffected.

COMPONENT TESTING

Irradiated IPD Fuel Examination, 105-C Facility - Examinations were completed on fuel elements from 62 tubes requiring 158.3 fuel examination units. Individual examinations completed were 4606.

<u>No. of Tube Charges</u>	<u>Production Test</u>
13	IP-216-A, Evaluation of Performance of Normal Production I&E Fuel Elements
20	IP-549-A, Half-Plant Low Alum Feed Water Treatment at F Reactor
20	IP-560-A, Half-Plant Low Dichromate, Low pH Water Treatment at C Reactor
1	IP-610-A, Evaluation of Induction Heat-Treated Fuel Ceres
8	IP-616-A, Irradiation of Enriched Hot-Die-Sized Diffusion-Bonded Fuel Elements

Eight fuel elements from PT IP-546-A, Irradiation of Hot-Die-Sized Diffusion-Bonded Fuel Elements, were selected and shipped to Radiometallurgy for detailed examination.

Irradiated N Fuel Examination, 105-KE Facility - Profile measurements were obtained of the following N fuel elements in accordance with PT IP-477-A:

<u>Number of Outer Elements</u>	<u>Tube and Discharge Date</u>
14	KER-4 1-23-64
12	KER-3 1-23-64

Irradiated Process Tube Measurement

Wall Thickness Gauge (eddy-current type) WTG

<u>Reactor</u>	<u>No. of Tubes Measured</u>	<u>Report No.</u>	<u>HW No.</u>
D	101	10	81090
C	77	11	81100
F	139	12	81285
DR	138	13	81448
Total	455		

Sector Annulus Gauge (eddy-current type) SAG

<u>Reactor</u>	<u>No. of Tubes Measured</u>
C	2
DR	11
F	9
Total	22

Ex-Reactor Visual, Weight, and Micrometer Measurement

<u>Reactor</u>	<u>No. of Tubes</u>	<u>Tube Samples Measured</u>	<u>Reason Examined</u>
B	2	37	Outlet flange failure
B	1	0	Tube removed as internal leak suspect; visual examination confirmed it having failed outlet flange
C	2	84	Evaluation of Corrosion, IP-560-A
DR	1	44	Outlet flange failure

Critical Reactor Component Examination - KW front flexible connectors on rows 1 through 10 and 44 through 58 were examined after tube replacement.

All DR front flexible connectors were examined after tube replacement.

Panellit System Programs

Gauges repaired, calibrated by Maintenance	-	41	
Gauges meeting calibration criteria	-	34	(83%)
-previous month	-		(87%)
In-board gauge reliability examination	-	60	
Gauges meeting examination criteria	-	60	(100%)
-previous month	-		(93%)
-average for past year	-		(98%)
Response time determination	-	60	
Gauges meeting response criteria	-	60	(100%)
-previous month	-		(100%)
-average for past year	-		(99.9%)
In-board Bourdon coil examination	-	6000	
Non-leaking coils	-	5993	(99.9%)
-average rate past two years	-		(99.8%)
Gauges receiving failure analysis	-	56	
2B-X1 switch examination	-	405	
-acceptance rate	-	380	(94%)
-previous month	-		(89%)
Gauges received from Central Maintenance and examined	-	476	
-acceptance rate	-	443	(93%)
-previous month	-		(87%)
Interconnecting lead examination	-	817	
-acceptance rate	-	753	(92%)

Nine hundred eleven 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, two of which are equipped with thermocouples, and four 17-inch NIEL fuel elements as heaters authorized by PT IP-601-D continued. The objective of the test is to further evaluate the effects of ammonium hydroxide for coolant pH control, particularly the crud-forming and decomposition characteristics of ammonium hydroxide at conditions approximating those expected at N Reactor.

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KER-2 - Testing of four NIEL fuel elements, two 18-inch lithium-aluminum target elements and one Zircaloy-2 clad thorium-uranium crud monitor authorized by PT IP-536-A, Supplement D, IP-584-D, Supplement A, and IP-644-D continued. IP-536-A, Supplement D authorizes the irradiation of NIEL fuel elements with modified end closures. The objective of the testing authorized by IP-584-D, Supplement A, is to gain additional exposure information on the irradiation of lithium-aluminum target alloys. IP-644-D authorizes the irradiation of the proposed N Reactor fuel surface crud monitor to demonstrate and evaluate its design. The loop pressure and temperature conditions closely simulate those expected at N Reactor as authorized by PT-IP-638-D.

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 - The loop remained out of service because of the damaged pressurizer vessel.

Single-Pass Tube Operation - 1706-KE

<u>Tube</u>	<u>Production Test</u>	<u>Water Supplied</u>	<u>Corrosion Inhibitors & Chemical Additions</u>	<u>pH</u>
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	6.6
			1.0 ppm silicon dioxide	
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	6.6
			1.0 ppm silicon dioxide	
SP-6 (4863)	IP-604-A	Service	2.0 ppm sodium nitrite	6.6
			1.0 ppm silicon dioxide	
SP-7 (4963)	IP-449-A	Process	1.8 ppm dichromate	6.6
SP-8 (5063)	IP-449-A	Process	1.8 ppm dichromate	6.6

*Began adding 2.0 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 or outage time was charged to production testing.

Out-of-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 with ammonium hydroxide used for pH control continued. Testing of NPR steam generator tubing to determine the leak rate and corrosion effects of leakage and uniform corrosion testing of NPR silver-plated components and copper continued. Operating conditions are 288 C, 1340 psi and pH 10.1.

TF-3 - Testing to evaluate crevice corrosion beneath Zircaloy-2 fuel element supports with ammonium hydroxide used for pH control was continued. Operating conditions are 314 C, 1985 psi and pH 10.0.

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-5 - Testing to evaluate the effects of a proprietary cleaning solution on N Reactor fuel elements was completed.

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

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. 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. A section of NPR steam generator tubing for determining the leak rate and the size propagation of a pin-hole leak formed by intergranular corrosion
9. Stainless steel and Inconel coupons to be prefilmed for decontamination testing

TF-8 and TF-17 - These two facilities were interconnected to simulate the NPR primary and secondary cooling systems with steam generation in the secondary. Steam is generated in samples of NPR steam generator tubing as the primary temperature is cycled between 250 F and 535 F. The object of the test is to evaluate tubing samples with known intergranular corrosion under cyclic thermal stresses equal to or greater than those expected during NPR power transients. The first sample failed on March 23 after 72 cycles.

TF-20 - Testing to determine the effects of heat transfer on aluminum corrosion in process water and the cause of resistance temperature detector

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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

Manager, Research and Engineering

FACILITIES ENGINEERING

DESIGN ENGINEERING

Vertical Safety Rods - Graphite Distortion

The previous attempt to clear VSR Channel 41 at C Reactor of accumulated debris in preparation for thermal shield drilling was not completed. A deep bed of 3X balls was found in the bottom of the channel which precluded drilling the anticipated graphite obstructions. A second attempt, during an outage late in the month, permitted vacuum removal of approximately two feet of 3X balls and removal of debris down to the lower cast iron elevation.

The following course of action has been proposed for this program.

1. Renovation of the VSR channels and liner installation will proceed on an "as required" maintenance basis rather than a project basis.
2. Sufficient graphite sleeves should be ordered to permit the lining of ten channels at 105-C Reactor in the next fiscal year.
3. The 105-C Reactor prototype shield enlargement and channel reaming equipment will be utilized in the renovation program.
4. Work directed towards the installation of several VSR channel liners in 105-K Reactors on a test basis should proceed as rapidly as possible.
5. Additional investigation of the feasibility of installing metallic VSR channel sleeves in certain locations in the reactors will be undertaken.

Process Piping System Studies

An interim report, Document HW-80550, has been issued which reports the status to date of the process systems investigations and projected plans. No further investigations are planned for those reactor plants scheduled for deactivation.

Power Recovery Study

Study I of the Power Recovery potential of the Hanford type reactors is in the report preparation status, the report document will be issued in April.

Replacement of Horizontal Control Rods

A replacement flexible high temperature horizontal rod tip is being developed for use in distorted horizontal control rod channels at the 105-K Reactors. The fabricator of the poison elements used in the rod assembly has been having difficulty meeting our dimensional requirements. Efforts by both General Electric and RLOO-AEC in expediting the vendor to produce the required material have been ineffective to date. A request has been forwarded to RLOO-AEC to obtain an alternate source of supply for the material. The lack of poison elements is currently holding up the completion of fabrication of the two prototype horizontal control rod tips. These delays are resulting in a corresponding delay in the over-all program.

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Zirconium Tube Installation - K Reactors - Design

Impact extruded inlet nozzles similar to those installed on the zirconium process tubes have been ordered for the spline tubes at the 105-K Reactors. Problems encountered in obtaining satisfactory extrusions are not deemed significant since the 600 nozzles in question are very similar to the 5000 nozzles previously procured for use with the zirconium tubes.

100-K Reactor Coolant Backup System

A study has been initiated to evaluate the 100-K Area high pressure cross-tie coolant backup system to determine the effect of corrosion on adequacy of coolant backup flow. The study includes a review of present capacities and requirements under present operating conditions, and limitations which might be placed on future operating conditions by the presently available flows.

Corrective measures under consideration to alleviate the expected inadequacy are: 1) cleaning and painting the extremities of the crosstie system wherein chemical corrosion inhibition has been impossible, and 2) increasing available coolant by increasing the speed of diesel-driven backup pumps.

Small Reactors Emergency Coolant Backup System

Preliminary engineering studies of reactor coolant backup systems are underway. The proposed deactivation of three of the smaller reactors has necessitated a modified approach to the problems of reliable reactor coolant backup. Present efforts are directed toward a system which will include diesel engine-driven pumps in 182-B to provide emergency coolant backup to the B and C Reactors and modification of the piping systems which will make the required backup requirements independent of the existing export system. These same pumps will provide emergency coolant backup to the 105-D Reactor through the export system piping. Additional steam turbine-driven export pumps would also be installed at 182-B and 182-D to ensure dependable water supply to the 200 Areas, and in the case of 182-D, to provide a secondary supply to the 182-B reservoir under specific emergency conditions.

Reactor Work Platform Gratings

An inspection has been made of all reactor charge platform grating installations. The installations appear to be entirely satisfactory, and the gratings currently provided are withstanding equipment loads without distortion or excessive wear. Of particular interest was a test section of an alternate type grating installed on the 105-C Reactor work platform in August 1962. This section appears to be wearing equally well when compared with adjacent extruded grating sections installed later.

In addition, a test section of extruded aluminum grating on which grit was applied to the top surface for personnel safety was inspected. This inspection showed that the grit surface on the 70 square feet of test grating was holding up very well.

EQUIPMENT DEVELOPMENT

Self-Supported Fuel Element (SSFE) Charging

The prototype SSFE charging machines continued to function satisfactorily during recent displacement discharging operations at the K Reactors. Higher-than-goal exposed fuel was successfully displacement discharged routinely even though abnormally high forces were encountered. The third charging machine, being procured from Union Machine Works, has been completed and is undergoing tests in the vendor's plant. Tests, utilizing four fully loaded magazines, of the loaded section indicate a weakness of the magazine holding mechanism; redesign and repair are under way.

The all-magnesium fuel magazines were tested on-reactor at the last KW Reactor outage and were judged to be satisfactory. Procurement of 1300 additional magazines has been initiated.

Prototype High Speed Scanner

The high speed scanner prototype system has operated a total of 27,125 hours. The equipment was shut down on March 5 due to a power supply failure in the input switch section. System repair has been initiated.

K Reactor Resistance Temperature Detector (RTD) Corrosion

Production Test IP-652-AF (HW-80404) utilizing on-reactor testing of experimental RTDs has been approved and 37 RTDs (Inconel, Inccloy, ceramic coated, Hinac, nickel coated, copper plated, nickel plated, cadmium, titanium plated, and silver plated) were installed in 105-KW during the recent outage. Laboratory tests are continuing in an attempt to simulate the corrosion observed on-reactor. Testing to date has been unsuccessful in establishing the corrosion method or cause.

Design Test Service

The N-Reactor program utilized 742 hours of engineering effort for design test service.

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PROJECT ENGINEERING

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

Four over-head traveling work platform cranes have been received on-plant and are being prepared for installation.

An order for 1300 all-magnesium fuel charging magazines is being processed. This change to all-magnesium magazines will result in a cost savings of approximately \$60,000 as compared with the magazines with plastic liners.

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

Title II drawings are now in preparation by Vitro Engineering. A letter has been forwarded to RLOO-AEC requesting that Vitro provide sufficient flexibility in the design of this facility to permit feeding Bauxite material which may vary in Al_2O_3 content from 50 to 80 per cent. The Design Criteria designates the Bauxite feed material to be within 61 to 68 per cent Al_2O_3 content.

CAI-108, Emergency Storage Basin Coolant

Construction of this project has been indefinitely delayed by RLOO-AEC.

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

Authorization to proceed with Title I and II design has been released to Vitro Engineering. GE-HAPO is authorized to provide technical direction of the design effort. Preparation of the Purchase Specification for the Log Radiation Monitors has been completed.

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

The curb has been poured for placement of the Safety Circuitry Panel in 1706-KER. Also started is installation of transmitters, fabrication of various brackets, and fabrication of shielding tanks for the neutron monitors.

Eighteen of 29 drawings have been accepted from Vitro Engineering and issued to the field.

The revised Design Criteria has been approved by the Design Council and forwarded to RLOO-AEC for approval.

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

Design Council approved revised criteria was transmitted to RLOO-AEC on March 12, 1964.

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

The order for platform safety brakes was sent to the vendor on March 30, 1964. The negotiations for the sprocket purchase is complete. These items will be expedited to try to obtain a June delivery.

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

Installation work was started on March 20, 1964 at 105-B and March 25, 1964 at 105-C.

MJA-42. Interior Painting, Process Water Storage Tanks, 100-B, F, H, DR, and C Areas

The sub-contractor is now working on the No. 1 water storage tank at 190-B.

Directives Received

HW-538, Mod. No. 1, High Speed Scanning System for Temperature Monitors - KW Reactor (Extended completion date to November 15, 1965).

CPFF Construction Service Contractor-Liaison

Issued four new work orders and supplemented three old jobs, for a total of \$276,395 to J. A. Jones Construction Company.

Plant Forces Work Review

The Labor Standards Board approved one job for assignment to plant forces, estimated to cost \$12,100.

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REACTOR PLANT DEACTIVATION

March was the first full month of operation of this component. During this time, preliminary cost estimates and schedules have been prepared and studies made.

1. Cost estimates have been prepared as follows:

Cost of maintaining one reactor in a state of readiness (warm and wet case) in single area.	\$550,000/yr.
Cost of maintaining one reactor in a state of readiness in a dual area.	\$415,000
Cost of maintaining each reactor in a state of readiness in both single area plants.	\$535,000
Capital costs associated with shutdown, not including export system.	\$1,200,000
Capital costs for export system changes.	\$570,000
Deactivation group costs.	\$474,000
Engineering Services costs.	\$177,000
Costs of plant forces during deactivation.	\$2,910,000
Post-layaway surveillance for each standby plant.	\$100,000/yr.
Post-layaway surveillance for each abandoned plant.	\$75,000/yr.

Also prepared were a number of studies for comparative costs of alternate scheduling and conditions of layaway.

2. A detailed schedule of plant forces manpower requirements and reduction in force was prepared. A critical path overall program schedule is in preparation.
3. Methods of preservation treatment are being investigated on a continuing basis. Information on the subject has been obtained from the Navy and other sources are being explored.
4. Liaison has been maintained with Design Engineering and Project Engineering in project proposal preparation for peripheral facilities, capital cost items directly related to laid-away facilities and the export system.

Manager, Facilities Engineering

RT Jessen:hrr

FINANCIAL

ACCOUNTING

FY 1966 and revised FY 1965 operating budget and Research and Development budget were completed and transmitted to Financial Consolidations April 1, 1964.

Responsibility for Essential Materials accounting is being transferred from Contract and Accounting Operation to IPD Financial. The addition of this accounting function will be accomplished by personnel currently assigned to IPD Financial.

Financial reviewed deactivation program studies of capital and expense cost estimates with the Manager-Reactor Deactivation for inclusion in the Department General Manager's letter to RLOO-AEC. Financial participation in the deactivation program will continue to provide guidance and evaluation of procedures and controls.

Automatic Data Processing equipment feasibility study for an IBM 1401, Model C, computer was completed and approved by General Electric management. The equipment is scheduled for release by Data Processing Operation. Request of RLOO-AEC approval is in process to transfer the equipment to IPD. The equipment will provide additional capacity and upgrading of present IPD equipment for performing production forecasting and scheduling for IPD and NRD.

AUDITING

Approximately 200 additional copies of two OPGs relative to classification and related practices were provided Department personnel.

Fourteen revisions of AEC Manual Chapters and one AEC Procurement Regulation were reviewed and appropriate action taken.

Manager-Finance

RW McMichael:WKH:slb

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SIGNIFICANT REPORTS ISSUED

<u>Number</u>	<u>Class'n</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-80907	Conf. Undoc.	WL Stiede	2-18-64	Memorandum on Safety Instrumentation Progress
HW-80889	Secret	WL Stiede	2-17-64	Octant Holes for Log-N Chambers
HW-78869	Conf.	CA Strand	1-14-64	End Closure of Hot Die Size Diffusion Bonded Fuel Elements
HW-81273	Conf.	WA Blanton	3-12-64	Increased Fuel Length evaluation Program
HW-80550	Unclass.	DF Watson	2-24-64	Engineering Review of Critical Process Piping, Interim Report
HW-80626	Secret	DF Watson	1-30-64	Effects of Corrosion Upon the Adequacy of the 105-KE and 105-KW Emergency Coolant Backup System
HW-80862	Secret	DE Cooley	2-14-64	Internal Graphite Moderator Forces Study - Supplemental Information
HW-81013	Secret RD	NF Fifer	2-26-64	Power Recovery Study I - Personal Notes
HW-81107	Secret	JW Ballowe	3-2-64	Meeting Minutes - Power Recovery Study Meeting No. 11 - February 28, 1964
HW-81365	Secret RD	MH Schack	3-17-64	Power Recovery Calculations
HW-81274	Unclass.	RR Cone ML Peterson	2-64	A Reliable Trip Comparator Suitable for Reactor Safety Circuit Use
HW-80912	Conf.	CA Munro	3-5-64	Supplement to Shutdown Control of Hanford Reactors
HW-74072	Conf.	JP Cooke SA Wood	2-14-64	PT-IP-515-AE - Use of Liquid Nitrogen for Stuck Charge Removal
HW-80677	Conf.	WH Clemans	2-3-64	Final Report - B, D, F, Reactor Side Shield Hole Boring Technology

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<u>Number</u>	<u>Class'n</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-81368	Conf.	RL Loundagin	3-5-64	Request for Appropriation - Vertical Safety Rod Shield Opening Enlargement Machines for K Reactors
HW-81378	Secret	JP Cooke	3-13-64	Report of Visit of Dr. LC Matsch March 11 and 12, Including Discussion at Meeting at the C Reactor Conference Room
HW-80939	Unclass.	HF Jensen	2-19-64	Development Test IP-663-AE Chemical Cleaning of K Reactor Crossheader Expansion Joints
	Unclass.	R Sherrard	3-5-64	Record of Visit to Astrodata on February 17-19, 1964
	Unclass.	GL Erickson	3-9-64	Ohmart Corporation Log Picoammeter Evaluation
HW-79614	Unclass.	RT Jaske	1-15-64	Large Scale Quarry Blasting on the Hanford Reservation
HW-81243	Secret	RW Hooper	2-26-64	Increased C Reactor Flow
HW-80966	Unclass.	EJ O'Black	2-24-64	Ball 3X Electrical System Review, Reactor Plants, B, C, D, DR, F, H, KE and KW
HW-81275	Unclass.	RE Miller	3-13-64	Crossheader Δ P Instrumentation - 105-B, C, D, F, H, KE and KW

TRIPS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
R Nilson	Univ. of Washington Seattle, Wn.	3/5-6/64	PhD Recruiting.
WK Woods	GE - APD Palto Alto, Calif.	3/26-27/64	Discussion of U-233 and thermionics.
FW Grubb	Industrial Education Institute Portland, Oregon	3/16-17/64	Attend seminar on report writing.
EA Weakley GB Hansen	ALCOA, Wenatchee, Wn.	3-17-64	AlSi ingot quality, aluminum alloy production techniques, AlSi alloy availability.
CJ Denton	National Lead of Ohio Cincinnati, Ohio	3/24-26/64	Technical problems concerning nondestructive testing.
LH Rice	National Lead of Ohio Cincinnati, Ohio	3/21-26/64	Uranium technology and resolve technical problems in non-destructive testing.
FJ Kempf	General Electric Co. Schenectady, New York	3/19-20/64	Discuss turbine generator requirements for power recovery study.
CW Harrison	General Electric Co. Schenectady, New York	3/18-20/64	To consult with GE Advanced Engineering Laboratories on pumps and Turbine Division on large turbine generators.
RT Jaske	US Dept. of Interior Fish & Wildlife Service Seattle, Washington Dr. Gerald B. Collins	3/17-19/64	Review of plans for upstream water temperature features of Canadian Treaty Dams.
	Geo-Recon, Inc. Seattle, Washington S. D. Schwarz		Arrange for building vibration measurements.

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<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
JW Green	National ISA Nominators, Chicago, Illinois	3-19-64	Attend meeting as the Northwest District IX representative.
DL Hollands	Atomic Power Equipment Department, GE Company, San Jose, Calif.	3-23-64	For interview regarding a position in Manufacturing Engineering.

VISITORS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
GB Campbell	ALCOA, Wenatchee, Wn.	3-6-64	AlSi quality.
DM Guy	ALCOA, Seattle, Wn.	3-6-64	AlSi quality.
F Morris	Turco Products Spokane, Wn.	3-17-64	Chemical compounds.
WS Langmade	Mine Safety Appl. Co. Seattle, Wn.	3-20-64	Plastic gloves.
J Horton	Travelers Indemnity Co. Seattle, Wn.	3-19-64	Third party inspection of #3 boiler and autoclaves in 313 Building.
PN McCreery MA Desesa CE Bussert D Nelson	National Lead of Ohio Cincinnati, Ohio	3/10-12/64	Reactor feedsite integration problems.
ER Parker	Univ. of Calif. Berkeley, Calif.	2/27-28/64	Consultation on brittle fracture problem.
WC Heath	NTH Products, Inc. San Diego, Calif.	3-17-64	Discuss prototype hori- zontal control rods.
Dr. Newman F Morris	Turco Products Los Angeles, Calif.	2-25-64	Decontamination of chemi- cals and coatings.
Dr. LC Matsch	Linde Div. of Union Carbide Co. Tonawanda, New York	3/11-12/64	To discuss gas purifi- cation proposals.
EW Legas	Chicago Pneumatic Tool Co. Chicago, Illinois	3-10-64	To demonstrate spline cap torque wrench.
RE Donelson	DeVar Inc., Portland, Oregon	3/5-6/64	To convert the input to the DeVar recorders to be used on bulk exit temperature to the NR-27 curve.

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