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IRRADIATION PROCESSING DEPARTMENT MONTHLY REPORT

NOVEMBER 1964

HANFORD ATOMIC PRODUCTS OPERATION

GENERAL ELECTRIC

RICHLAND, WASHINGTON

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IRRADIATION PROCESSING DEPARTMENT MONTHLY REPORT NOVEMBER, 1964

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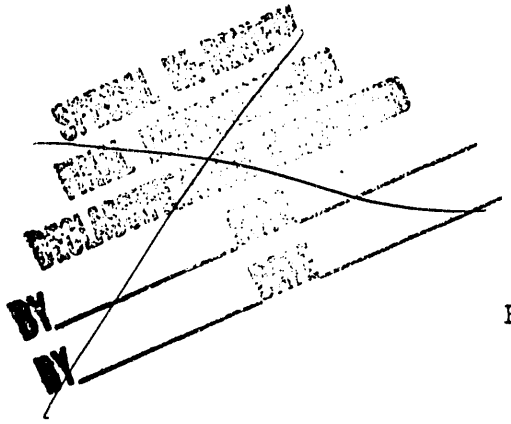

Compiled By
IPD Personnel
December 14, 1964

RICHLAND, WASHINGTON

Work performed under Contract No. AT(45-1)-1350 between the Atomic Energy Commission and the General Electric Company.

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SUMMARY

MANUFACTURING

Reactor input plutonium production for November was 487.6 KMWDs: 267.3 KMWDs at the six smaller reactors and 220.3 at the two K Reactors. Tritium input production for November was 2181 equivalent MWDs and thorium input production was 3567 equivalent MWDs.

Over-all time operated efficiency was 82.4% (85.2% forecast): 81.7% at the six smaller reactors and 84.7% at the K Reactors. Forecast efficiency was not made at the smaller reactors due to fuel element failures and miscellaneous outages largely associated with reactor hardware.

Power levels at the C, D, DR, F and H Reactors were restricted by a bulk outlet water temperature limit of 95 C except for the last half of the month when the H Reactor level was limited by tube power restrictions designed to minimize rupture potential. The B Reactor power level was restricted by trip-after-instability limits associated with some distortion of flux around the experimental E-D (depleted uranium) block. Power levels at the two K Reactors were restricted by the administrative limit of 4400 megawatts.

Nine failed I&E fuel elements were removed from the reactors: eight of natural uranium and one of enriched uranium. In addition, the can wall was partially stripped from a stuck natural uranium element when the piece was removed from the tube. Four of the natural failures were at D Reactor, two were at B, one (overbore) was at C and one was at H. The enriched failure was at F Reactor and the stuck natural uranium element was at H Reactor. All failures occurred at 75% to 102% of goal exposure. Five of the failed elements were side hot-spot failures and four had not been examined at month's end. Six of the failed elements were stuck in process tubes and one caused a process tube water leak.

One internal process tube leak was corrected at D Reactor. Eight new process tubes were installed.

PRODUCTION FUELS

A total of 635 tons of natural and enriched fuel elements was produced in November, 105% of forecast.

Canning line operation was at the rate of nine lines per day. One overtime day, November 7, was worked. Canning line efficiency was 98.6% for November.

Bare core inventory at month's end totaled 717 tons, a 1.2 months' supply. Finished fuel inventory was 1094 tons, a 2.2 months' supply.

The manufacturing yields of all fuels remained at high levels during the month, all categories being above forecast.

One autoclave failure occurred in November. Examination revealed a small pinhole in the weld connected to an unbonded area beneath the cap.

Thoria target elements for loading the B Reactor fringe on November 15 and the KW Reactor core on November 30 were finished and delivered on schedule.

RESEARCH AND ENGINEERING

Approximately 27 tons of thoria target elements are now under irradiation in the fringe zones of KW, D and B Reactors. With reactivity matched, adjacent tube powers have been approximately 10% to 15% less than predicted; a slightly longer irradiation time is therefore indicated for the fringe columns.

The Hazards Evaluation of the KW Reactor core thoria loading was approved by the ACRS. The first half-core loading was in progress at month's end. The loading of thoria in the C and KE Reactor fringes is scheduled for December and the second half-core loading for KW is scheduled for early January.

Depleted uranium irradiations in B and KE Reactors are progressing satisfactorily; exposures have reached approximately 29% and 22% of goal, respectively.

Observations at C Reactor disclosed separations of approximately one inch between graphite blocks adjacent to the front and rear banks of VSR channels. Graphite blocks adjacent to these C Reactor channels are the only ones susceptible to separation because of differences in the key and block arrangement. In the event of a Ball 3X trip, these separations would result in some residual balls being adjacent to the front and rear VSR channels but would not cause reactivity and level losses as severe as those observed at DR Reactor.

FACILITIES ENGINEERING

Deactivation procedures for DR Reactor are approximately 90% complete. The first issue of the Deactivation Manual was issued to DR management.

The high strength graphite test sleeves which were ordered in January, 1964 for installation in No. 41 VSR channel at C Reactor are now on plant. Evaluation of the certified chemical analysis of sleeving material indicates that the sleeve material has been thermally purified but not gas purified as required for production of nuclear grade graphite. Agreement has been reached that the installation of the unpurified sleeves in one channel will not cause a noticeable change in reactivity.

The final assembly of the first prototype Inconel sheathed HCR for the K Reactors has been undertaken following the receipt of sufficient poison material from the vendor.

Bids were received for the fabrication of two prototype aluminum HCRs for test purposes. All of the bids contained minor discrepancies; negotiations are under way with the apparent low bidder.

An off-site contractor was visited to review the status of their materials evaluation work and define future phases of work for the uncooled HCR concept. The results to date are encouraging. The candidate materials for rod sheathing have been narrowed to two alloys - 19-9DL and Inconel 600.

The design of a test facility for a sodium silicate system in 190-D Building is progressing in support of the planned half-plant test. In this program, sodium silicate will be injected into the reactor coolant downstream of the 183-D filter plant to observe the effect of such chemical addition on effluent activity.

Further activity in connection with reactor effluent studies includes feasibility investigations of alternate methods of reactor effluent disposal. Work on this program has been concentrated on disposing of reactor effluent, particularly from the 100-K Area, by means other than discharge directly to the Columbia River.

Testing of the latest qualification lot of RTD cable produced by one vendor is in progress. Tests to date show the cable does not meet specification requirements for water absorption, and conductor insulation is below standard elongation characteristics in the "as-received" condition. In addition, the cable tends to break through the soft silicone insulating material because of the severe "kneeing action" of the conductors.

Project CGI-966, Safety Circuit Trip Identification Systems - 105-B, C, D, DR, F, and H Buildings, was stopped prior to the installation at 105-B because of a shortage of authorized funds.

The vendor, Astrodata, Incorporated, has advised of an estimated overrun of $113,000 and a completion delay to March, 1965 for the high speed scanner on Project CGI-967, High Speed Scanning System for Temperature Monitors, KW Reactor.

RESPONSIBILITY

There were no significant changes in responsibilities.

FORCE SUMMARY

	Exempt	Non-Exempt	Total
General	8	2	10
Research and Engineering	83	46	129
Manufacturing	332	1220	1552
Production Fuels	89	344	433
Facilities Engineering	83	25	108
Financial	18	22	40
Employee Relations	5	2	7
TOTAL	618	1661	2279

SAFETY, SECURITY AND RADIATION EXPERIENCE

There were 84 medical treatment injuries, two security violations and no radiation incidents exceeding operational control limits. A disabling injury was incurred when a Manufacturing Utility Operator suffered severe burns on the feet and legs. The employee was struck by a stream of hot water from the discharge of a sump pump while removing effluent water from a chamber adjacent to the downcomer.

INVENTIONS

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

Name	Date	Title
G. Miller	11-2-64	A Fixture for Compacting Ceramic Fuel or Target Material into Cans for Irradiation into Nuclear Reactors

General Manager

AB Greninger:DLD:bm

MANUFACTURING

PRODUCTION & GENERAL

Reactor Production

Reactor input plutonium production for November was 487.6 KMWDs: 267.3 KMWDs at the six smaller reactors and 220.3 KMWDs at the two K Reactors. Tritium input production in fringe poison at the six smaller reactors was 2181 equivalent MWDs and thorium input production at B, D, KE and KW Reactors was 3567 equivalent MWDs.

Power levels at the C, D, DR, F and H Reactors were restricted by a bulk outlet water temperature limit of 95 C except for the last half of the month when the H Reactor level was limited by tube power to minimize fuel element failures. The B Reactor power level was restricted by trip-after-instability limits and power levels at the two K Reactors were restricted by the administrative limit of 4400 megawatts.

Over-all time operated efficiency was 82.4% (85.2% forecast): 81.7% at the six smaller reactors and 84.7% at the K Reactors. Forecast efficiency was not made at the smaller reactors due to fuel element failures and miscellaneous outages largely associated with reactor hardware.

Fuel Exposure

There were no discharge goal exposure adjustments during November. The average discharge exposure was near to that required to provide weapons grade plutonium. However, there was more blending of high and low exposure material than usual. Variations from planned exposures were necessary to utilize unscheduled outages and to avoid having several reactors shut down simultaneously. The average exposure (MWD/Ton) of irradiated fuel discharged is as follows:

	Smaller Reactors	KE & KW Reactors
Natural	592	630
Enriched	790	1032

Reactor Personnel Certification

Oral examinations were given to three operators. One operator completed the third written examination and was upgraded to "Nuclear Reactor Control Operator." Two operators were downgraded during the month for failing oral examinations, leaving a total of 53 operators upgraded at month's end. Thirty-seven operators have completed all requirements and have received their certificates.

REACTOR AND POWER STATISTICS — NOVEMBER, 1964

REACTOR DATA	B	C	D	DR	F	H	KE	KW	TOTAL
INPUT PRODUCTION – PU – KMWD	38.2	50.6	36.1	51.5	44.6	46.4	110.9	109.4	487.6
" " – TRITIUM – EQUIV. MWD	212	67	9	469	168	1256	0	0	2181
POWER LEVEL – MW (MAX.)	1850	2205	1920	1900	1900	1930	4400	4400	20505
" " – MW (AVG.)	1676	2092	1713	1807	1812	1794	4347	4320	19561
TIME OPER. EFFICIENCY – %	76.0	80.6	70.2	95.0	82.0	86.1	85.0	84.4	82.4
OUTAGES – ALL CAUSES	2	4	7	2	3	2	1	3	24
OUTAGE TIME ALLOCATION – %:									
CHARGE – DISCHARGE	12.7	10.3	2.7	4.0	6.7	5.1	9.3	1.8	6.6
FAILED FUEL REMOVAL	4.9	0.4	11.5	-	0.4	1.8	-	-	2.4
WATER LEAKS	-	-	-	-	-	-	-	4.5	0.6
TUBE REPLACEMENT	0.3	0.7	-	-	2.5	-	-	-	0.4
OTHER MAINTENANCE	2.9	2.2	15.4	0.8	8.2	1.0	4.0	8.0	5.3
PRODUCTION TESTS	2.0	2.4	-	-	0.1	-	1.7	0.4	0.8
PROJECT WORK	-	-	-	-	-	-	-	0.8	0.1
OTHER	1.2	3.4	0.2	0.2	0.1	6.0	-	0.1	1.4
TOTAL	24.0	19.4	29.8	5.0	18.0	13.9	15.0	15.6	17.6
WATER LEAKS – TUBE	-	-	1	-	-	-	-	-	1
" " – VAN STONE	-	-	-	-	-	-	-	-	-
NEW TUBES INSTALLED	2	-	3	-	2	1	-	-	8
FUEL CHARGE – TONS NAT. U.	126.2	187.0	148.1	132.6	195.7	126.7	392.1	337.1	1665.5
" " – TONS ENR. U.	81.8	36.9	57.1	37.0	27.4	74.6	65.7	95.1	475.6
FUEL ELEMENT FAILURES	2	1	4	-	1	1	-	-	9
HELIUM CONSUMED – M CU FT.	309.4	258.8	274.7	133.9	314.8	168.6	186.8	265.1	1912.2
POWER DATA									
RIVER WATER PUMPED – M GALS.	7836.1		6773.2		3564.0	3856.2	8939.7	8695.0	39664.2
WATER EXPORTED – M GALS.	619.8		98.3		-	-	-	-	718.1
WATER TREATED – M GALS.	2627.1	4586.7	3574.9	2993.6	3528.4	3853.4	8925.3	8695.0	38784.4
WATER TO REACTOR – M GALS.	2974.1	3643.1	2644.5	3550.2	3353.4	3627.9	7884.0	8134.6	35811.8
" " " – GPM (NORM)	89100	99500	89100	87800	89000	93300	209000	209000	
" " " – pH	6.65	6.67	6.62	6.63	6.64	6.63	7.07	7.07	
" " " – DICHROMATE (PPM)	1.00	.99	.98	1.00	9.1	.95	.90	1.00	
STEAM GENERATED – M LBS.	59332		63061		36880	32775	24180	22918	
LBS. STEAM / LB. OF COAL	9.03		7.91		8.92	8.25			848.0
" " / GAL. OF OIL							104.8	109.4	107.0
ELECTRICITY GENERATED – MWH							1489.6	1550.6	3040.2

B-2

HW-82944

REACTOR OPERATIONS

Reactor & Power Statistics

These are tabulated on page B-3.

B-C Plant

Power level at B Reactor was restricted by trip-after-instability tube temperature limits and was approximately 5% below normal. Power level at C Reactor was restricted by the 95 C bulk outlet temperature limit.

Two unscheduled outages (38.9 and 124.6 hours) due to failed natural metal fuel elements were experienced at B Reactor. In addition, the October 30 outage extended 9.2 hours into November. Major work, other than normal charge-discharge, accomplished during these outages included: replacement of five resistance temperature detectors, completion of the overhaul and installation of new hoses on all horizontal rod hose reels, charging of 140 tubes of thoria and 235 tubes of support enrichment, replacement of nine front nozzle lug rings and measurement of the wall thickness of 13 process tubes.

Three unscheduled outages (36.4, 45.9 and 6.4 hours) and one scheduled outage (50.9 hours) occurred at C Reactor. The unscheduled outages were caused by a failed overbore fuel element, an unexplained Panellit trip and a manual scram to repair front face cap leaks. Major work performed (in addition to charge-discharge) during these outages was: replacement of 76 front face fringe nozzles to permit charging of thoria fuel elements, wall thickness measurement of 35 process tubes, and repair of six front and four rear cap leaks.

The following design changes were completed:

No. 835 - Revisions to Horizontal Control Rod Wiring at 105-B

No. 874 - Modification of the Graphite Temperature Recording System at 105-C

No. 929 - Replacement of the Subcritical Bypass Switch at 105-B

No. 930 - Installation of High Tank Temperature Controllers at 105-B and C

No. 931 - Replacement of the Safety Circuit Transformer at 105-B

D-DR Plant

Power levels at the D-DR Reactors were restricted by bulk outlet water temperature limits of 95 C.

D Reactor was not operating at the start of the month because of a continuation of the October 19 outage (56.5 hours in November). Seven unscheduled outages were experienced: four (33.5, 13.3, 33.4, and 38.1 hours) because of failed natural metal fuel elements, one (4.6 hours) due to a Panellit trip caused by a venturi partially plugged with a piece of gasket material, one (34.5 hours) caused by a faulty rear crossheader Parker fitting insert, and one (0.6 hour, after a start-up) to fully engage a front face cap. Major work other than charge-discharge accomplished during these outages included: completion of thermocouple repairs and continuity checks on tubes having venturi changes, foaming of tube bellows and Omega seals, replacing the insert in one rear crossheader Parker fitting and reaming ten to accommodate heavier inserts, and installing three new process tubes.

DR Reactor experienced one scheduled outage (35.0 hours) for charge-discharge and one unscheduled outage (0.8 hour) when a Panellit gage tripped during an attempt to remove a spline stub. Outage work accomplished (other than charge-discharge) included installation of two 0.344 venturis and the repair of five thermocouples.

Installation of the sodium silicate storage facility in the 190-D Main Pump House in conjunction with the planned production test for feed of this material to reduce effluent water activity was started on November 19.

F Plant

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

Three outages were experienced at F Reactor: one to remove a failed I&E enriched bumpered fuel element (42.2 hours), one a scheduled charge-discharge (56.2 hours), and one, a Panellit trip, caused by a leaking spline cap seal (31.2 hours).

Principal work accomplished during the first outage was removal of the rupture with the charging machine, wall thickness measurement of 28 process tubes, charge-discharge of 268 tubes and repair of 17 faulty tube outlet thermocouples. Major work accomplished during the second outage was charge-discharge of 594 tubes, wall thickness measurement of 168 tubes, replacement of two thin-wall process tubes, charge-discharge of two graphite samples, replacement of the seal between the downcomer and the rear crossover line and replacement of a gasket in the 105 effluent line. Work accomplished during the third and final outage consisted of inspection of all rear face gas seal boots, cleaning of 94 thermal loop Visi gages and investigation of the hardware of tube 3662 to determine the cause of the Panellit scram.

The safety valves were tested on the No. 1 boiler November 19 and were approved for operation; the boiler was placed in service on the same day.

H Plant

Maximum power levels of the reactor were restricted by the 95 C bulk outlet temperature limit. During the latter portion of the month, an administrative

tube power limit of 1250 KW was imposed as a means of fuel element failure control.

Two outages occurred during the period. Outage causes were a Panellit scram on poison spline process tube 2585-H resulting from a swollen fuel element (62.4 hours) and a fuel element failure in tube 1085-H (37.5 hours). Removal of the charge in process tube 2585-H required cutting out the portions of the poison spline upstream and downstream from the stuck element, and removal of the downstream process tube ribs. The fuel element was partially decanned when removed with forces up to 6000 psi. A new process tube was installed in the channel.

Thirty-eight modified poison spline cap assemblies were installed on the reactor front nozzles. The assemblies were designed to increase coolant flow in spline tubes.

KE-KW Plant

Power levels at both reactors were restricted by an administrative limit of 4400 MW for the entire month.

KE Reactor was shut down 107.8 hours for a scheduled charge-discharge outage, during which No. 3 HCR was relieved of binding at the 10% position. Installation of extruded nozzles on spline tubes completed the upgrading of front face hardware at both reactors. Photographs were taken of No. 49 VSR channel in preparation for overboring and sleeving. Van Stone inserts were installed in rear nozzles of spline tubes for the prevention of scrams from broken splines (Design Change No. 979).

KW Reactor experienced three outages. In addition, the reactor was down for 66.4 hours on an outage initiated in October by an obstruction in a Panellit line. Crossheaders were flushed and several crossheader screens were cleared of rust and corrosion products. The following two outages (0.7 and 13.1 hours) resulted from Panellit scrams on the same Panellit gage. It was determined that both scrams were the result of inlet orifice assemblies not being compatible with flow requirements. Because of the past history of scrams from zone 12 orifice assemblies, 49 were changed to the zone 13 type. No further problems have been encountered. The last outage (32.0 hours) was scheduled for charge-discharge and the correction of a minor water leak.

Alum concentration was increased November 19 from 10 to 12 ppm at the KW filter plant and from 10 to 14 ppm at the KE filter plant. The operation of the two filter plants will be observed for comparison.

The KW backwash pumps were disassembled for inspection. Broken cooling vanes were found but no coil damage was observed. Both motors were sent off plant for rewedging and vanes fabricated on plant were installed. All backwash pumps have now been overhauled and are back in service. A severe leak developed in the No. 2 boiler at 165-KE when a gasket on the water wall header failed. Repairs were accomplished with No. 3 boiler placed on the line.

APPLIED REACTOR ENGINEERING

Plant Engineering

Electrical

Rotor fan breakages, in October, in two backwash pump motors at the KE filter plant have been attributed to metal fatigue. New annealed, heavier configuration fan blades have been provided. Future inspections of motors will include dye checking of the cooling fan blades.

Minor Design Change E64K-PJ-002-A was issued to provide semi-permanent electrical connections for trip-out tests at the 100-K Area. This modification will afford a convenient method for making electrical connections which permit reactor emergency coolant trip-out tests to be conducted without jeopardizing plant operating continuity or safety.

Design Change 966 has been issued providing for removal of the jumpers on the LP (low pressure) test switches to reduce the possibility of inadvertent starting of the reactor coolant backup diesels in 100-K Area. With the present installation (when the test switches for both of the LP switches were in the test position at the same time), the automatic bypass feature on the diesel starting circuit was removed. This had caused several unnecessary starts of the diesels.

Mechanical

Design Change 979 was issued to authorize the use of modified Van Stone flange inserts at KE and KW Reactors. The intent is to prevent broken splines from entering the rear nozzles, resulting in reduced water flow and causing scrams.

Seven Inconel outlet connectors (pigtails) suspected of leaking were removed from DR Reactor. Tests showed that three of the pigtails were leaking as a result of cracks in the flared section at the crossheader end. Dye penetrant tests revealed no stress corrosion or pinhole leaks.

Inspection of high-lift process water pump No. 4 in Building 190-KW indicates that by the end of CY-1965 its impeller will have failed by cavitation attack, as defined by the warranty agreements. By that time, this impeller will have operated about three-fifths of its guaranteed service life. A request has been made for procurement action by the RLOO-AEC Purchasing Section to have a replacement impeller ready for use by July 1, 1965. The design of these impellers has been improved since the No. 4 unit was manufactured and several of these improved impellers are now in service. One complete shaft and impeller assembly of the improved type is available in the spare parts warehouse.

One phase of process water pump train inspection has been to run vibration analyses and dye checks of the flywheels. Severe vibration of the flywheel casing on unit No. 3 in Building 190-F was investigated. The cause was

found to be accumulations of greasy material on the flywheel. As a precautionary measure, a routine cleaning program has been established for all pump train flywheels.

The corroded tubes recently replaced in the top rows of No. 1 steam generator at Bldg. 165-KE were examined. Failure had resulted from external corrosion caused by strong acid sulfur compounds which had premeated the boiler insulation.

Tooling is complete for the test removal of standard and overbore size zirconium tubes at C Reactor utilizing the new zirconium splitter. Arrangements are being made to obtain outage time for conducting these tests.

Design Change 953 has been issued providing for the separate routing of the dual sensing lines from the individual front risers to the pressure switches in the freight elevator lobby of each K Reactor. The existing copper lines are to be replaced by stainless steel for added mechanical protection.

To determine whether horizontal rods containing packed, granular boron carbide are susceptible to swelling (as are those using sintered boron carbide-aluminum rings), the No. 4 half-rod removed from C Reactor last July was uncovered, measured, and cut into sections for a more detailed examination in the Radiometallurgy Laboratory. Single diameter measurements made each foot along the rod's entire length indicate that the rod is tapered from the original 2.970" diameter at the connection end to something measurably larger near the tip. More precise data will come from Radiometallurgy measurements.

Engineering follow-up was accorded the venturi thread failure which occurred on one process tube at C Reactor on October 25, 1964 when water pressure was raised prior to reactor start-up. Although it was concluded that this thread problem was confined to C Reactor only (having resulted from machining done under Design Change 518), an inspection was made of off-reactor spare components in all other Plant areas. Of the 762 inspected, six were rejected for minor discrepancies, none of which was considered hazardous. A program has been started to improve assurance of front face hardware integrity. This program is quite broad and several groups within Applied Reactor Engineering will contribute to it.

Instrument

Minor Design Change I64-BC-IJ006E has been issued to consolidate control instrumentation on the Building 115-B gas panels from four separate panels into two panels. This should permit more efficient operation during dryer changes and provide for better control of gas pressure at B and C Reactors.

Minor Design Change I64D-ID008, Addendum 1, was issued to provide for the design and installation of instrumentation for monitoring effluent water level in the downcomer at D Reactor.

Minor Design Change I64F-IH002 was issued authorizing pressure switch revision on the raw water annunciators in Buildings 105-F, 190-F, and 182-F. The existing pressure switches have a wide differential between trip and reset pressures, which requires raising water pressure higher than desirable (for the type of water line joints) to reset the switches and clear the annunciator should an alarm occur. The new pressure switches will reset when normal raw water pressure is restored.

Industrial

Pneumatic torque-controlled wrenches and auxiliary equipment for spline cap installation were purchased (under AR P-55005) and delivered to all reactors except DR, F, and H (the three to be deactivated). Maintenance representatives were instructed in the calibration and maintenance of these tools.

Minor Design Change I64-B,C,D,KE, & KW was issued authorizing: 1) the substitution of thin plastic tags for neoprene tags, 2) the use of an additional tag type for tubes charged with K4N metal at the K Reactors, 3) the use of an additional tag type for tubes to be charged with thoria as core loads, and 4) the use of a sectioned container for tag storage.

Plastic pre-marking tags of special design for the planned core loading of thoria at KW Reactor were procured. The modification and inspection of nozzle caps for thoria-loaded process tubes at B and KE Reactors were completed.

A descriptive and pictorial brochure of the planned new Reactor Manufacturing Training Program (for newly hired technical personnel) was prepared for use by IPD recruiters visiting colleges.

Engineering Studies and Analyses

An interim report was issued discussing the problem associated with undetectably small discharge currents in the Ball 3X battery systems at all reactors, and the possible courses of action which might be taken. The report set forth the rather strict criteria which are required if an adequately sensitive device is to provide protection against a battery discharge condition.

Maintenance Standards and Manuals

The status of Equipment Maintenance Standards preparation and issuance in November compared with October as follows:

	November	October
Issued to date	155	143
Being routed for signature	12	14
In comment status	20	20
In preparation	37	37
	224	214

(In addition, 26 Standards are in process of revision.)

Work was started on three new Standards on In-Reactor Test Facilities and three new Standards on Zone Temperature Monitors for B, C, and D Reactors. The Reactor Confinement Standards for all plants are being routed for signature. Emergency Electrical Backup Standards (Reactor Building) for six plants and eight Standards on the Inlet Crossheaders have been approved by the plants.

Revisions to the Charge Platform Standards redefining operation of certain safety devices are now being made. A revision to the Front Face Hardware Standard is being developed to strengthen assurance that only certified components are utilized in critical reactor hardware rework and replacement.

An instrument procedure for testing reactor front crossheader check valves was distributed.

Plant Personnel Training

A series of three sound-slide programs on the reactor confinement system have now been prepared and issued to B, C, D, F, H, and K Reactors. These programs provide instruction on 1) the confinement facilities, 2) cell isolation (filling the seal pits), and 3) draining the seal pits. The programs prepared for DR Reactor are being issued for use by the Reactor Personnel Certification group since DR is soon to be deactivated.

A series of four sound-slide programs on K Reactor rear face decontamination were revised and updated to reflect significant methods changes as well as general improvement in the programs. These programs cover 1) make-up and service crews, 2) purge room procedure, 3) riser pit, front face, and pickup chute procedures, and 4) rear face procedure.

OC Schroeder

Manager, Manufacturing

OC Schroeder:DLD:bm

PRODUCTION FUELS

ALSI SHOP

Production

Canning line operating efficiency was 98.6 per cent, 1.6 per cent above forecast.

Manufacturing yields in November were above forecast in all categories except for a small amount of reprocessed enriched six-inch material. The elliptical rail and self-support welding yield continued at the overall average of 98.7 per cent.

Production of fuel elements with arched rail supports was initiated in November on the automatic rail welder. This fuel was prepared for the K core thoria charge scheduled for loading November 30. The welding rate was quite satisfactory in spite of two to four hours per day downtime. Even more satisfactory was the welding yield which averaged 99.5 per cent for nearly 17,000 fuel elements.

Thoria target element production continued through November at a satisfactory rate considering model changes, oxide availability, the tap density of oxide received, and the changeover from the engineering development hood to the newly installed manufacturing hood. The average daily production increased from slightly more than 300 pieces to more than 550 per shift with the new hood and facilities. Both the B Reactor load scheduled for November 15 and the KW core load scheduled for charging November 30 were delivered on schedule. To meet the KW core charging date, it was necessary to expedite oxide deliveries by premium shipping methods including air freight, and to work the premium pay holidays of November 26, 27, and 28.

Production of projection fuels during November was:

	Natural U	Enriched U
Tons Produced	44	213
Finished Inventory	334	259

Acceptable Fuel Elements (Tons)

NATURAL				ENRICHED					
C	K	K5NS	Reg.	C	K	K5ES	Reg.	Bumper	Total
18.7	67.6	43.7	279.2	0.3	0	158.0	12.2	55.2	634.9(1)
Per Cent of Forecast									
623	157	65	95	-	-	145	-	94	105

(1) Includes 5.2 tons of upstream fuels.

Manufacturing Yields

NATURAL				ENRICHED				
C	K	K5NS	Reg.	C	K	K5ES	Reg.	Bumper
November								
95	95	93	96	-	-	91	92	94
Forecast								
92	92	89	92	92	-	89	92	89
Previous Month								
94	-	93	95	94	-	90	95	95

Operating Conditions, Incidents, and Improvements

Production of the enriched K Reactor self-supported fuel elements with arched rail supports was begun on the automatic rail welder in the 306 Building on November 16. A high production rate of approximately 2600 fuel elements per day on two shifts was attained. Downtime on the rail welder has been approximately two to four hours per day. This downtime will be reduced as the bugs are worked out of the welder and when bits of scrap metal can be effectively removed from the rails. The bits of scrap metal plug up the rail tracks and photocell light parts causing the machine to stop.

Operation of the automatic rail welder in the 306 Building has afforded an opportunity to train people for the forthcoming automation of the rail welders in the 313 Building. About the only difference between the welders is in the number of welder heads and the layout of the control panels. Familiaration with the welders in the 313 Building will require only a short training period.

Additional steps taken to improve internal bonds on the K Reactor natural metal self-supported fuel included canning at higher furnace temperatures and improvement of the action of the pressure quench machine. These actions were taken as part of the continuing program being followed in an attempt to eliminate the causes of autoclave failures recently experienced with eight-inch self-supported model.

Two duplex agitators were changed out during the month. The clutch mechanism in these two agitators did not always engage immediately. Occasionally there would be a lapse of several seconds before agitation actually began. The two replacement agitators are performing quite satisfactorily and should help to improve the internal bond defective rate on these two lines.

The centrifuge time following rail tab oiling has been extended from 15 minutes to 25 minutes to improve oil removal from the rails. Several

baskets of rails were found where sufficient oil had not been removed. The longer centrifuge time will assure greater uniformity in the preparation of rails for the 313 ultrasonic welders.

The discharge elevator from the double spindle welder line has caused a small number of rejects each day since it has been in operation. The cause of the rejects has been difficult to determine because of the infrequent occurrence. In an effort to find out why fuel elements were being dropped, the elevator was watched continually for approximately three hours until the malfunction occurred. The problem was in the tipple micro-switch which infrequently allowed two elements to be loaded into one elevator basket.

A corrective modification was made to the electrical circuit which will prevent the double loading of the elevator baskets.

The Illuminating Engineering Society recommends a minimum of 150-200 foot candles of illumination for semi-critical visual work and up to 500 foot candles for very critical work. To determine how our inspection lighting compares with these standards, a light intensity survey was made in the weld inspection booth and at final inspection. The results of the survey recommended the elimination of contrasts at weld inspection and increased lighting sources at final inspection. The recommended changes, which should increase the efficiency at these visual inspection stations, have been made with the comparable results as follows:

	Weld Inspection	Final Inspection
Before	190 F/C	85 F/C
After	300 F/C	150 F/C

Nuclear safety in the Production Fuels Section was improved in November when twelve-inch high red flags were provided for use on all hand trucks which contain enriched uranium fuel elements. The flags stand above the fuel elements and are easier to see from a distance than the previously used signs. The flags were also provided for the 306 Building Pilot Plant for use on autoclave baskets of enriched fuels.

In order to meet production requirements for November, it was again necessary to accept thoria below the minimum specifications of 7.0 gr/cc tap density. Particle size variance also caused compaction difficulties. The compacting of this material in the six and one-half inch cans was so difficult that it was necessary to drop to a compaction density of 7.0 gr/cc for 1049 of these elements.

The start-up of the new thoria production hood was accomplished on November 16, 1964. Two main problems noted immediately were: compaction difficulties of the low density, small particle thoria and the tendency of the automatic scale to feed differently, depending again on the type of thoria being processed. One vibrator station has been changed to a lower frequency type vibrator, and performance to date has been noticeably better. The installation of this same type vibrator

on the other stations was in process at month end. Scale calibration and tests on material feed were also in process at month end. In general, the start-up and "debugging" of the new equipment proceeded smoothly with the anticipated daily production rate being achieved in the third full day of operation.

End closure welding of thoria elements still continued to be a most serious problem during the month. The welding difficulties increased with the processing of the larger K Reactor element. An over-all survey for the month found 16 per cent of the elements required decanning. A complete overhaul of the welding equipment was scheduled for the last week of November.

Autoclave Failures

One autoclave failure occurred in November. The cap failed due to a small pinhole or crack in the cap weld.

Lot #	Model	Type	Date	Cause
KV-233-SX	K5NS	Complete	11-2-64	Pinhole or crack in cap closure weld

MATERIALS

Fuel Recovery

The following amounts of AlSi fuel were recovered:

	Pieces
Eight-inch Natural	10,025
Six-inch Enriched	9,744
Total	19,769

Hanford Test Reactor

Available reactor time was utilized as follows: 298 routine production tests were performed (86 drift tests and 212 GO NO-GO tests) representing approximately 70 per cent of the available time, with the remainder being utilized for special testing.

Scrap

Three shipments of metallic uranium scrap were made during the month. Shipments totaled 9.9 tons C-6 enriched and normal sludge, 0.2 tons filter press canvas, 12.2 tons NRD scrap, and 77 empty boxes with lids.

FUELS ENGINEERING

Quality Control

One natural self-supported K Reactor fuel element failed in the autoclave test as a result of a defect in the cap weld closure. This increases the total autoclave failures to seven for the year, with six in the K5NS fuel model. An analysis of "Quality Certification" data shows that the bond quality of the K5NS fuel model is significantly lower than that of other models. Limited braze closure tests also indicate the closure quality of the K5NS fuel model is below that of the small reactor natural (03N) fuel model. A program has been initiated in an attempt to identify and control the process variables contributing to the observed differences in fuel quality.

The status of upstream fuel accumulated for charging in low rupture potential positions of the reactor process tubes is as follows:

	No. of Pieces
Total shipped to reactors	37,537
Total in storage	4,252

Process Development and Improvement

AlSi canning tests completed in the Pilot Plant show that fuel element quality can be improved by establishing a better relationship between the can-sleeve preheat and submerge times. Further testing is planned in the AlSi Shop to confirm this data prior to a revision of process specifications.

Can-base preheating rates were determined for cans fully seated and non-seated in the steel sleeves. During the normal can-sleeve preheat cycle (44 to 50 seconds), a 0.010 inch non-seated can base is from two to seven degrees centigrade colder at the time of submerge, and a 0.065 inch non-seated can base is four to thirteen degrees centigrade colder at the time of submerge than a fully seated can. This data emphasizes the importance of the cans being fully seated to minimize assembly and non-wetting problems.

Analysis of a statistically designed canning test using C Reactor natural self-supported (C5NS) fuel cores with can-core annuli of four, six, and eight mils and spire-core annuli of four, 6.5, and nine mils indicated the following:

1. A smaller can-core annuli will reduce the external total bond count.

2. A smaller spire-core annuli will reduce the internal total bond count.

3. A smaller can-core annuli tends to reduce external braze closure total bad discs.

Based on the above results, a test is planned on K Reactor natural self-supported (K5NS) fuel cores with a 0.004 inch larger O.D. and a 0.004 inch smaller I.D. to evaluate potential quality improvements.

Rupture Experience

Ten fuel element failures occurred in the reactors during November including a stuck natural metal element decanned during discharge.

Fuel Element Type	Tube and Reactor	Exposure % of Goal	Rupture Classification	Failure Date	Canning Date
Natural Nonbumper	1560-B	78	Unknown - Not Examined	11/4/64	4/30/64
Natural Nonbumper	2585-H	58	Side Unclassified	11/4/64	9/8/64
Enriched Bumper	2078-F	102	Unknown - Not Examined	11/6/64	8/14/64
Natural Overbore	2868-C	96	Unknown - Not Examined	11/9/64	---
Natural Nonbumper	0969-D	79	Side Hot Spot	11/12/64	4/6/64
Natural Nonbumper	0986-B	100	Unknown - Not Examined	11/14/64	7/29/64
Natural Nonbumper	3161-D	78	Side Hot Spot	11/14/64	7/27/64
Natural Nonbumper	3485-D	84	Side Hot Spot	11/23/64	7/27/64
Natural Nonbumper	1085-H	89	Side Hot Spot	11/25/64	9/3/64
Natural Nonbumper	3674-D	88	Side Hot Spot	11/29/64	8/21/64

The fuel failure trend was relatively unchanged during this period. Nonbumper fuel performance continues to be adversely effected by the incidence of "side" failures, which bumper fuel is designed to prevent.

Examination of an enriched bumper fuel failure, sustained in H Reactor during September and classified as a hole-manufacturing defect, has been

completed in the Radiometallurgy Laboratory. Water entry through a pinhole in the base weld closure was confirmed as the cause of failure.

Alternate Product Development

U-233 Program: The quality of thorium oxide received from Mallinckrodt Chemical Works has declined in recent shipments. A major part of the lots canned for the central thorium-oxide target element loading in KW Reactor could not be compacted to nominal densities above 6.9 to 7.1 grams per cubic centimeter. The decline in oxide quality coincided with a decrease in the ratio of coarse to fine particle sizes, and this shift in particle size distribution is the probably cause of the compaction problem. Because of the limited supply of thorium-oxide available for canning to meet reactor charging schedules, the lower density target element lots will be irradiated under a material waiver. A new target element lot stamping system is being used, with the first two digits indicating the lot number and the last two digits indicating the nominal compacted density.

Originally, a loss-of-ignition specification of 0.04 per cent maximum was established for thorium-oxide as a possible means of controlling the amount of contained volatiles. Although MCW has failed to meet this specification, HAPO analyses of ten lots do not indicate a strong relationship between loss-of-ignition and volatile content.

Equipment Development and Testing

Because the arch-rail support offers reduced hydraulic resistance, authorization was received to use this rail as an alternate for the standard collapsible-bridge rail on the enriched self-supported fuel (K5ES) for the central thorium-oxide target element loading in KW Reactor. The Pilot Plant ultrasonic welder, equipped with an automatic feeder and shear tester, was used to attach the arch rails for this loading. Throughput rates of up to 240 fuel elements per hour were achieved at yields approaching 99.8 per cent. About half of the loading was provided with arch rails.

Necessary electrical and mechanical design was completed to convert the ultrasonic welders in the AlSi Shop to arch-rail support and arch-bumper rail welding.

Installation of prototype equipment in the thorium-oxide target element pilot production line hood was completed November 3. Sufficient debugging and testing were accomplished to release the line for operation on November 16. Beneficial use of this facility has not only increased production capacity, but provides an automated thorium-oxide transfer, blending, and weighing system to minimize contamination and radiation hazards.

PLANT FACILITIES

Status of Active Construction Projects

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

The erection of the structural steel is essentially complete and construction continues on schedule with approximately 18 per cent completion.

CAF-979 - Pilot Scale Plating Equipment - 300 Area

Negotiations continue with the vendor on the replacement of steam coils for heating the nickel plate tanks, cooling coil, rectifier damage, and the contact changer. The facility is in operation.

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

Construction progress is estimated to be 39 per cent complete, 6 per cent ahead of the revised schedule. Erection of the steel work for the building frame is essentially complete and the corrugated steel roof has been installed. While moving the boiler for installation on the foundation pad, the lifting crane failed and dropped it a few inches. There appeared to be only minor damage to the exterior structural support. The third party boiler inspector inspected the boiler and will recommend specific tests to ensure against interior damage. This inspection was made with the AEC's concurrence.

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

Construction progress is still behind schedule with 45 per cent completion as compared with 49 per cent scheduled. The first tie-ins to the PRTR utilities were made during the November 20 outage. Additional tie-ins will be made at the next scheduled outage of the test reactor. The contractor's revised schedule completion date of December 29, 1964, appears to be in jeopardy.

CAI-150 - Relocation of 300 Area Administration Building and Related Work

The new parking lot north of the 300 Area is essentially complete. Bituminous surfacing is being withheld until more suitable paving weather. The badge house footings and floor were constructed lower than design called for, so the road will be graded accordingly. The 3703 Building was completely vacated November 5 and the moving of 3703 Building was completed November 27, 1964. Relocation of building personnel involved six different buildings within the 300 Area for temporary quarters until the 3703 Building is available for occupancy again. During the moving of the east half of the building as one unit, the contractor damaged the building. The west

half was moved in two pieces. The target date for completion of the move is December 11, 1964, and ready-for-occupancy date is December 14, 1964.

Equipment Operation

Loss of canning line efficiency attributed to equipment malfunction was about 0.7 per cent as compared with 0.5 per cent the previous month. Approximately 40 per cent of the malfunction was involved with the duplex loaders which was more than double the time lost the previous month. The major portion of this lost time was for removal of AlSi from moving parts of the equipment and the replacement of a faulty tipple air cylinder. Other causes of lost time were the duplex agitators, primarily replacement of agitator baskets; the pressure quench machines due to problems encountered with AlSi removal from the bearings, stuck fuel elements in the pressure bells; the canning jacks which required the change of canning baskets; thermocouple replacements for furnace controls; and, cleanout of AlSi splashed into the pulser mechanisms.

Equipment Modification

The first automatic rail feeder has been installed on the 2A ultrasonic welder and debugging is in progress. The second set of vibrating bowls was unacceptable at the vendor's plant thus delaying installation of the second feeder and track. Numerous modifications were made on the first system before it would operate satisfactorily. There are still several problems to be resolved to prevent an occasional bent rail from leaving the bowl and entering the feeder track upside down.

There have been several modifications made to the facing lathes this month which should improve their performance. These modifications involved safety circuit performance, emergency stop switches, and improved oil splash shields.

Utilities

The replacement air compressor (No. 5) was installed under the direct supervision of the vendor's representatives and test run on November 6, 1964. The unit was placed in service and has been performing satisfactorily. The unit was removed from service on November 23, 1964, checked by the vendor's representative, and found to be fully acceptable.

The new No. 2 Air Dryer was received on site and is awaiting installation in the 384 Building.

Two tubes separated from the front water wall header on No. 5 Boiler, requiring the boiler to be removed from service until repairs could be made.

Statistics

	November	October
Maximum steam generated (M lbs/hr)	118	94
Total steam generated (M lbs)	61,012	40,584
Total condensate returned (M lbs)	23,213	9,615
Coal consumed (tons)	2,798	2,020
Evaporation rate	10.90	10.04
Efficiency - Actual	85.1	77.5
Efficiency - Optimum	85.0	81.6
Import water (M gals)	115.8	109.8
Peak water flow (gpm)	5,400	5,600
Peak water consumed in 24 hours (M gals)	4.2	4.2
Compressed air produced (M scf)	68,609	64,477

Plant Services

Major jobs completed during the month of November included installation of the thoria process hoods; fabrication and installation of stainless steel flange and valve bonnet guards in the 3716 Building; fabrication of a large stainless steel spray calciner for the 321 Building pilot plant; fabrication of fuel element racks for the hot die sizing process; fabrication and installation of the bottom portion of a vapor collection system for the sleeve cleaning machines in the 313 Building; fabrications for the single spindle welder conveyor modifications; installation of a bypass water line and valve at the 313 Building to permit the building water loop to be fed from either the south or the north main, and fabrication and installation of three high temperature furnaces for Hanford Laboratories in the 3706 Building.

With the installation of a milling machine from the 200 Area shops, a portion of the milling backlog has been completed. The shortage of machinists required several jobs to be farmed out to Technical Shops.

WN Mobley

Manager - Production Fuels

WN Mobley:WKW:gl

RESEARCH AND ENGINEERING

PROCESS AND REACTOR DEVELOPMENT

REACTOR FUELS

Thoria Irradiations

An analysis of KW Reactor operating conditions contained in RL-REA-61 ("KW Reactor Operating Conditions with E-Q Loadings") shows that the use of arch-type supports on KVE fuel elements will be required to achieve current reactor coolant flow rates with core E-Q loadings. Considering the use of arch-type supports on fuel elements loaded into central-zone columns, the reactor flow rate will decrease 0.7 per cent, the bulk outlet coolant temperature will increase 0.6 C, and the outlet coolant temperature of central-zone process tubes will increase 3 C compared to current natural uranium loadings at the same reactor power level. These conditions can be supported without adversely affecting reactor operating efficiency.

Initial loadings of thorium oxide target elements in fringe-zone process tubes have now been accomplished. The outermost lattice unit tubes in the KW Reactor were charged with thoria during the September 30, 1964, outage. Similar charging of the target elements into the fringe-zone of D Reactor took place during the October 19, 1964, outage, and in B Reactor during the November 14 outage. A total of approximately 27 tons of thorium oxide target elements are now under irradiation. Loading dates for the fringe-zone regions of C and KE Reactors and the KW core are uncertain pending clarification of the thoria delivery schedules.

Depleted Uranium Irradiations

B Reactor. The 104 columns of depleted uranium (0.22 w/o U-235) fuel elements now under irradiation in the central zone of B Reactor have accumulated an average exposure of approximately 400 MWD/T of a 1400 MWD/T goal which is anticipated by June 1965.

KE Reactor. An average exposure of 350 MWD/T of a 1600 MWD/T goal is now estimated to have been obtained by 90 columns of depleted uranium fuel elements in the KE Reactor.

Self-Support Development

Nineteen columns of self-support fuel elements fabricated as a portion of a production test to evaluate "arch-rail" self-supports are now under irradiation in the KW Reactor. Ten of these fuel columns are equipped with downstream thermocouple probes to measure the coolant temperature unbalance in the process tubes. The initial measurements obtained from this test indicate no operationally significant differences between fuel columns containing arch-rail elements and those columns with

STATUS REPORT OF PRODUCTION TESTS

Test No.	Type Metal	Tubes	Reactor	Goal Exposure	Current Exposure	Remarks
IP-216-A	Normal production natural and enriched fuel elements.	68	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 CVN 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-684-A	Hot-die-sized diffusion-bonded elements.	23	C	800 MWD/T	760 MWD/T	Evaluation of effects of process parameters on dimensional behavior of hot-die-sized elements. Test columns charged during July 11, 1964, outage; discharged during November 12, 1964, outage.
IP-708	Hot-die-sized diffusion-bonded elements.	18	C	800 MWD/T	540 MWD/T	Evaluation of the effects of uranium heat treatment parameters on behavior of hot-die-sized elements. Elements charged during September 3, 1964, outage.

STATUS REPORT OF PRODUCTION TESTS (cont'd.)

Test No.	Type Metal	Tubes	Reactor	Goal Exposure	Current Exposure	Remarks
IP-669-A	Depleted uranium target elements.	104	B	1400 MWD/T	400 MWD/T	Irradiation of ten tons of depleted elements for production of 18 w/o Pu-240.
IP-694-A	Depleted uranium target elements.	90	KE	1600 MWD/T	350 MWD/T	Irradiation of 12 tons of depleted elements for production of 18 w/o Pu-240.
IP-696-A	I&E self-support fuel.	20	KW	1000 MWD/T	340 MWD/T	Evaluation of arch-rail self-support fuel elements. Test elements charged during the September 30, 1964, outage.
PITA-31	Thorium oxide target elements.	196	KW	175 operating days	24 operating days	Initial loading of thoria elements in fringe zone process tubes for production of clean U-233. Elements charged during September 30, 1964, outage.
PITA-31	Thorium oxide target elements.	168	D	165 operating days	18 operating days	Production of clean U-233. Elements charged during October 19, 1964, outage.
PITA-31	Thorium oxide target elements.	141	B	160 operating days	4 operating days	Production of clean U-233. Elements charged during November 14, 1964, outage.

[redacted]
D-3

standard production bridge rails. A comprehensive evaluation will not be available until the test elements have been discharged and examined. The fuel columns are currently estimated to have an average exposure of 190 MWD/T, with a goal exposure of 1000 MWD/T.

REACTOR ENGINEERING

C Reactor Ball Loss

As part of a program to determine the distortion of the C Reactor moderator stack, extensive measurements and observations were made of C Reactor VSR channels during July of this year. An important observation made during these examinations was the separations in the front and rear banks of VSR channels. Separations between the graphite blocks composing these channels of approximately one-inch were noted over 1/3 to 1/2 the length of the channels. It is estimated that a total of approximately 300 pounds of balls could be trapped in these separations in the event of a ball drop. Only the front and rear VSR channels are susceptible to separation because of slight differences in the key and block arrangement, therefore, ball loss in the remaining channels is considered unlikely.

Improved Gas Drying Facilities - K Reactors

Discussions with industrial representatives indicate that substitution of silica gel with molecular sieve material in the drying towers will substantially reduce the gas inlet dewpoint. Replacement with molecular sieve material, with no changes in present equipment at the K Reactors, is estimated to provide gas with a dewpoint of about -50 F. The addition of a small heater in the regeneration line to more thoroughly remove water from the sieve during regeneration would reduce the inlet dewpoint to about -90 F. Molecular sieve is slightly more expensive than silica gel and is being investigated further.

REACTOR PHYSICS

Neptunium Production Test

The irradiation of recycle fuel columns in the study of the conversion of U-236 to Np-237 is continuing. The discharge exposures for the six columns which were irradiated in the E-N core were calculated independently from daily observations using our code XI, and by Production Scheduling. The maximum discrepancy between the two methods is less than one-half per cent. Work is continuing on obtaining independent estimates of the exposure of the other fuel columns.

E-Q Program

The K Reactor E-Q hazards report was completed and issued in October. Review of the K core loading was given to the ACRS Hanford subcommittee on November 6 and to the full ACRS on November 13. Dr. Thompson of MIT expressed interest in our spatial-dependent kinetics calculations, and a copy of the CLUMSY document will be sent to him.

KW Reactor started up in early October with a thoria blanket loading and was found to be short in reactivity by about 0.2% k. This amount of reactivity deficit is not entirely attributable to the thoria blanket. Thirty-six tubes of enrichment were added to the reactor core to bring the reactivity up. The blanket-supporting E-metal is running 10% colder than predicted on a simple cylindricizing of the reactor geometry.

D Reactor was also loaded with the thoria blanket in mid-October, and apparently is performing as predicted from standpoint of reactivity.

Calculations are being made for core E-Q loadings in B, D, and C Reactors to develop loading patterns to produce an additional 60 kg of U-233.

Equipment is being assembled and plans being made for insertion of a special low-level neutron chamber in the 2B test hole at 105-KW to monitor the E-Q loading scheduled for November 29, 1964, to December 1, 1964. The detector would be inserted into the center of the reactor and probably converted to one of the present readout instrumentation. The increased sensitivity gained is desirable in the monitoring of the progress of loading.

Speed-of-Control Studies

The speed-of-control calculations for normal fuel loads in all IPD production reactors have been completed. Calculations for E-Q loads are nearly finished, and revised bases will be issued in the near future. In general, revised limits will not affect current reactor operations, and the speed-of-control requirements for E-Q loadings will be less restrictive than for normal loadings.

In the course of the speed-of-control work for the technical bases, the effects of varying rod strengths and speeds on speed-of-control limits have been determined for the small reactors. It is believed that this information can be used to better obtain power limits for temporary PCA's permitting inoperable VSR's in excess of the two permitted by Process Standards. Examples of results obtained are: an increased VSR drop time for BDF reactors from 2.3 to 2.5 seconds imposes a 22% reduction in the equilibrium power limit at goal exposure. A 25% reduction in VSR system strength (2.3 seconds drop time) reduces the allowable power limit by less than 10%.

Alternate Control Systems

One of the concepts which have been proposed for holddown control of the production reactor is the use of steel chain. These chains would be inserted into the vertical safety rod openings into which it would be undesirable to insert either rod or balls. A comparison of the reactivity effect of plain steel chain versus a standard 70/30 mixture of boron-steel and mild-steel balls was made in the Hanford Test Reactor (HTR). The relative strength of plain chain in a four-inch square, foot-long aluminum can was compared to the steel ball mixture in the same configuration and a similar comparison was made in a three-inch diameter, ten-inch long aluminum can. The results indicate the chain to be 55% and 45% as effective as the steel ball mixture for the two aforementioned cases. The analyses of these measurements make no attempt at present to correlate the packing fraction with the poison strength. An evaluation of the blackness will be made later. The results do indicate that the geometry has an effect. If the hole is not completely filled or is not as thoroughly packed in the production reactor, the poison strength of the chain will be reduced from that indicated in the above measurements.

Seismic Measurements

On November 6, 1964, the Hanford highway construction contractor detonated about 21,000 pounds of explosive in three sections in a quarrying operation near Horn Rapids Dam. The basalt rock will furnish ground for the new road. IPD, CPD, and HL made displacement measurements of the blast. The 100-K badge house and the upper structures of 105-KE were instrumented; one location at each building. No significant vibrations were measured, and no reactor galvanometer movement was noted.

Further blasts are planned by the contractor as work on the highway progresses.

Critical Mass Bases

The revision of the Technical Bases for the Process Standards for storage, transportation, and fabrication of fissile material is continuing.

Work on Part IV of the basis has been started. All experimental data for fissionable fuel elements of unusual physical dimensions, extraordinary enrichments and unusual material compositions are being collected. NUCSAFE IA is being used to compute the nuclear safety parameters from given buckling values at certain water-to-uranium volume ratios.

A nuclear safety review was carried out for fabrication, handling and storage of 1.25 w/o U-235 enriched uranium I&E elements. A nuclear safety review is being carried out for PuO_2-UO_2 fuel elements. (Enrichment: 1.50 w/o PuO_2 in UO_2, and 0.22 w/o U-235 in uranium metal.)

RADIOLOGICAL ENGINEERING

Radiation Control Experience

The following table summarizes the radiation exposure experience for critical IPD classifications through 44 weeks of the 1964 badge year:

Classification	Total Dose	No. of Employees	Average Dose/ Employee	Extrapolated Year End Average	No. of Employees Over 3 R Extrapolated Exposure
Radiation Monitors	166488 mR	69	2413 mR	2852 mR	22
Processing Operators	530880	231	2298	2716	57
Pipefitters	209943	97	2164	2557	24
Millwrights	162786	76	2142	2531	27

Radiation Occurrences

Two radiation occurrences were reported during the period. One involved the spread of contamination to nonregulated areas as the result of discharge operations on an experimental level. In this case, hand contamination also occurred. The other involved slight internal deposition of Co-60 and Sc-46 to two employees as the result of using a heating torch on the walls of a 107 retention basin without use of respiratory protection.

	Distribution by Reactor and Component								Totals
	B	C	D	DR	F	H	KE	KW	
Central Maintenance			1						1
Research and Engineering	—	—	—	—	—	—	1	—	1
Totals	0	0	1	0	0	0	1	0	2
Year to Date									120

Effluent Activity Data

The table below shows the average concentration of five radionuclides in reactor effluent samples taken in October 1964. All units are 10^{-12} curies/ml.

Reactor	As-76	P-32	Zn-65	Cr-51	Np-239
B	140	3.6	5	380	170
C	130	8.0	9	640	140
D	91	6.3	3	430	90
DR	63	4.6	18	480	110
F	62	4.3	10	270	80
H	86	7.5	5	380	110
KE	64	6.3	5	120	60
KW	47	4.0	6	86	30

The coolant pH was reduced from 7.0 to 6.6 at DR and F Reactors on October 23, 1964, and October 29, 1964, respectively. There were no other significant changes made in the treatment of reactor coolant during October 1964.

Thoria Irradiations

Radiological information has been developed to assist the processing personnel to prepare guides on handling thoria target elements. Most of the potential problems would stem from the failure of the cladding of a thoria element irradiated or unirradiated and the subsequent release of a fine powder.

The normal dose rate for handling thoria elements is about five times higher than that for uranium fuel elements (15 mR/hr versus 3 mR/hr).

PROCESS TECHNOLOGY

PROCESS STANDARDS

HW-46000 B, Process Standards - Reactor

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

Process Standard C-020 - "Power Level Monitoring"

This revision provides for withholding a specified amount of insertable control rod during the charge-discharge operation and control rod insertion if the subcritical neutron monitor indicates an increase in flux during this period.

HW-46000 D, Process Standards - Reactor

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

Process Standard C-020 - "Power Level Monitoring"

This revision was identical to that made for HW-46000 B and described above.

HW-46000 F, Process Standards - Reactor

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

Process Standard C-050 - "Process Tube Temperature Monitoring"

A new criteria for determining the coolant outlet temperature on process tubes containing a faulty temperature sensor was established. Conditions under which this criteria must be used are established.

HW-46000 H, Process Standards - Reactor

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

Process Standard C-050 - "Process Tube Temperature Monitoring"

This revision was identical to that made for HW-46000 F and described above.

HW-27155 Rev1, Process Standards - Water Plant

Two standards were revised during the report period. These were:

Process Standard 183-A-020 - "pH Control"

This revision raised the process water pH at K Reactors to 6.9 - 7.1 and established the range for the other reactors at 6.5 - 6.7. A maximum pH of 7.1 for periods of reactor shutdown was established.

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

This revision established the same TORP requirements for the secondary water system performance at C Reactor that is in effect at the other older reactors. A new high-tank and water-pumping status was established for H Reactor during outages whenever one or more crossheader valves were closed.

PROCESS CHANGE AUTHORIZATIONS

Ten Process Change Authorizations were issued during the report period. These were:

PCA #4-88 - "High Graphite Temperature - KE Reactor"

This PCA authorized operation 20 C above the graphite temperature limit specified in PT IP-694-A under specified alternate requirements.

PCA #4-89 - "Graphite Temperature Limit Exceeded - KW Reactor"

Authorization was given to operate with graphite temperatures up to 50 C above the normal startup limit for wet reactors provided other special limits were met.

PCA #4-90 - "Foundation Temperature - KW Reactor"

The minimum acceptable foundation temperature could not be met within the allotted time interval. This interval was extended under specific conditions.

PCA #4-91 - "Time Limit for Recirculation Operation With One Primary Pump - KER-1"

This PCA extends the provisions of PCA #4-69. The PCA authorizes continued low pressure and temperature recirculation on loss of one of the two KER-1 pumps, provided the pump can be replaced in 24 hours.

PCA #4-92 - "Graphite Temperature Limit Exceeded - KW Reactor"

At the expiration of PCA #4-89 (see above), the graphite temperatures were within the limits of the Process Standards. A short time later the maximum graphite temperature again exceeded the limit and this PCA reimposed the alternate restrictions of PCA #4-89 for five more days.

PCA #4-93 - "Irradiated Fuel Shipping Times - All Reactors"

Circulating for approvals.

PCA #4-94 - "Horizontal Bowing Measurements- B, C, D, and K Reactors"

This PCA authorized postponement of horizontal bowing measurements until modifications to the measurement equipment are complete.

PCA #4-95 - "Excessive Base Change to Panellit Gauges - B Reactor"

This PCA extends the provision of PCA #4-86 pending further resolution of the administrative details of the Panellit gauge limits. The original PCA relaxed the gauge accuracy requirements for gauges monitoring process tubes containing nonfissionable material and provided for compensating restrictions.

PCA #4-96 - "Temperature Maps - B-C Reactors"

This PCA extends the provisions of PCA #4-85 which had expired. PCA #4-85 waived the requirement of Standard C-050 and authorized use of updated specifications in Standards C-020 and C-070.

PCA #4-97 - "Water Shutoff Times - B, C, D, F, and K Reactors"

Current studies of water shutoff data will not be completed for an extended period. The PCA specified the method of obtaining water shutoff data for overbore channels greater than 30 mils and zirconium tubes, when such data are not in the standards.

PCA #4-98 - "Excessive Water Collection Rates and Exit Dew Points - KW Reactor"

This PCA authorized continued operation of the reactor at high water collection rates provided conditions are met wh ich will maintain a graphite burnout rate at or below the established maximum.

MEMORANDUM OF PROCESS STANDARDS RELAXATION

One memorandum was issued during this report period. This was:

Memorandum of Process Standard Relaxation - #4-7M

This memorandum extended the authorization for use of 7.0 pH process water at K Reactors and 6.6 pH water at DR and F Reactors until the Process Standard could be reissued (see Process Standards - Water Plant above).

AUDITING

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

FUEL FAILURE EXPERIENCE

Failure Date	Tube Number	Lot Number	Type of Material	Tube Power at Failures (kw)	Exposure MWD/T	Type Failure
11/4/64	1560-B	KZ-097-A	I&E N	1309	427	UN
* 11/4/64	2585-H	KZ-156-C	I&E N	1168	341	SU
11/6/64	2078-F	KY-693-Q	I&E EB (0.94%)	1153	708	UE
11/9/64	2868-C	Unknown	I&E NS	1467	767	UN

* Indications of a failed element became apparent when the stuck piece was dislodged.

Failure Date	Tube Number	Lot Number	Type of Material	Tube Power at Failure (kw)	Exposure MWD/T	Type Failure
11/13/64	0969-D	KZ-087-A	I&E N	1286	415	SH
11/14/64	3161-D	KZ-138-A	I&E N	1277	420	SH
11/14/64	0986-B	KZ-132-A	I&E N	1305	521	UN
11/24/64	3485-D	KZ-127-C	I&E N	1242	473	SH
11/25/64	1085-H	KZ-160-A	I&E N	1236	507	SH
11/29/64	3674-D	KZ-140-A	I&E N	1226	493	SH

Legend

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 jacket. 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.

I&E NS - This is the symbol for internally and externally cooled production reactor fuel elements of natural uranium which have projections welded to the fuel element jacket. The fuel is irradiated in ribless process tubes.

First Character

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

Second Character

N	Not examined	Failure has not been examined.
U	Unclassified	No other character logically applies to the failure.
H	Hot-spot	Failure caused by accelerated high temperature corrosion attack.
E	Examined, not found	Suspected failure pieces were examined but no failure was found. Other evidence, Panellit, gamma monitor, etc., is conclusive of failure.

OPERATIONAL PHYSICS OPERATION

PILE PHYSICS PLANT ASSISTANCE

Only two reactors were restricted by other than bulk temperature or bulk power limits during the report period; B Reactor total power was limited by graphite and local tube temperatures due to a persistent flux depression across the enriched uranium depleted uranium (E-D) block, whereas the H Reactor level was limited by an administrative tube power limit. Flattening efficiency was down an average of three per cent from the previous 12 months' average as would be expected with the general reduction in E-ring enrichment inventory and increase in "nonstandard" loadings (viz. E-D, E-Q, core and fringe, respectively).

Fringe thoria loadings are now in place in B, D, and KW Reactors; initial reactivity effects were about as predicted. Operation with fewer heat generating columns has resulted in some increases in local graphite temperature, central zone tube powers, and control rod incremental worth.

Loading and operation at DR Reactor continued to be influenced by planning for shutdown at year's end.

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

Reactor	B	C	D	DR	F	H	KE	KW
ECT in November*	1405	1520	1485	1455	1510	1500	2410	2275
12-Month Average ECT	1465	1600	1500	1515	1495	1515	2460	2415
Recording Time:								
From:	10-21	10-21	10-21	10-23	10-22	10-22	10-21	10-21
To:	11-15	11-16	11-16	11-16	11-16	11-16	11-17	11-16

*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.

B Reactor - C. E. Hughey

Several unscheduled outages interrupted operating continuity; consequently, operating efficiency was slightly below average, as evidenced by lower flattening efficiency and larger startup losses and prediction errors. The E-D (enriched uranium-depleted uranium) block reactivity is apparently on schedule after an initial period of slower-than-expected gains; some flattening efficiency loss is attributable to the presence of the block, since the reduction in power of the depleted uranium columns must necessarily be compensated by higher central zone powers elsewhere, thus lowering ECT (number of Effective Central Tubes). Most of the fringe thoria (E-Q) load has been charged under authorization of PITA-31; due to thoria supply limitations the lithium-aluminum blanket along the top will be replaced later.

C Reactor - J. R. Heald

As a result of a large number of unscheduled outages, nonequilibrium losses were relatively high and flattening efficiency was somewhat reduced during the report period.

While still at low level during a recent startup, the Number 1 Galvanometer and Number 1 Beckman indicated a power level in the range of ~200 MW, a factor of 100 higher than temperature instrumentation; after some delay, simultaneous discrepancies were found, the first due to a failed octant chamber in the galvanometer system and the second to an unrecorded movement of the Number 1 Beckman chamber during the outage to a more sensitive position. The situation was resolved and startup proceeded normally.

D Reactor - R. L. Miller

During an extended outage (10-19-64 to 11-3-64) a fringe thoria loading was charged under authorization of PITA-31; as expected, increases have been noted in local graphite temperatures at equivalent total level, and in control rod worths. Several other unscheduled outages occurring since the November 3 startup have resulted in relatively high startup losses, but flattening efficiency has remained within one per cent of the previous yearly average.

DR Reactor - S. M. Skidmore

Equilibrium operation was nearly continuous except for an outage caused by a rear pigtail failure; the failure had no nuclear safety implications, however, as full flow to the affected tube was maintained. Flattening efficiency has been lower than the yearly average, due to phaseout loading change restrictions for optimizing operation until the planned shutdown in late December.

F Reactor - G. C. Masche/J. R. Langton

Good flattening efficiency characterized operation during the report period, with only one shutdown interrupting continuity of operation. A pilot lot of undersized splines was used for flattening efforts during the month; the expected decrease in the percentage of "no go" splines did not materialize, however, as the reduced mechanical strength of the thinner units resulted in greater kinking tendency.

H Reactor - G. C. Masche/J. R. Langton

Operation was relatively smooth during the report period, with only one outage occurring. Flattening efficiency, while not up to the previous yearly average, was reasonably high considering the transition from the previous E-N (enriched uranium-lithium aluminum) to the present "standard" natural uranium core. Remedial measures for normal startup radial flux distortions have been complicated by the "two downcomer" power calculation approach; a signal from only one of two downcomers is used as the temperature input for the power recorder. This sometimes results in an indicated

power difference from actual as much as ten per cent, requiring more conservative startup ascension rates.

KE Reactor - G. D. Baston

No unscheduled outages occurred during the report period, and the single scheduled outage on 11-14 terminated four weeks of continuous operation. Flattening efficiency compared very favorably with the previous yearly average, as final adjustments for the recently completed decrease in flat zone size were implemented, and as analysis of transient behavior in the E-D block (PT IP-694-A) progressed. The increasing reactivity potential due to plutonium buildup in the E-D block now requires extra Total Control compensation, and rod-free, spline-free minimum startups can no longer be made.

KW Reactor - R. A. Dieterich

The reactor was started up on 10-20-64, following an extended outage during which a fringe E-Q (enriched uranium-thorium oxide, PITA-31) was charged; subsequent operation has been sporadic. A shutdown was required four days after startup in order to add sufficient spike enrichment to provide adequate reactivity for temperature distribution control flexibility. Several other unscheduled outages, due to flow monitor trips, resulted in higher-than-average startup losses and reduced flattening efficiency.

The reactivity status of the active zone does not appear to have been altered significantly by water in spite of a high collection rate during operation.

PROCESS PHYSICS STUDIES

Reactivity and Control Studies

A scope document on a physics testing program to be carried out in conjunction with the reactor shutdown and deactivation program at the F and possibly H Reactor(s) has been prepared for comment. Subsequent to receipt of comments a production test is to be prepared early in 1965.

A document has been prepared in rough draft form on the reactor physics implications of residual balls in event of a ball 3X trip at the C Reactor. Channel conditions and geometries are such that most residual balls would be expected to be adjacent to front and rear channels. The local distortion effects expected to result would not cause such severe reactivity and level losses as observed at DR nor as expected at the K's. The initial reactivity loss expected would be of the order of 0.5% k and would cause an increase in added fuel costs of the order of $500,000 (in addition to expected production losses).

Accountability studies during the report period included the initiation of calculations for accomplishing a final renormalization of IPD prediction tables to observed CPD recovery experience prior to the end of fiscal year

1965; the preparation of computer cases for calculating effects of segmented discharge and for use in a curve-fitting parametric prediction method under development by NRD; the incorporation of thoria-supporting E-metal in IPD accountability tables; and liaison with accountability and production components for keeping program entries and results up to date.

Production-Related Studies

The process improvement transition authorization for central zone irradiation of thoria in the KW Reactor (PITA-33) was prepared in final form and routed for approval. Arrangements have been made with Instrument and Electrical Development Operation to provide a fission chamber for placement within the core during charging which may be used with one of the KW subcritical monitor readout channels.

The fringes of the KW and D Reactors have been loaded with thoria, as has roughly 80 per cent of the B fringe (PITA-31). With reactivity matched, adjacent tube powers have been approximately 10-15 per cent less than anticipated at time of schedule preparation; a slightly longer irradiation time would thus be indicated for the fringe columns.

Startup losses during the first ten months of 1964 averaged approximately 0.23 effective day per startup (0.20 for C and K's, and 0.26 for five smaller) compared to approximately 0.25 effective day average loss per startup during the equivalent interval of 1963 (0.28 for C and K's, and 0.22 for five smaller).

Reactor Fundamentals Training

Additional copies of the programmed learning text, Book I - Atomic Structure, are being prepared to satisfy the requests for additional copies. A second programmed learning text, Book II - Chain Reaction Theory, has been completed in rough draft form and is currently being prepared in conjunction with Reactor Processing Certification personnel on duplimat. Work has been started on another programmed learning text, Book III - Variations in Pile Reactivity.

TESTING

PLANT ASSISTANCE - IPD

Corrosion Testing Facilities

TF-20 - Testing continued to determine the cause of resistance temperature detector corrosion and the effect of various coatings to prevent corrosion. Operating conditions are 120 C, 9.5 gpm and pH 6.6.

Irradiated Process Tube Measurement

Wall Thickness Gauge (eddy-current type) - WTG

Reactor	No. of Tubes Measured	Report No.	Document Number
D	216	43	RL-REA-65
DR	60	44	RL-REA-66
F	28	45	RL-REA-177
B	13	46	RL-REA-182

Ex-Reactor Visual, Weight and Micrometer Measurement

Reactor	No. of Tubes	Tube Samples Measured	Reason Examined
D	2	88	Special measurements
K	1	65	Suspect leaker
	Total	153	

Critical Reactor Component Examination

Twenty-four B Reactor front-face flexible connectors were examined at 108-B. Twenty-two of the connectors were examined to determine if the connectors had been damaged or weakened by the decontamination methods used on B Reactor's front hardware. No damage was detected and the bursting pressures were found to be normal (5600 to 6800psi). Two connectors were leakers, and examinations revealed the cause of the leaks to be manufacturing flaws in the plastic liner.

Eight connectors were examined on-reactor at 105-B. The connectors were in good condition.

Pressure Monitor System Programs

In-board Bourdon coil examination	-	3220	
Non-leaking coils	-	3209	(99.7%)
-average rate past two years	-		(99.8%)
Gauges receiving failure analysis	-	32	

Gauges received from Central Maintenance and examined	-	197	
-acceptance rate	-	183	(93%)
-previous month	-		(96%)

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

Reactor	Channel	Motion Picture Record	Purpose*
C	VSR No. 41	Yes	1
KE	VSR No. 49	Yes	1

*1. HCR-VSR channel problems

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

Reactor	No. of Tubes
C	13
B	12
KW	6
KE	11
H	6

TESTING AND IRRADIATION SERVICES - OTHER DEPARTMENTS, CONTRACTORS

Irradiations - Non-Loop- Routine sample irradiations were handled as follows:

Reactor	Test Hole	Facility	Request No.	No. of Samples	Material-Purpose
F		Process Channel	HAPO-098	40	Graphite (burnout rate determination)
KE	2D	Quickie	HAPO-184	66	Washington Designated Program
KW	2A	Quickie			
KE	2D	Quickie	HAPO-252	1	Arsenic (isotope production)
KE	2D	Quickie	HAPO-254	16	Water (activation analysis)
KW	2A	Quickie			
KE	2D	Quickie	HAPO-314	1	Bismuth (polonium production)
KW	4B	Snout	HAPO-270	2	UO_2 (irradiation damage study)
KW	2A	Quickie	HAPO-271	2	Copper-arsenic (isotope production)
KW	2B	Snout	HAPO-307	1	In-core flux monitor (monitor development)
KW	2B	Snout	HAPO-309	1	UO_2 pellets (micro-structure at high temperatures)
KE	0074	General Purpose	HAPO-223	15	Cobalt (gamma irradiation facility sources)
KE	2D	Quickie	HAPO-321	8	Urine (dosimetry study)
KE	2D	Quickie	Reed College	1	Tissue (cancer research)
KE	2B	Magazine	ORNL-204	1	Mercury (isotope production)

Reactor	Test Hole	Facility	Request No.	No. of Samples	Material-Purpose
		Gamma*	HAPO-320	6	RTD's and plastics (radiation damage study)

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

A special capsule irradiation was handled as follows:

Irradiation of SNAP-8 Fuel Element Capsule NAA-117 - An enriched uranium-zirconium fuel element capsule (Atomics International Division of North American Aviation capsule NAA-117) was charged into bottom front-to-rear test hole 0065 at KW Reactor.

Irradiations - Loop Facilities

KER-1 Loop Operation - Testing with three NIE1 fuel elements, two lithium-aluminum target elements, and front and rear crud probe train assemblies containing four ceramic fueled crud probes authorized by PT IP-601 was terminated and the loop discharged during the November outage. The objectives of these tests were to evaluate the crud forming characteristics of loop coolant containing ammonium hydroxide for pH control by operating at conditions generally regarded to induce high crud concentrations and to provide lithium-aluminum samples which can be used to determine production and extraction information. The loop was left empty and on layaway status.

Ex-Reactor Pressurized Water Loops

TF-3 - Testing was continued to provide long term corrosion data at N Reactor alternate primary coolant water conditions. The operating conditions are 560 F, 1350 psig, and pH 10.0 adjusted with lithium hydroxide.

TF-7 - Corrosion and equipment testing was continued. Operating conditions are 1125 psig, 277 C and pH 10.0 adjusted with ammonium hydroxide. The test sections contain the following materials:

1. PRTR fuel element for fretting corrosion
2. Two dummy fuel elements, two NIN1 fuel elements and coupons for ALK-15 crevice corrosion tests
3. Three NPR valves with loosened packing to simulate a steam leak
   The valves are periodically removed and examined for ammonia stress cracking corrosion of the bronze components.
4. Special NPR type inner fuel elements for fretting corrosion
5. One KSE3 fuel element for uniform corrosion testing
6. Two coupon holders for film buildup studies
7. One Zr-2 specimen for caustic attack testing

TF-17 - A non-standard water quality test continued. Corrosion probes are

installed in the loop for testing to establish the integrity of the probes for use in the N Reactor secondary system and to obtain corrosion data at conditions simulating N Reactor conditions. On November 20, a test was initiated to determine the stress corrosion cracking of 17-4 PH stainless steel in water and steam at the same N Reactor conditions. Operating conditions are 85 psig, 140 F and pH 9.0 controlled by morpholine.

Legend

NIN1 - N Reactor, inner tube, natural, first model
NIE1 - N Reactor, inner tube, enriched, first model
KSE3 - KER loops, single tube, enriched, third model

R. M. Reid acting for
Manager, Research and Engineering

FACILITIES ENGINEERING

DESIGN ENGINEERING

Vertical Safety Rods - Graphite Distortion

The preparation of the production test authorizing channel enlargement and sleeving of two 105-KE Reactor VSR channels has been completed and the test is being routed for approval signatures. Additional boroscope movies and dimensional data have been obtained for 105-KE channel #49 which is scheduled for the first enlargement attempt. The vendor has completed design of the K Reactor biological shield boring machine, and fabrication has been initiated. Final assembly and initiation of preliminary testing of this machine is scheduled for early December. The 105-C Reactor thermal shield boring machine has been modified for use at the 105-K Reactors and is undergoing final adjustment prior to moving to the 195-D Test Tower for mockup testing. The multiple pass concept of the graphite removal from the VSR channels test work has continued with studies of the cutting characteristics of the channel resizing cutter heads underway. The test results indicate that the enlarged channels are straight enough to permit the installation of the VSR sleeves with a minimum hazard to the adjacent process tubes.

The graphite test sleeves which were ordered in January, 1964, for installation in #41 channel at 105-C Reactor are now on plant. Evaluation of the certified chemical analysis of sleeving material has indicated that the sleeve material had been thermally purified but not gas purified as required for production of nuclear grade graphite. In order to avoid an additional delay in the test program, the effect of installing non-nuclear grade graphite sleeves in one VSR channel has been reviewed and agreement has been reached that the installation of the unpurified sleeves in one channel would not cause a noticeable change in reactivity.

A new specification for the graphite sleeves for five channels at 105-C Reactor is being prepared. Following last month's cancellation of the previous bid invitation for these sleeves, visits were made to each of the potential vendors to discuss their questions regarding the sleeve specification. The information obtained in these discussions is being included in the new specification.

Replacement of Horizontal Control Rods - C & K Reactors

The final assembly of the first prototype Inconel sheathed HCR for the K Reactors has been undertaken by the vendor following the receipt of sufficient poison material from General Astrometals. At the vendor's present rate of production, all of the poison material for the second prototype HCR should be available in December.

Sintercast Division of Chromalloy Corporation was awarded a contract on September 30, 1964, to produce 50 to 100 boron carbide-aluminum elements with an option for the production of sufficient elements for two HCR's. They have produced 15 pieces which meet all requirements except for the overall width dimension. The vendor is confident that this discrepancy can readily be corrected.

Bids have been received for the fabrication of two prototype aluminum HCR's for test purposes. All of the bids received contained minor discrepancies and negotiations are underway with the apparent low bidder.

Uncooled Horizontal Control Rods

The Nuclear Materials and Propulsion Operation of the General Electric Company was visited to review the status of their materials evaluation work and define future phases of work for the uncooled HCR concept. The results of their work to date are quite encouraging. The candidate materials for rod sheathing have been narrowed to two -- 19-9DL and Inconel 600. These materials have passed the 3000 hour point in a scheduled 10,000 hour test in a furnace atmosphere (He and CO_2) simulating reactor environment. A test to determine effects of a He-N_2 atmosphere will also be made. Small scale samples of the proposed dysprosium oxide-nickel cermet poison material have been fabricated. These are being assembled into cans made from candidate sheath material to provide composite test samples. The final phase of this current program will provide short (about 1 foot long) segments of a full-scale HCR joined with an articulation joint for final testing and specification.

100-K Reactor Coolant Backup System

Preliminary engineering in support of the program to improve flow conditions in the 100-K emergency coolant backup system has continued. A market survey in search of a suitable pipe coating material which would solve our corrosion problems in the system has not been productive thus far. Suitable coatings are available but require extensive cleaning and sandblasting of the surface to be coated in order to obtain reliable service. The high cost of such cleaning and extensive lost productive time during the cleaning operations makes these coatings unattractive. Investigations in connection with this program have extended to other possible approaches to the problem such as cement mortar lining of the pipe, a deaerating system which would reduce corrosive attack by removal of oxygen from the water, and flow-restricting devices intended to divert optimum flow to the reactor in need of emergency coolant.

Process Piping Study

The program to assess the integrity of critical process piping has continued. An additional sample of tank material has been removed from a second 183-C storage tank and sent to an off-plant laboratory for testing. The sampling of process piping and material testing has been completed except for a few samples yet to be tested from 105-B and 105-C. An extended reactor outage is required for the remaining sample removals.

Reactor Effluent Studies

The design of a test facility for a sodium silicate system in 190-D is progressing in support of the planned half-plant test. In this test

program sodium silicate will be injected into the reactor coolant supply downstream of the 183-D filter plant to observe the effect of such chemical addition on effluent activity.

Further activity in connection with reactor effluent studies has included feasibility investigations of alternate methods of reactor effluent disposal. Work on this program has been concentrated on the problems of disposing of reactor effluent, particularly from the 100-K Areas by means other than discharge directly to the Columbia River. This work has included investigation of potential inland canal and lake sites, percolation and infiltration effects, radioisotope cleanup potential of the soil column, and thermal decay effects of an open canal and lake system. Work has been initiated on preliminary cost estimates of several alternate effluent canal routings.

EQUIPMENT DEVELOPMENT

Self-supported Fuel Element (SSFE) Charging

Evaluation of plastic magazines has again been postponed by delay in the delivery of prototypes. One vendor, General Plastics Corporation, Tacoma, Washington, appears to be unable to perform; we have initiated action to cancel the purchase order. The second vendor, General Plastics Corporation, Los Angeles, California, has delivered two sample magazines. These two samples will be evaluated for strength and alignment before proceeding with the balance of the order.

Chemical Decontamination Development

Development of a prototype spot contamination-locating instrument is progressing to the final stages. The current prototype instrument resembles a five-cell flashlight with a long, slender probe attached to one end. The reduced weight and revised location of controls materially improved the utility of the instrument. On-reactor tests, while not complete, have demonstrated the usefulness of this instrument.

Progress is being made in the program of reducing chemical concentration of decontamination solutions while maintaining effectiveness. On-reactor tests have demonstrated the efficiency of a solution utilizing a 25 per cent reduction in concentration. Preliminary tests at 50 per cent reduced concentration appear promising; additional tests are planned.

Identifying Seals for International Atomic Energy Agency (IAEA) Inspection

The support effort to develop and test prototypic seals and procedures has been completed.

Integral Connector and Cable Testing - Resistance Temperature Detector (RTD) Assemblies

Testing of the latest qualification lot of RTD cable produced by L. Frank Markel and Sons is in progress. The cable does not meet specification requirements for water absorption, and conductor insulation is below standard elongation characteristics in the "as received" condition. In addition, severe "kneeing" of the conductors exists, which causes the cable to be prone to break through the soft silicone insulating material.

No additional qualification samples of integral connector assemblies, which utilize a revised molding technique, have been received from T. A. Edison Company.

Design Test Service

The N-Reactor program utilized 206 hours of engineering effort for design test service.

REACTOR PLANT DEACTIVATION

Two informational meetings were held to present the status and plans of the deactivation program to interested IPD Management.

The first issue of the Deactivation Manual was forwarded to the DR plant management. At mid-month the DR deactivation Procedures and Instructions were approximately 90 per cent complete.

Agreement was reached with Manufacturing for the post-deactivation requirements for First Aid services. Currently, it is planned to deactivate the services at F Area and retain limited services at H Area.

Significant project activities for AEC-187 and AEC-186 included the fact that the Commission has authorized a revision to the HAPO Standard AC-5-40 which permits greater distance between monument posts.

Under Project CAI-142, the specifications for the underground piping between 182-B and 105-B/C has been completed.

A comment draft of Process Standards prepared by Research and Engineering for shutdown, discharge, and water removal from the DR Reactor was reviewed and comments submitted.

PROJECT ENGINEERING

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

The charge seaters are being installed on the "C" elevator in KW Area. All of the magnesium magazines (1,700) have now been received. This completes the procurement of engineered items and construction is essentially completed.

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

At the request of RLOO-AEC, the scope of this project is being modified to include installation of equipment for transmission of radiation data to a remote central location.

CAI-142, Coolant Backup Modifications Required by Reactor Deactivation - Three Small Reactors

Title II Design being performed by the on-site Architect-Engineer is proceeding and is approximately 26 per cent complete. Preliminary emphasis in design effort has been placed on preparation of installation drawings for diesel engine and steam turbine pump drive and preparation of procurement specifications for critical equipment. The procurement specification for the diesel engine drive has been completed, approved, and issued to the field for procurement action.

CGI-143, Linear Power Rate-of-Rise Instrumentation - 105-KE and Three Small Reactors

A revised design schedule was submitted to the RLOO-AEC for approval to comply with Modification No. 1, Directive EQT-812, by reducing the scope of this project to the 105-C Reactor only. The Vitro Engineering Company has installation design 45 per cent complete.

AEC-186, Equipment for Reactor Deactivation

Design progress: Title II is 16 per cent complete, compared to 21 per cent scheduled.

The Title I steam boiler installation drawings were received for comments on November 18, 1964. Design Criteria for "Evacuation Alarms and Electrical Equipment Heating" was approved by the Project Representatives. No construction money has been released to date.

AEC-187, Plant Modifications for Reactor Deactivation

Design Progress: Title II is 12 per cent complete, compared to 18 per cent scheduled.

Design Criteria for "13.8 KV Line from White Bluffs to 100-F Area" was [redacted] the Project Representatives. No construction money has been released to date.

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

Final tie-in of the KER safety circuitry to the 105-KE wiring system was started. No further information has been received on the first and second stage impellers (four each) promised by Byron-Jackson. In the meantime, Pump No. 560, which has modified first and second stage impellers, is on test. No further pump modifications can be done until additional impellers are received.

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

Clean-up jobs on work platforms continued. The 105-KE "D" platform was turned over to Processing on November 15, 1964, with operable emergency brakes. The brakes at 105-KW "D" platform are also operable and undergoing final check at month end.

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

Work on this project was stopped on November 15, 1964, in order to avoid exceeding authorized funds. A project proposal revision is being prepared to request additional funds and a time extension.

CGI-967, High Speed Scanning System for Temperature Monitors, KW Reactors

The high speed scanner vendor, Astrodata, Incorporated, advised by a letter dated November 11, 1964, that cost of the scanner will exceed his estimate by $113,078 and that delivery will be delayed to March 1, 1965. A cost-to-complete estimate has been prepared, and it is evident that nearly all of the existing contingency money will be required to offset this increased engineered equipment cost.

MJA-42, Interior Painting, Process Water Storage Tanks, 100-B and C Areas

The subcontractor, H. B. Painters, Incorporated, is now sandblasting and painting the 190-B Tank No. 3. The humidity and temperature are holding satisfactorily in the building.

MJA-53, Installation of Rear Crossheader Expansion Joints, 105-B, D, and H Buildings

The Flexonics Division of Calumet & Hecla, Incorporated, suppliers of the expansion joints for 105-B and 105-D (105-B joints failed in service), has agreed to replace all expansion joint liners and provide ten expansion joints for those that failed and those destroyed in testing. These liners will be of a new design having a self-centering Vanstone-flanged end instead of the welded end originally provided.

Revision 2 to MJA-53, reducing total funds from $423,000 to $253,000 was approved on November 20, 1964. This reduction is caused by the elimination of 105-DR and 105-F from the scope of work.

MJA-60, RTD and Lead Wire Replacement - 105-KE and KW Process Tube Temperature Monitoring System

The RLOO-AEC has placed orders for 100,000 feet of RTD lead wire with both the General Electric Company and The Prestolite Company. Negotiations with Thomas A. Edison Industries for RTDs are in progress.

Project Proposals Issued by RLOO-AEC

AEC-186, Mod. 1, dated November 2, 1964.
Equipment for Reactor Deactivation - $410,000.

AEC-187, Mod. 1, dated October 27, 1964.
Plant Modifications for Reactor Deactivation - $480,000.

CPFF Construction Service Contractor - Liaison

Issued one new work order for a total of $10,000 to the J. A. Jones Construction Company.

Plant Forces Work Review

The Labor Standards Board did not approve any jobs for assignment to plant forces.

Manager, Facilities Engineering

RT Jessen:dgm

[redacted]

FINANCIAL

ACCOUNTING

FY 1965 Midyear Review Budgets were completed and transmitted to Contract and Accounting Operation on November 20, 1964.

The Plant and Capital Equipment Budget for FY 1967 and Revision of FY 1966 is in progress and a meeting is scheduled with RL-AEC to discuss proposed items to be budgeted.

Physical inventory of movable and fixed property assigned to Production Fuels-Engineering Components has been initiated. Property tabulations of property units were forwarded to property custodians for verification.

Reactor Deactivation Property Control and Property Pass Procedures have been reviewed with management personnel and an IPD-Organization and Policy Guide is being prepared for management's approval.

A listing of 100 and 300 Area facilities was issued November 20, 1964, as requested by RL-AEC.

AUDITING

Revision of the following types of Government instructions were reviewed and appropriate action taken:

AEC Manual Chapters	15
RL-AEC Manual Chapters	2
Federal Procurement Regulations	1
RL-AEC Procurement Information	3
AEC Immediate Action Directive	1

Manager-Finance

RW McMichael:WKH:slb

[redacted]

SIGNIFICANT REPORTS ISSUED

Number	Class'n	Author	Date	Title
HW-82943 C	Secret	WN Mobley	11-5-64	IPD Production Fuels Section Monthly Report - October 1964
HW-84315	Unclass.	EV Padgett WF Stevenson	10-2-64	Quality Policy and Procedures for Procured Materials Quality Control Manual #3
RL-REA-59	Confid.	CA Strand	11-5-64	Status of Development Work on the Hot Die Size Fuel Element Growth Problem
RL-REA-216	Secret	WN Mobley	11-30-64	Uranium Delivery Schedule January 1, 1965 through June 30, 1965
RL-REA-61	Secret	PA Carlson	10-30-64	KW Reactor Operating Characteristics with E-Q Loadings
HW-84408	Secret	RS Peterson	10-22-64	Minutes - VSR Program Meeting, 9-29-64
RL-REA-62	Unclass.	PH Hutton	10-26-64	Evaluation of Expansion Induced Stresses in Rear Cross-headers and Risers - C Reactor
HW-78818 Add. 1	Unclass.	LB Brinkman PF Mercier	8-26-64	Development Test, IP-615-E Removal of Circular Plugs From Process Piping for Metallurgical Testing
HW-78818 Add. 2	Unclass.	LB Brinkman PF Mercier	10-23-64	Development Test, IP-615-E, Removal of Circular Plugs From Process Piping for Metallurgical Testing - 105-C and 190 Buildings
HW-84279	Unclass.	JE Boyd	9-28-64	Authorization Request for Potential Noncompliance with the American Standard Safety Code for Elevators, Dumb-waiters, and Escalators.

Number	Class'n	Author	Date	Title
RL-REA-79	Unclass.	WR Thorson	11-2-64	Project CGI-125 Fixed Radiation Monitoring Project Representatives Meeting No. 5
HW-79819 Suppl. A	Unclass.	HF Jensen	10-22-64	Supplement A, Production Test Authorization IP-639-AE, Reactor Test of Van Stone Seal Insert Modification
HW-56001-J	Unclass.	HF Jensen	11-5-64	Interim Report No. 11, Chemical Decontamination Activities - 105 Reactors - During the Period October 1963 through October 1964
HW-84357, Add. 1	Secret	WV Thompson	11-13-64	Information Report on Downcomer Instrumentation, 105-H
RL-REA-170	Unclass.	WV Thompson	11-16-64	Rear Face Crossheader Fitting Failures, 105-H
RL-REA-70	Unclass.	WD Hamilton	10-30-64	Magnetic Amplifier ZTM Controllers Acceptance Test Data, 105-B
RL-REA-68	Secret	JR Young	11-2-64	100-K Reactor Xenon Override
RL-REA-88	Unclass.	LD Gustafson	11-5-64	Results of Test Addition of Sodium Silicate to 100-D Fire and Sanitary Water
HW-83242	Secret	TW Hauff	10-30-64	Manufacturing Section Semi-Annual Summary Report (Period Ending June 30, 1964)
RL-REA-15	Secret	HG Spencer	10-13-64	Multi-Product Allocation of U-235 Burnout and Reactor Costs
HW-84294	Secret	JW McCurry and HG Spencer	9-29-64	H Reactor Loads FY 1964

TRIPS

Name	Firm & Location	Date	Purpose
OH Greager TW Ambrose R Nilson	Washington, D.C.	11-6-64	Attend Hanford Subcommittee Meeting of ACRS.
WK Alexander	Amer.Potash & Chemical West Chicago, Ill.	11-9-64	Discuss material specifications and procurement.
	Ford Motor Co. Dearborn, Mich.	11-10-64	" " "
	Dresser Products Inc. Great Barrington, Mass.	11-11-64	" " "
	Electron Beam Techniques Plainville, Conn.	11-12-64	" " "
	Coors Porcelain Co. Golden, Colo.	11-13-64	" " "
OH Greager TW Ambrose R Nilson	Washington, D.C.	11/12-13/64	Attend ACRS Meeting.
R Nilson	GE-Missile and Space Division Valley Forge, Pa.	11-14-64	Discuss physics work.
	Yeshiva University New York, N.Y.	11/15-16/64	Attend Conference on Science Advances.
PF Mercier	University of Calif. Berkeley, Calif.	11-16-64	Discuss and observe testing of 190-C water storage tanks.
	Aerojet General Sacramento, Calif.	11-17-64	" " "
FJ Kempf	General Electric Co. Schenectady, N.Y.	10-27-64	Discuss current status of Contract ATH-IP-1-65.
	Speer Carbon Co. Niagara Falls, N.Y.	10-28-64	Discuss graphite sleeve fabrication and procurement problems.

Name	Firm & Location	Date	Purpose
FJ Kempf	Union Carbide Corp. New York, N.Y.	10-29-64	Discuss graphite sleeve fabrication and procurement problems.
PH Hutton	General Electric Co. Cincinnati, Ohio	10/26-27/64	Discuss uncooled HCR development program.
PH Hutton	NTH Products, Inc. El Cajon, Calif.	11/16-17/64	Discuss supplement to Contract SA-303.
DF Arnold	Astodata Anaheim, Calif.	10/26-29/64	Review progress on Contract DDR-179.
R Sherrard	Astrodata Anaheim, Calif.	11/8-11/64	Review progress on Contract DDR-179.
JM Fox, Jr.	General Electric Co. Cincinnati, Ohio	10-25-64	Metallurgy of uncooled control rod.
JM Fox, Jr.	Union Carbide Linde Division Indianapolis, Ind.	10-26-64	Cobalt plating.
JM Fox, Jr.	American Society for Metals Cleveland, Ohio	11-8-64	Meeting of ASM Metals Handbook Planning Committee.
JM Fox, Jr.	University of Calif. Berkeley, Calif.	11-15-64	Discussion of brittle fracture data.
JM Fox, Jr.	Aerojet-General Corp. Sacramento, Calif.	11-16-64	Discuss sonic failure warning device.
RT Jaske	Oregon State Univ. Water Resources Inst. Corvallis, Oregon	11-10-64	Present paper at Water Resources Seminar.
RT Jaske	U.S. Dept. of Interior Fish & Wildlife Seattle, Wash.	11-12-64	Discuss Lake Roosevelt density currents.
RT Jaske	Geo-Recon, Inc. Seattle, Wash.	11-12-64	Review seismic testing.
RT Jessen	Astrodata Anaheim, Calif.	11-9-64	Discuss status of Contract DDR-179.

Name	Firm & Location	Date	Purpose
FAR Stainken	Univ. of No. Dakota, Grand Forks No. Dakota	11/2-3/64	Participate in Company's BS/MS recruiting program.
FAR Stainken	No. Dakota State Univ. Fargo, No. Dakota	11/4-5/64	Participate in Company's BS/MS recruiting program.
FAR Stainken	Oregon Drilling Ass'n. Portland, Oregon	11-21-64	Present speech at Annual Meeting.
HC Money WK Wright	National Lead Co. Cincinnati, Ohio	11/12-13/64	Discuss production and delivery schedules.
JT Stringer	ANS/AIF Meeting San Francisco, Calif.	11/30-12/3/64	Attend meeting and atomic fair.
AR Maguire	Washington, D.C.	11/5-6/64	Discuss thoria loading at ACRS Meeting.
CR Oak	Link Belt Company; Chain Belt Company; JT Ryerson & Sons; Gardner-Denver Co.; (all of Seattle, Wn.)	11-12-64	To obtain design information on conveyor and material handling systems.
WD Hamilton GC Clodius	Minco Products, Minneapolis, Minnesota	11/4-6/64	Consult on strap-on RTDs.
HD Green	Astrodata, Anaheim, Calif.	12/1-12-23/64	To obtain data for the preparation of a Maintenance Manual on the High-Speed Scanner.

VISITORS

Name	Firm & Location	Date	Purpose
J Horton	Travelers Ind. Co. Portland, Oregon	11-11-64	Third party inspection of pressure vessels.
U Thomas Z Zelander	Atlas-Copco Co. San Calos, Calif.	11/4-7/64	Vendor's representatives present during installation and startup of the replacement air compressor.
AJ Secor M Ziegler DM Guy	ALCOA Edgewater, N.J. ALCOA - Seattle, Wn.	11/19-20/64	Discuss quality control and receiving inspection techniques.
G Del Faro	R&R Tool & Die Corp. No. Hollywood, Calif.	11/30-2/12/64	Discuss quality control and receiving inspection techniques.
ET Fish	Great Lakes Carbon Corp. Menlo Park, Calif.	11-4-64	To discuss graphite sleeve fabrication and procurement problems.
WG McCarthy	Pacific Steel Products Seattle, Wash.	10-29-64	Discuss bid exceptions on Requisition D-53045-K (aluminum HCRO).
HT Baughman RE Wright	Philadelphia Quartz Co. Berkeley, Calif.	11-12-64	Discussion regarding Berkeley, Calif. installation of storage and feed facilities for sodium silicate.
David Sprauge	MB Electronics Culver City, Calif.	11-18-64	Examination of shaker table and discussion of shaker equipment maintenance.
RT Bissler	Fawick Corp. Cleveland, Ohio	11/2-3/64	Reviewed brake installation on Project CGI-960.
E Denhard	Armco Baltimore, Ohio	11-5-64	Stress corrosion cracking 17-4 PH.
E Hall	Esco Portland, Oregon	11-5-64	Stress corrosion cracking 17-4 PH.

Name	Firm & Location	Date	Purpose
T Jerstand	Anchor San Francisco, Calif.	11-5-64	Stress corrosion cracking 17-4 PH.
EM Chandler BB Gillies JE Kinzer AF Lillie FW Peters CC Woolsey	Atomics International Canoga Park, Calif.	10/25-11/7/64	Review test irradiation program.

RESEARCH AND ENGINEERING

Reactor Fuels

The irradiation test of hot-die-sized elements comparing the effects of various fabrication parameters on the irradiation behavior of the elements was discharged from the C Reactor during the November 12, 1964, outage. Exposure at the time of discharge of the twenty-three columns averaged 760 MWD/T. Post-irradiation examination of the elements is in progress.

The hot-die-sized fuel element test involving eighteen columns in C Reactor to test the effects of uranium heat treatment parameters on irradiation behavior has attained an average exposure of 540 MWD/T, of an 800 MWD/T goal. Discharge of the test is scheduled for December 1964.

Pocket Radiation Alarm Devices

The layout for the modified Chalk River dose alarm device employing the use of a circuit board has been completed. The dimensions of the device will be 3-1/2" x 2-1/4" x 1". The procurement of a suitable case is currently being negotiated with a plastics vendor. Assembly of the electronic components on circuit boards is ready to begin. About 40 instruments will be fabricated for testing purposes.

Plutonium-238

A cursory look at a self-contained plutonium fuel cycle (using a plutonium-depleted uranium load) in a small reactor indicates that about 40 kg of Pu-241 could be made per year. The plutonium would contain about seven per cent Pu-241. Further Pu-241 step-up in our thermal converters does not look practical due to Pu-241 burnout. Maximization of Pu-241 by irradiation of plutonium in a resonance flux would deserve a closer look and is planned. By this scheme and subsequently irradiating Am-241 milked from plutonium, about 150-200 kg of Pu-238 could be formed by 1980. Milking of power reactor plutonium (8-12 per cent Pu-241) should be substantially cheaper and considerably more productive of Pu-238 by 1980. Further study, including the economics, is planned for the near future.

Monte Carlo

The author of code GMCM-9, Mr. Kniedler, was contacted. According to him, GMCM-9 does not have any provisions for specifying reflecting boundaries. This is an essential feature in applying the generalized Monte Carlo code for lattice evaluations. The possibility of modifying the code for inclusion of a reflecting boundary is being investigated.

Computer Programming

A recent decision by the Data Processing Operation to change from FORTRAN II language to FORTRAN IV will require rewriting of all existing programs. COLPRO I was rewritten from FORTRAN II into FORTRAN IV using the SIFT program. Test problems will be evaluated to get some estimate on computing time requirements for Monte Carlo calculations using FORTRAN IV as compared to FORTRAN II.

Irradiated IPD Fuel Examination, 105-C Facility

Examinations were completed on fuel elements from 75 tubes requiring 8072 individual examinations.

No. of Tube Charges	Production Test
56	IP-216, Evaluation of Performance of Normal Production I&E Fuel Elements
4	IP-684, Hot-Die-Sized Parameter Evaluation
15	Regular Production Fuel, Examination of Production Fuel Elements from B, D, DR, F and C Reactors for Groove and Ledge Type Corrosion

Photographs were taken of a rupture from B Reactor and a rupture from H Reactor.

Single-Pass Tube Facility Operation-1706-KE

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

* Water Treatment Pilot Plant product. The flocculating agent is aluminum sulfate in sufficient quantity to maintain the zeta potential near zero. The pH is controlled by the addition of 12.5 cu. ft/hr carbon dioxide.

** Process water has been supplied from 1706-KE since November 19.

FACILITIES ENGINEERING

Prototype High Speed Scanner

The prototype system was shut down on October 26 due to a failure of an input amplifier. This failure was determined to be due to a Bristol chopper in the amplifier feedback tube and is considered insignificant in that normal maintenance requires replacement of the chopper after 5000 hours of use; this chopper had operated 7500 hours prior to failure. This particular component is not being utilized in the KW system design. Total accumulated operational hours are 29,243.

Dose Rate Telemetry

Approval for contract placement was received from the AEC on November 17. Verbal notice to proceed has been transmitted to Tracerlab, Incorporated, Richmond, California.

In-Core Flux Monitor

Channels 1 and 2 and guards 6 and 7 of the gamma sensitive stainless steel in-core chamber assembly are functioning satisfactorily. Channel 5 is transmitting intermittent signals and exhibiting failure characteristics similar to those observed on chambers 3 and 4, which subsequently failed completely. A review and evaluation of the data obtained to date has been initiated.

Older Reactor Power Recovery Studies

At the request of the Atomic Energy Commission, a new summary report regarding the FY-1964 older reactor power recovery study program is being prepared. The principal revisions in the economic evaluation contained in the previous study program summary report (HW-83189-RD, "Summary Report Power Recovery Study Program Existing Smaller Hanford Reactors", dated July 31, 1964, Staff of IPD), which the new report will reflect are as follows:

1. A change in financing from public to private ownership.

2. The elimination of radioisotope production credits in computing net electrical power costs.

3. The use of commercial fuel fabrication and NFS separation costs.

4. The use of published uranium burnout price schedules.

All of the changes will tend to increase the net electrical power costs previously reported. Work is underway on the preparation of the revised report. Completion of it is scheduled for early in January.

PRODUCTION FUELS SECTION

Hot Die Sizing Process Development

Production test IP-684-A, designed to evaluate the effect of end bond pressure and uranium core "skin effect" on the irradiation behavior of hot die size fuel, was discharged November 13 at an exposure of about 800 MWD/T. Six of the 24 columns required above-normal discharge forces. Post-irradiation measurements and an analysis of the dimensional data are expected to be completed by mid-December.

Production test IP-708-A, charged in C Reactor to determine the effect of core heat treatment and stress relief by alpha annealing and AlSi dip brazing on fuel stability, is expected to reach goal exposure before year end.

A pilot run was made on small reactor natural (model 03AN) fuel elements during the month to test the automatic nickel-plating machine and to study process capabilities. A total of 680 cores were plated, of which 452 were acceptable for die sizing. As a result of a high plating reject rate, the run was discontinued until November 12. The plating problem was manifested by longitudinal, dark streaks up to 60 mils in width on the surface of the as-plated fuel cores. Both metallographic examination and muffle-furnace tests revealed either poorly adherent or extremely porous nickel plate within these streaks. An extensive investigation, including use of the laboratory plating facilities, indicated the electrolytic etch bath was the source of the problem. Other possible contributing factors were hydraulic oil leaks, and a deterioration of pump packing in the process solution systems. The electrolytic etch bath was replaced, and no further evidence of plate streaking has been observed. Plating equipment problems have continued to cause considerable operating time loss during the shake-down period.

Nickel thickness was measured nondestructively at mid-point on the O.D. of approximately one per cent of the fuel cores processed through the new plating machine and ranged between 0.8 and 1.1 mils. Stud pulling on jacketed cores indicated the nickel-uranium adhesion is not as good as that obtained using laboratory equipment, but is generally acceptable. Bond fracture occurred at the Ni-U interface on about 65 per cent of the studs pulled, with forces ranging from 390 to 1020 pounds and averaging 600 to 1000 pounds for various areas of the jacket. Typical results on laboratory-plated material have been 15 to 30 per cent fractures at the Ni-U interface with minimum stud-pull forces of 500 to 600 pounds.

The feasibility of using a momentary high back-pressure (about 12 tons) to improve the cap-to-can bonding of hot die size fuel elements during sizing has been demonstrated. This technique upsets the cap sufficiently to produce a friction weld between the cap and can. Application of the high back pressure for a fraction of a second prior to sizing the cap end of the fuel is expected to improve end closure quality, allow a reduction in end bonding pressure, and permit water quenching after sizing.

Development tests were continued on the induction end bonding presses. Quench rates were examined to determine effect on the fuel dimensions. Based on measurements taken at the longitudinal center of fuel elements before and after end bonding, there appears to be no difference between air-quenched and water-quenched pieces. There was a difference, however, on the lateral surface under the die cups. The average O.D. of the ends of the water-quenched pieces decreased 0.001 inch, as compared to an average increase of 0.0015 inch for the air-quenched pieces. This would indicate that the differential thermal expansion end bonding dies apply a lateral pressure during water quench. Further tests are being made to determine an optimum die design.

In an attempt to evaluate the effect of exposing preheated fuel assemblies to air before die sizing on closure quality, aluminum foils were placed over the ends of fuel assemblies to retain the argon atmosphere after preheat. Following subsequent die sizing and end bonding, the pieces were examined. End bonds were strong and continuous, except for an apparent non-uniformity in thickness within 1/16 inch from the ends of the cores. This may be caused by incipient oxidation of the fuel core during and/or following preheat. Additional samples are being prepared for metallographic examination.

Product specifications for the uranium core, diffusion barrier, nickel plate, bond, cladding and other hot die sized fuel element characteristics have been prepared and are being reviewed.

R. M. Reid acting for

Manager, Research and Engineering

DATE
FILMED
2/1/93