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IRRADIATION PROCESSING DEPARTMENT

MONTHLY REPORT

FEBRUARY, 1963

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HANFORD ATOMIC PRODUCTS OPERATION

GENERAL ELECTRIC

RICHLAND, WASHINGTON

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IRRADIATION PROCESSING DEPARTMENT
MONTHLY REPORT
FEBRUARY, 1963

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March 14, 1963

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SUMMARYMANUFACTURING

Reactor input production (MWD) was 7.2% below forecast: 0.5% below at the six old reactors and 16.3% below at the K's. Production was below forecast at the K Reactors because of nine unscheduled outages at KE and a three-day extension of the KW zirconium tube outage to accomplish other necessary shutdown work.

Over-all time operated efficiency was 69.0% (71.9% forecast): 71.7% at the six old reactors and 60.9% at the K's.

A new power level record of 2005 megawatts was achieved at D Reactor surpassing the previous record of 1970 megawatts for the five old reactors set at D Reactor in March, 1962.

Ten ruptured fuel elements, six I&E natural and four I&E enriched, were removed from the reactors. Three of the natural metal ruptures were at D, two at DR and one at C. The enriched ruptures were one each at C, DR, H and KE. Five of the natural metal ruptures and two of the enriched ruptures were bumpered fuel elements. The enriched rupture in the E-N loading at H Reactor, at 10 per cent of goal exposure, was caused by charging machine damage.

A total of 533 process tubes was replaced including the installation of 56 zirconium tubes at KW Reactor.

Four tube and five Van Stone leaks were corrected.

PRODUCTION FUELS

A total of 597 tons of natural and enriched fuel elements was produced for 100% of the forecast.

Production through the AlSi Shop was at the rate of ten canning lines per day during February. Canning line operating efficiency was 98.9% for the month.

Bare core inventory reflects a 1.7 months' supply. This figure does not include 288 tons of dingot material. Finished fuel inventory reflects a 1.9 months' supply, excluding 105 tons of dingot material.

The over-all reject rate in the AlSi Shop was higher during February. The higher rate is attributed to an increase in marred surface rejects resulting from the excessive handling associated with numerous model changes; a porosity problem in the weld head, the cause of which has not been determined; and a high rate of rejection at the UT-4 (end closure) test.

A series of tests have been performed to evaluate the feasibility of recovering KVNS fuel elements rejected for minimum rail height of less than 92 mils. The following conclusions have been reached from evaluation of test data: (1) a

substantial portion of the reject fuel elements can be recovered by a closely controlled "upsizing and downsizing" process, and (2) the performance of the recovered fuel elements can be expected to be satisfactory.

Vacuum outgassing of uranium cores at National Lead Company of Ohio has been discontinued for an indefinite period of time. The observation of various degrees of oxidation on the internal diameter of the outgassed cores prompted this action.

Manufacturing problems in conforming to rigid specifications for rail height and the projected diameter of self-supported fuel elements necessitated preparing and charging ten columns of KVNS fuel elements into KW Reactor (PT IP-572-A). This test will further define minimum rail height specifications which are currently based on laboratory data and limited in-reactor measurements.

The fabrication of the CIVE (94%) hot press fuel elements at Sylcor under contract DDR 149 has been completed. The initial shipment is expected to arrive at Hanford about March 1, 1963.

The cap and base end of the hot-die sized fuel elements have been successfully end-bonded, using differential thermal expansion dies. This end-bonding was accomplished without can wall upsetting or bond deterioration which were experienced in the first two tests.

RESEARCH AND ENGINEERING

During February the primary limit on reactor power levels at B, C, DR and F Reactors was tube outlet temperature; at D and H Reactors it was bulk outlet temperature; and at the K Reactors it was administrative limits.

The half-plant test at F Reactor using low alum feed rates for water treatment was delayed by the early spring thaw which occurred the first part of February. This short-term condition required feed rates up to 25 ppm to produce reactor quality water.

Latest physics calculations indicate that the retubing and refueling of the K Reactors with zirconium tubes and KV fuel will result in a reactivity gain of about 0.6 per cent $\Delta k/k$.

Two reports on the Poison Spline Supplementary System were completed. One describes the development, procurement and application phases and the other summarizes the improvements in operating efficiency achieved through spline usage.

Operation of the 1706-KER recirculation loop facility has continued in support of the NPR development program. Following a sequence of tests to simulate pre-startup cleaning operations at N Reactor, KER-1 Loop has been charged with twelve 17-inch enriched N inner fuel tubes; the test of eight 17-inch N inner fuel tubes in KER-2 continued; KER-3 remained shut down because of primary pump failures; and the testing of fourteen 23-inch N fuel elements in KER-4 continued.

FACILITIES ENGINEERING

Fifty-six channels at the 105-KW Reactor were reconditioned and retubed with smooth-bore Zircaloy-2 process tubes during a one-week outage, beginning February 11. The inlet gunbarrels were regrooved on-reactor to permit installation of the thick section retaining ring. Three outlet gunbarrels were also regrooved due to corrosion of the existing ring groove.

The production model boring bar was used during the outage. A zirconium tube life of at least ten years is indicated by bore gage and traverse data taken during the outage.

Two Self-Supported Fuel Element prototype charging machines were tested on the 105-KW Reactor on February 16-17, following the tube replacement. A total of 50 tubes was successfully charged with the two prototypes. A third prototype machine is scheduled for delivery early in March, at which time laboratory testing will be initiated.

The revised Vertical Safety Rod tip, previously reported as being modified, was used in a successful series of VSR liner drop tests. Simulated VSR drop tests were conducted using channel liners of polycrystalline graphite, aluminum oxide and pyrolytic graphite. Each of the first two liner materials successfully withstood 1000 drops, which is about 25 years of life, without major damage. The pyrolytic graphite test sleeve failed after about 900 drops were completed.

Flow tests of the cross-tie line made subsequent to the line cleaning were successful, and Project CGI-844, 100-K Area Coolant Backup, was closed with minor exceptions. Raw test data indicate achievement of the 32,000 gpm design criteria flow.

RESPONSIBILITY

There were no significant changes in responsibilities.

FORCE SUMMARY

	<u>Exempt</u>	<u>Non- Exempt</u>	<u>Total</u>
General	7	2	9
Research and Engineering	84	55	139
Manufacturing	390	1433*	1823
Production Fuels	110	423	533
Facilities Engineering	86	38	124
Financial	<u>21</u>	<u>16</u>	<u>37</u>
TOTAL	698	1967	2665

* Includes 17 N Reactor replacement trainees.

SAFETY, SECURITY AND RADIATION EXPERIENCE

There were 115 medical treatment injuries, one security violation, no disabling injuries or radiation exposures exceeding operational control.

INVENTIONS

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

<u>Name</u>	<u>Date</u>	<u>Title</u>
C. P. Cabell E. D. Stone	2-7-63	Self-Loading Automatic Fuel Charging Machine
G. F. Howden	2-18-63	A device for inserting poison splines into reactor process tubes for reactor control.
G. F. Howden	2-18-63	A device which may be used for field machining snap ring grooves or as a pipe cut-off tool.

General Manager

AB Greninger:DLD:ewn

MANUFACTURING

PRODUCTION OPERATION

There were no discharge goal exposure adjustments initiated in February. A 20-ton batch of central zone unbumpered regular uranium is proceeding toward the unclassified plutonium exposure level at F Reactor as planned.

FEBRUARY DISCHARGE EXPOSURE (MWD/T)

<u>Regular Uranium</u>		<u>Enriched Uranium</u>	
<u>6 Old</u>	<u>2 K's</u>	<u>6 Old</u>	<u>2 K's</u>
678	690	809	816

Rail and truck shipments of Essential Materials were as follows:

Carload shipments for IPD	-	420
Carload shipments for other Depts.	-	174
Truck shipments for IPD	-	<u>149</u>
Total		743

MONTH		REACTOR OPERATION STATISTICS - PROCESSING											TOTAL HOURS	% OF TIME
FEBRUARY, 1963		B	C	D	DR	F	H	KE	KW	TOTAL				
INPUT PU (% OF FORECAST)		124.6	83.3	95.4	72.1	116.9	113.5	73.3	97.2	92.8				
TIME OPER. EFF. (% OVERALL)		52.5	71.2	76.7	44.0	89.9	96.2	62.2	59.5	69.0				
NEW TUBES INSTALLED		188	4	4	279	1	0	0	57	533				
WATER LEAKS - TUBE		2	1	1	0	0	0	0	0	4				
- VAN STONE		2	0	3	0	0	0	0	0	5				
FUEL ELEMENT RUPTURE		0	2	3	3	0	1	1	0	10				
HELIUM CONSUMED - M CU. FT.		405.3	961.1	1054.6	222.2	744.3	377.4	393.5	168.5	4326.9				
UTILIZATION OF REACTOR OUTAGE HOURS														
CHARGE - DISCHARGE		33.9	38.8	41.2	16.7	22.0		98.2	45.6	306.4	5.7			
RUPTURE REMOVAL			20.0	28.9	19.4		19.6	2.4		90.3	1.7			
WATER LEAK		35.6	17.5	30.5						83.6	1.5			
TUBE REPLACEMENT		142.4	26.8	14.9	265.6	10.4		20.3	158.8	629.2	11.9			
MAINTENANCE		92.7	57.9	35.5	62.3	24.2	5.5	86.1	12.8	377.0	7.0			
STANDARD CHECK		3.7	0.6	4.2						8.5	0.2			
PRODUCTION TEST		11.1	31.9	1.5	5.3	1.0		27.5	10.1	88.4	1.6			
PROJECT WORK			0.3		7.2		0.7	8.2	16.7	24.9	0.5			
OTHER								11.2	27.9	47.3	0.9			
TOTAL		319.4	193.8	156.7	376.5	67.6	25.8	253.9	271.9	1665.6	31.0			
REACTOR OPERATION STATISTICS - POWER														
RIVER WATER PUMPED - M GALS.		6975.7		6278.7		3768.2	3565.7	7512.9	6790.0	34891.2				
WATER TREATED - M GALS.		1711.9	4684.0	4210.3	1947.6	3724.8	3446.2	7464.1	6790.0	33978.9				
WATER TO REACTOR - GPM NOR.		82200	97300	87500	86000	89200	83280	205100	205000	943180				
FINISHED WATER - ANALYTICAL DATA														
TURBIDITY PPM AVG.		.003	.004	.004	.003	.005	.002	.006	.004					
PH AVG.		6.90	6.90	6.97	6.95	6.92	6.90	6.60	6.60					
CL ₂ RESIDUAL PPM AVG.		.05	.05	.15	.15	.05	.13	.07	.09					
DICHROMATE PPM AVG.		.99	1.34	1.89	1.00	1.02	.97	1.85	1.87					
STEAM GENERATED M LBS.		71665		87136		43300	51071	26720	27922					
EVAPORATION RATE/LB. OF COAL		7.84		8.09		8.70	9.15							
EVAPORATION RATE/GAL. OF OIL														
TOTAL KW - HR GENERATED								105.7	108.1	3146000				
								1549600	1596400					

B-C REACTOR OPERATION

B Reactor experienced two outages: one for tube replacement and one to correct an excessive water collection rate. Four significant outages occurred at C Reactor: one for metal processing, two to remove ruptured fuel elements and one due to a water leak.

During the January-February outage at B Reactor, 408 process tubes were replaced. Thirty-five tubes with reduced rib heights were installed above row 36 to permit charging of eight-inch rather than four-inch metal. Four problem channels were cleared of obstructions and retubed. Graphite obstructions were removed from VSR channels 35 and 37. A draw-down test of the high tanks was performed.

To permit the draining of the 182-B reservoir and repair of an expansion joint, D Area provided the export water supply from February 18 to 23, 1963.

Fourteen-inch bypass lines have now been installed on all four process water storage tank inlet lines in Building 190-B. This installation permits supplying sufficient process water to the 190-B Building without operating a steam backup pump in 183-B Building.

By venting the reactor atmosphere gas directly into the tunnel to the 117 Building, airborne contamination was materially reduced while process tube and VSR channel work were being performed.

D-DR REACTOR OPERATION

D Reactor experienced three shutdowns all of which were due to failure of fuel elements. DR Reactor experienced two shutdowns. Both outages were initiated by failure of fuel elements. The second outage occurred on February 14 and was continuing at month's end as a scheduled outage for replacement of process tubes. Five of the six fuel element failures detected during February at D and DR Reactors had exposures exceeding the normal metal exposure goal because of the unclassified plutonium program; the other was an enriched fuel element.

An electrical power surge on the BPA system was noted on February 15, but was of insufficient magnitude to cause interruption of electrically operated equipment.

During the February 14 shutdown at DR Reactor, all vertical safety rods reached at least a 90 per cent insertion in 2.5 seconds. This represents an improvement in vertical rod drop time, but operation under a Process Change Authorization is still necessary. The removal of the DR Reactor rear face tool dolly facility was completed in February.

The replacement of front caps on spline tubes at D Reactor with caps having modified spline seals (Design Change 657) was completed. The new seals are designed to reduce water leakage. At D and DR Reactors, modification of the gas system oxygen analyzer (Design Change 620) was completed. This change provides greater sensitivity to oxygen and thus improves the ability to detect and monitor air leakage into the reactors. At DR Reactor, an Analog to Digital Converter was installed in the process tube exit water temperature monitoring system to achieve faster and more accurate monitoring and reduced maintenance.

F REACTOR OPERATION

Production during February was limited by one scheduled outage during which 145 tubes were probologged; none was found that required immediate replacement.

Water collection from the reactor by the dryers in 115 Building remained between one and two gallons per day after equilibrium levels were reached.

Alum feed rates had to be increased to 25 ppm because of a high raw water turbidity which reached a maximum of approximately 200 ppm on February 7. Production Test IP-549-A, specifying a reduced alum feed of six ppm to the west half of the 183-F Building filter plant, was affected by this occurrence but a feed rate of six ppm was re-established on February 17.

Results of a routine inspection of the confinement filters in the 117 Building indicated water damage to the lower two rows of filters in Cell A. A total of 16 filters was replaced without difficulty and procedures have been modified to prevent a recurrence. Inspection of filters in other cells indicated that they were in satisfactory condition.

Eight Panellit gauges were replaced and 114 were adjusted. Panellit row relay and high-low trip decks were made on each panel. The malfunction of the power calculator system was corrected by installing new tubes.

The major electrical and mechanical activities included tests on the safety circuit relays, the A and B horizontal control rod electrical system, the Ball 3X System and the vertical and horizontal rod systems. The vertical safety rod clutches on No. 27 and No. 28 winches were overhauled. It was necessary to replace worn brushes and slip rings on the motors in the 190 Building. Special efforts to reduce gas losses were beneficial.

H REACTOR OPERATION

Production was interrupted by an outage to discharge a ruptured fuel element and again briefly during non-equilibrium operation following startup because of activation of an electrical power loss relay at the 190 Building. Recording instrumentation indicated an instantaneous fluctuation in total consumed power, apparently due to a local condition. The subject remained under investigation at month's end.

Reduced power levels with the E-N demonstration load were required until achievement of the low reactivity turnaround because of effects of Sm^{149} . Subsequent equilibrium operations continued at levels approximately one per cent below normal because of reduced total reactor flow and higher graphite temperatures. Control characteristics of the reactor with the E-N load were excellent.

Vertical safety rod Number 22 was removed from service because of an obstruction in its graphite channel. Corrective action was deferred until outage time is available.

Helium control efforts included the installation of a new balancing sensing unit in the oxygen analyzer of the 105 Building. Installation was made by a representative of the Beckman Instrument Company. In other control efforts, eight front face gunbarrel bellows were sealed with unicellular silicone compounds and five thermal loop bellows were sealed with a neoprene binder and silicone type cement.

A control station for removal of non-radioactive poison splines was installed on the "C" work platform in accordance with Design Change Number 634. The change will expedite the removal of splines not requiring removal by remote means.

KE-KW REACTOR OPERATION

KE Reactor experienced nine outages. Those which resulted in significant outage time were: one caused by a defective spline cap seal, one due to a defective spline, one due to failure of a fuel element and one caused by a defective vertical safety rod latch assembly. In addition, a manual shut-down was experienced because of insufficient control rod at turnaround and a scram occurred due to a 1706-KER instrument panel failure caused by a loose terminal connection in the main instrument power disconnect box.

KW Reactor outages included an unscheduled outage in progress at the start of the month, an extended outage for process tube replacement and metal processing, and a brief outage to correct a defective resistance temperature device.

A total of 56 new smooth bore zirconium tubes was installed at KW Reactor during the extended tube replacement outage. Zirconium tube installation work included overboring of tube channels and replacement of front and rear bellows type gas seals, nozzle flange retaining rings and nozzles. New grooves were cut in the front gunbarrels and new nozzle flanges were installed to accept enlarged retaining rings. All rear adapter O-ring seals were also replaced as a part of a program to reduce water leaks.

The sleeved channel of Horizontal Control Rod No. 17 at KE Reactor was bore-scoped. Results indicated that some rubbing has occurred; however, the recently installed graphite sleeves were intact and there were no obstructions in the channel.

An Inconel-sheathed Geminol front-to-rear graphite stringer was installed in process tube channel 4371 at KW Reactor. In addition to providing graphite temperature information, moisture and gas composition data can be obtained in support of graphite burnout studies.

A new Geminol-sheathed stringer was installed in RS-2 at KE Reactor in place of a beaded iron-constantan stringer.

The heating system in the new laboratory addition to the 1706-KER facility was connected to the area ethylene glycol system.

APPLIED REACTOR ENGINEERING

MAINTENANCE PRACTICES OPERATION

The inventory of aluminum process tubes is adequate for the balance of CY 1963. A breakdown of this inventory, including tubes on hand and in transit, is 5473 of the B-D-F type, 667 of the C type and 2319 of the K type.

A total of 3787 aluminum process tubes has been dimensionally checked. The reject rate has dropped to zero and the fringe tube classification has decreased twelvefold.

SPECIAL OUTAGE SERVICE OPERATION

Fifty-six aluminum process tubes were replaced at KW Reactor with zirconium smooth bore tubes as authorized by Production Test IP-565-AM. The newly designed gunbarrel regroover and zirconium tube Van Stoner performed satisfactorily.

A vacuum probe device used to remove water trapped in the distorted section of a process tube is now being used routinely prior to the tube splitting operation. Volumetric checks show that an average of 1.75 gallons of water per tube is being removed and thereby prevented from wetting the moderator. A second benefit resulting from the use of this device is that it permits the boring to be done in dry graphite. Also, the problem of plugged vacuum systems has been minimized and the average personnel dose rate for boring has been reduced from 40 mr/hr to 20 mr/hr.

MAINTENANCE ENGINEERING OPERATIONS

All safety rods in both KE and KW Reactors dropped within the prescribed time during the last rod drops. No trouble with limit or pressure switches was encountered.

New uptake damper controls were installed on Nos. 1 and 4 boilers at the 184-H Building. This has resulted in improved boiler control.

OC Schroeder:DLD:ng

Manager, Manufacturing

MANUFACTURINGPRODUCTION FUELSCurrent Month's Production

	NATURAL					ENRICHED					Total
	C	K	Reg.	Bumper	K5S	C	K	Reg.	Bumper	K5ES	
Acceptable Fuel Elements (Tons)	71.2	174.7	239.3	4.4	24.6	21.2	16.4	7.4	37.8	0	597
Per cent of Forecast	140	170	84	13	46	-	82	-	99	-	100

Manufacturing Yield

Current Month Per cent	91	89	88	-	64	91	85	88	85	-	
Forecast Per cent	90	90	90	85	55	90	90	90	85	55	
Previous Month Per cent	90	87	88	-	71	91	90	91	81	-	

Bare Uranium
Available for
Processing
(Tons)

1047

Finished Products
in Storage
(Tons)

1182

Work in Process
(Tons)

251

Special Products
Finished (Pieces) 4" Li-Al - 2161

Uranium Utilization
Per cent

98.1

Fuel Recovery

8" I&E (Pieces) 10,097
6" Enriched (Pieces) 14,060
6" Watermix (Pieces) 1,183

MANUFACTURINGProduction

Yields and efficiency for February were as follows:

	<u>February</u>	<u>Forecast</u>	<u>Variance</u>
Eight-inch I&E	89	90%	-1.0%
Six-inch I&E	90	90%	--
Operating Efficiency	98.9	96%	+2.9%

Projection elements produced during February totaled 38 tons of six-inch material and 33 tons of eight-inch fuel. The yield on the six-inch material was 85 per cent and 64 per cent on the eight-inch. The welding yield on this fuel was 94 and 87 per cent respectively.

Production for February and to date is as follows:

	<u>February 1963</u>		<u>Nov. 1960 to Date</u>	
	<u>Natural</u>	<u>Enriched</u>	<u>Natural</u>	<u>Enriched</u>
Tons Produced	33	38	1883	1010
Tons Finished Inventory	85	138	--	--

A total of 191 canning line shifts were operated during the month. The total includes one canning line operated on Saturday, February 9, 1963, to produce K5NS elements with varying rail heights for test loading in zirconium tubes at KW Reactor.

A total of 2161 lithium-aluminum four-inch elements was produced and placed in storage during the month.

Scrap

Two shipments of scrap were made during February, totaling 15 tons of natural and 15 tons of enriched metal. Two shipments of 840 empty boxes with lids were also made.

Canning Line Operation

Production through the AlSi Shop was at the rate of ten (10) canning lines per day during February. The Shop intends to reduce canning to a nine (9) line operation effective March 4, 1963. The people made available by this reduction will be used for sizing of K5 and C5 self-support elements and to provide manpower for the elliptical bumper program.

Reject Rates

The facing reject rate increased slightly during the month. The primary

cause of this increase being tool breakage or other equipment malfunction coupled with the automatic loader feature. Since these machines are not constantly attended by an operator, it is possible for several rejects to occur before being noted and the lathe shut down.

Welding rejects have been reduced on the semi-automatic welders by the installation of a toggle switch to control the flow of the argon gas for purging. By allowing the argon to flow through breaks and lunch periods, condensate does not collect in the welding head. Experience in the past has shown porous welds occurring as a result of the condensate collection.

Marred surface rejects increased principally as a result of excessive handling necessitated by numerous model changes.

New Sleeve Cleaning

Production Work Request #9 was written to investigate the cleaning of new sleeves by ultrasonic cleaning rather than rotary brushing. Results show better cleaning and a saving in time and labor. Twenty-eight sleeves can be cleaned at a time using the ultrasonic method whereas rotary brushing required individual handling of the sleeves.

Cleaning of the Trichlorethylene Still

The trichlorethylene still used in connection with the cleaning of spires and cans was cleaned using soda ash on a trial basis. Results of the soda ash cleaning were satisfactory. The prior method of disassembling the still and cleaning on Saturday will be discontinued as the soda ash method allows on-shift cleaning with no disruption to operations.

Ajax Furnaces

AlSi slag and chips falling into the core cavities of the Ajax Furnaces in the past have caused damage to the core or the coil, and in some cases both. Sheet metal enclosures have been installed on all furnaces to prevent this type of damage.

Renovation of the canning furnaces continues with only one furnace remaining that has not been rebuilt. The others in service were rebuilt in 1960, 1961, 1962, and 1963.

Testers (Bare Core)

The UT-2 testers have operated with an availability of 97.7 per cent for the month. Electronic modifications on all UT-2 testers were completed this month so that all of them are compatible electronically.

The UT-4 (end closure) testers have operated with an availability of 87.2 per cent for the month. The Bond and Penetration testers (UE-1) have operated with an availability of 86.9 per cent for the month. There were no outages on any of the testers of sufficient duration to interrupt continuity of the canning operation.

FUELS ENGINEERINGFUEL PERFORMANCE ANALYSISRupture Experience

A total of 10 I&E fuel elements (9 regular production I&E and 1 test) failed in the reactors during February, 1963.

<u>Fuel Element Type</u>	<u>Tube and Reactor</u>	<u>Exposure (MWD/T)</u>	<u>Rupture Classification</u>	<u>Failure Date</u>	<u>Canning Date</u>
<u>Natural</u>					
Bumper	1475-DR	756	Hole	2/2/63	9/13/62
Bumper	2466-D	927	Hole	2/3/63	6/22/62
Bumper	2079-DR	999	Hole	2/14/63	8/6/62
Bumper	0682-D	878	Side Other	2/19/63	8/7/62
Bumper	2759-D	1030	Hole	2/26/63	8/8/62
Self-Support	3584-C	738	Comp. Cleavage	2/10/63	3/22/62
<u>Enriched</u>					
Bumper	1362-DR	963	Hole	2/2/63	6/8/62
Bumper	3457-H	84	Mech. Damage	2/9/63	11/20/62
Non-Bumper	4065-KE	589	Side Hot Spot	2/6/63	10/15/62
Non-Bumper	4272-C	625	Side Hot Spot	2/24/63	10/26/62

There were no unusual rupture trends indicated by the past month's experience. Failures that are believed to be caused by non-uniform corrosion comprised the majority of ruptures, as has been the case for the past seven or eight months. One rupture was in C5NS (self-supported) material. It was a compound (longitudinal and transverse) cleavage failure.

K5 Support Upsizing

A series of tests has been performed to evaluate the possibility of recovering K5NS fuel elements rejected for minimum rail height of less than 92 mils. The following conclusions have been reached from evaluation of test data:

- 1) A substantial proportion of the reject rails can be recovered by a closely controlled "upsizing and downsizing" process.
- 2) The recovered rails can be expected to perform equivalent to non-upsized material with respect to deflection vs. load provided that a major amount of the "upsizing" is taken back in "downsizing" to the required acceptable range. The ratio of mils downsized over mils upsized should exceed approximately 0.70, based on test data.
- 3) The recovery process would consist of upsizing all reject rails to a given height, and downsizing by application of a fixed load.

Uranium Technology

Vacuum Outgassing of Uranium Cores

Vacuum outgassing of uranium cores at NLO has been discontinued for an indefinite period of time. The observation that the internal diameter of the outgassed cores showed degrees of oxidation prompted this action.

Feed Site Data

EDPO personnel have completed the program for routinely summarizing analytical, yield, and dimensional data from the feed sites. It is anticipated that this system will greatly reduce the problems presently associated with accountability and receiving inspection. This will also greatly enhance the ability to analyze these data and identify problem areas which need improvement. The system will be fully operational in approximately six weeks.

Bumper Fuel

The irradiation status of bumper fuel elements in the old reactors is as follows:

	<u>Total Charged</u> (Tons)	<u>Total Discharged</u> (Tons)	<u>No. of</u> <u>Ruptures</u>
Natural 8" Bumper	1545	1230	33
Enriched 6" Bumper	862	643	*37

*Includes 15 ruptures in first H reactor E-N load and one mechanical damage failure in current loading.

Although the over-all performance of bumper fuel has been adversely affected by an increased incidence of "side other" and "hole" failures, largely attributed to ledge and groove corrosion, none of the failures experienced to date have been of the "hot spot" type bumper fuel was designed to prevent.

Self-Supported Fuel

The irradiation status of overbore and regular self-supported fuel in the C reactor test facilities is as follows:

	<u>Total Pieces</u> <u>In Reactor</u>	<u>Total Pieces</u> <u>Discharged</u>	<u>*Side</u> <u>Other</u>	<u>Core</u> <u>Split</u>
Overbore C6N	1386	4,832	2	**5
Regular C4NS and C5NS)	2208	14,936	1	1

*Cladding corrosion failures caused by broken or damaged projection rails.

**Includes three ingot core failures in a single column associated with a temperature cycling incident and two dingot cores in separate columns.

Because of the manufacturing problems experienced in conforming with the specified minimum rail height and projected diameter of self-supported fuel elements, ten columns of K5NS fuel elements were prepared and charged in KW reactor this period under a production test (PT-IP-572-A). This test is designed to evaluate both the effects of reducing projection rail height uniformly across the column and in local high temperature position on annular coolant flow temperature and corrosion. The currently specified minimum rail height is based on laboratory data and limited in-reactor measurements.

ALSI PROCESS DEVELOPMENT

Fabrication of enriched fuel elements for the second loading of the E-N reactor charge has begun. The same process specified for the first load is being used. The non-destructive tester data sampling system is functioning as expected and should allow a reasonable separation of material.

Investigation into the fuel quality of the C6NS overbore fuel indicates two basic problems. The most current and serious are the can and cap non-wetting conditions. This condition aggravates the second problem--voids and shrinkage cavities in the cap braze. The wetting problems are associated with the C6NS model and are not pilot plant oriented. Evaluation of all phases of development testing is not complete.

The fuel core geometry for the prototypical increased length enriched fuel element has been established. Component design for a nominal core length of 10.378 inches is complete.

During the reporting period, a total of 8,461 fuel elements was fabricated in the 306 Pilot Plant. Of these, 7,885 were production items (O5N and C6N).

ALTERNATE PROCESS DEVELOPMENT

Sylcor Hot Press

The fabrication of the C4E enriched (.94%) hot press fuel elements at Sylcor under contract DDR 149 has been completed. The initial shipment is expected to arrive at HAP0 about March 1, 1963. The fabrication of ALSi bonded control elements for an in-reactor production test is being scheduled.

Hot-Die Sizing

A test was completed to evaluate the effect of a more sophisticated control of the inert gas shield during assembly and sizing operation.

It had been previously determined that the oxidation of the nickel plate in the closure zone was resulting in non-uniform diffusion bonding in the subsequent end bonding operation. A technique was devised whereby the assembly was placed in a vacuum bell jar and pumped down; the chamber was then back-filled with argon. The fuel assembly was then essentially completely and reliably purged with argon. An 18% increase in bond strength resulted.

The cap and base end of the hot-die sized fuel elements has been successfully end bonded using differential thermal expansion dies. This end bonding was accomplished without can-wall upsetting and bond deterioration experienced in the first two end bonding tests. The following process conditions have been determined to be within a range which will produce good end bonding:

Pressure	3.0, 4.0 and 5.0 T/in. ²
Die Temperature	610, 640 and 670°C
Pressing Time*	2.5, 3.5 and 4.5 min.

*Sized pieces fitted with end caps are pre-heated to 400°C by heating for 5 minutes in a 680°C furnace.

Electroplating Nickel on Uranium

Plating laboratory process studies were aimed at improving the reliability of the cleaning and etching processes employed for the bare uranium. Investigations included evaluation of a new nitric acid electrolytic etch and further studies of the phosphoric-hydrochloric acid electrolytic etch.

The nitric acid electrolytic etch appears to be a highly attractive simplification of uranium pretreatment, since the etching bath is merely dilute nitric acid and a clean, etched surface is produced. Thus, no treatment is required between etching and plating other than water rinsing. Preliminary beaker-scale studies indicated good nickel continuity was obtained and the etched uranium surface was highly active. So far, attempts to reproduce these results on the manual plating line have been unsuccessful.

Studies of the presently used phosphoric-hydrochloric etch were made to improve the uniformity of etching. Periodically, the normally micro-roughened etched surface is studded with relatively smooth plateaus up to 7 mils in diameter and encompassing up to approximately 50% of the surface area on some sections of the fuel element. Machining marks were still evident on these plateaus when observed at 40X magnifications. The etching bath current density, time, and chemical composition was varied over a wide range of conditions. At normal current density, both increased time and increased chloride appeared promising in producing a more uniform etch. The increased time was adopted as the most reliable for current plating work. Good nickel

adhesion was confirmed by bond strength data on seven (7) fuel elements. The bond strength averaged more than 1,000 pounds with minimum of 740 and maximum of 1370 on 0.194 inch studs.

EQUIPMENT AND DESIGN DEVELOPMENT

K5N Self-Support Program

During February, work was initiated on two techniques to fabricate an improved and stronger "T" section K5 support design. The first technique was for aluminum X-8001 drawn alloy wire in the "T" section shape and furnished in rolls, which could be reworked in a die to form a "T" section support. The second technique was to fabricate "T" section supports from aluminum X-8001 alloy from sheet stock. This concept involves a multiple station forging type die arrangement. Test tooling should be complete by the first of March and small samples of the "T" section rail will be available for evaluation during the first week of March.

Two minimum rail height gauges were completed during this period and one additional unit is in fabrication. Three sizing presses were fabricated and two lines for sizing and measuring rail heights have been set up. Several experimental sizing devices were designed and are currently being evaluated. The mechanical portion of the prototype production size machine to handle production quantities automatically is being released to shops for fabrication at this time. Experience to date on the K5 program indicates that initial yields in the 80 to 90% range can be expected through controlling the minimum rail reject in the sizing operation.

C5 and C6 Supports

Both the C5 and C6 fuel supports have been redesigned during this period, and in the future sizing down will be required as is currently being done on the three-dimple and two-dimple K5 support.

Autoclave Basket Liners

A mandrel and punch were designed and fabricated to form supporting ridges on autoclave basket tubes. The first 30 tubes produced appear good enough to warrant a larger test. The ridged tubes are designed to protect the self-support rails during autoclaving.

QUALITY CONTROL

Yield Control

	<u>January Yield</u>	<u>February Yield</u>
8-inch I&E normal	88.7	88.9
6-inch I&E enriched	90.8	90.0
8-inch I&E bumpered	71.0	60.5
6-inch I&E bumpered	81.3	85.1

There was an increase in the 6-inch bumpered yield for February due to a decrease in the O3E rail weld reject rate, pinhole rejects, and in the AlSi slop reject rate.

The 8-inch bumpered yield is down due to increased production of C5 and K5 self-support elements. The rail weld process is the primary cause of the lowered yield in that the remainder of the process does not vary significantly from other production model fuels.

Hanford Test Reactor

During December, 1962, a procedure was implemented in the 305 Test Reactor for testing three enriched cores at a time instead of one at a time. As forecast at the start of this changed testing procedure, the routine fuel element production testing backlog has been reduced from January's figure of seven days to a normal figure of three days.

The reactivity diH value for all bare fuel element cores tested during the period covered by this report were within reactivity limits.

Approximately 20 per cent of the over-all reactor operating time was made available and utilized for special testing purposes. These were as follows:

1. SWR 730 - Measured the nuclear absorption cross section of a sample of Alconex cleaning compound for NPR Fuels Engineering, NRD.
2. Measured diH value of aluminum tube filled with samarium balls for Facilities Engineering, IPD.
3. SWR 731 - Measured diH of 130 splines for Facilities Engineering Operation, IPD.
4. SWR 732 - Measured diH of six K-size bars of graphite for Nonmetallics Development, Hanford Laboratories.

Lathe Audit

An analysis of the raw data from a lathe depth-of-cut audit for the two-month period (November 10, 1962 through January 12, 1963) has been completed. The results show that the indicated residual end cover, as determined by the

depth-of-cut measurements and also by physical measurements of the residual end cover as measured by the Finishing technicians, is well within the specification limit of 250 mils minimum. This audit indicated that an end-cover decrease of 0.040 inches would still result in maintaining specified minimum end cover.

Component Preparation Rejects

The over-all average AlSi sloop defective rate for January, 1963, was 1.0 per cent as compared to 2.2 per cent for the year 1962. This decrease is attributed to the coating of the AlSi groove region with Diversey PX-1288. The primary cause of component preparation rejects at canning is now due to stuck sleeves. Further effort in the direction of reducing the number of these rejects is planned by the implementation of Process Work Request No. 114 (1962) which provides for alterations in the concentrations of the soap and/or sodium aluminate solutions in the sleeve cleaning machines.

Self-Support Fuel Elements

Difficulty has been experienced in meeting the specifications regarding the minimum support height and maximum circumscribed circle diameter. The problem in meeting the required process capabilities has resulted from height distortion caused by welding, handling, and possibly autoclaving and, in the case of the K5N and K5E, failure to fabricate the supports to the necessary tolerances. The following items are presently in progress in an attempt to reduce the distortion:

- 1) Maintaining a support height control chart for detecting welder-caused changes in height and attempting remedial action where indicated.
- 2) Installing corrugated autoclave basket liners which are designed to prevent support height damage due to loading, unloading, or chattering during autoclaving.
- 3) A redesign of shipping pallets to prevent support height damage due to loading, transporting, or unloading.
- 4) A redesign of the support to obtain greater strength.

A preliminary test of 20 newly-designed autoclave basket liners has indicated an improvement over the old type. On this basis, 360 additional liners have been ordered for further testing.

About 160 of the newly-designed supports should be available in about two weeks for dimensional tests and preliminary testing for dimensional stability during welding. Test quantities are not expected until about April 1, 1963.

PLANT FACILITIES

Status of Active Construction Projects

CAF-954 - High Pressure Autoclave Development Facility

Further delays in customer approval of the design criteria have been experienced with the result that issuance to the Commission for approval has been rescheduled for March, 1963.

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

Preparation of the design criteria is underway and is scheduled for issuance during March, 1963.

CAF-973 - Steam Distribution Line Modifications - 300 Area

The design criteria was approved by the AEC February 1, 1963. Negotiations are currently underway between the AEC and an Architect-Engineer for the performance of detail design.

CGF-979 - Pilot Scale Plating Equipment - 300 Area

Further fund authorization from the AEC is being delayed pending receipt from GE of further evidence of technical feasibility in lieu of irradiation experience. This has been requested by the local AEC for transmittal to AEC authorities in Washington, D. C.

CAF-980 - Boiler Replacement for Additional Steam Generating Capacity - 384 Building - 300 Area

The revised project proposal has been prepared and is being routed for appropriate General Electric approvals. Major revisions involve the change to oil as a primary fuel and flexibility to allow for gas as a future backup fuel. It is anticipated that this revised proposal will be transmitted to the AEC during March, 1963.

CAI-994 - Utilities Extension - 300 Area

The project proposal was approved by the HAPQ General Manager on February 21, 1963, and forwarded to the local AEC on the same day. It is anticipated that this project will be reviewed by the Review Board on March 7, 1963.

Plant Conditions, Incidents and Improvements

AlSi Shop

Automatic Welders - Review of the requisition and bids for the automatic welders to weld the canning components for fuel elements has been completed by the AEC and the order is expected to be placed by March 1, 1963. Installation is scheduled for June, 1963.

Utilities

<u>Statistics</u>	<u>February</u>	<u>January</u>
Average steam generated (M lbs/hr)	97	106
Maximum steam generated (M lbs/hr)	155	174
Total steam generated (M lbs)	72,557	78,496
Total condensate return (M lbs)	29,643	33,366
Coal consumed (tons)	3,438.1	3,730.7
Evaporation rate	10.49	10.52
Efficiency - Actual	71.5%	71.2%
Efficiency - Optimum	74.6%	74.8%
No. of Boilers on: 3 4 3 2		
Date of Change: 29 3 4		
Sanitary water from 3000 Area (M Gals)	137.8	129.6
Peak water flow - 3000 Area (gpm)	5,500	5,100
Average water flow per month (gpm)	3,088	2,903
Peak water consumed in 24 hours	5.0	5.0
Compressed air production (scfm)	53,247	53,549

Installation of the motor control center in the 384 Building is 60 percent complete with completion scheduled for April 19, 1963.

Review of the purchase requisition for the emergency generator was completed by the AEC and released to Purchasing on February 11, 1963. Minor revisions were made to the specifications. It was evidently determined that the cabin enclosure around the generator did not constitute a structure.

Craft Training

A total of 202 manhours of training was given during the period of January 20, 1963, through February 20, 1963. A course on transistors is scheduled to start February 27, 1963. The course in refrigeration is being held in abeyance pending determination of how this work will be performed in the 300 Area in the future.

Janitorial Service

Due to the spilling of contaminated material in the 325 Building, extensive janitorial work was required following decontamination procedures.

Duplicating

The volume of work in the duplicating function greatly increased over that experienced during the previous two months.

Craft Services

The current backlog of craft work has increased from the previous month.

The immediate need for fuel element pallets for the K5 fuel elements will

delay some lower priority work.

The new fuse panel for the civil defense alarm system in the 300 Area permits more rapid detection and isolation of trouble.

J R Carrell
acting Manager - Production Fuels

WN MOBLEY:PGR

RESEARCH AND ENGINEERINGPROCESS AND REACTOR DEVELOPMENTREACTOR FUELSProjection Fuels

Two columns of KVNS fuel elements were discharged from KW Reactor on 2-16-63 at an average exposure of 565 MWD/T. Ten columns of KVNS fuel elements with definite support heights were charged into KW Reactor on 2-16-63 under production test IP-572-A. This test is designed to evaluate the effect of support height on KVNS fuel behavior under irradiation.

A fuel element failure was sustained on 2-10-63 in a smooth-bore zirconium tube in C Reactor charged with CVNS elements. The average tube exposure at the time of failure was 738 MWD/T and the failure mechanism was a longitudinal core cleavage.

Overbore Fuel

Seventeen central zone overbore fuel columns were discharged from C Reactor during the 2-4-63 outage. Included in the discharge were four conversion ratio columns which had an average tube exposure of 760 MWD/T.

REACTOR ENGINEERINGZircaloy-2 Process Tubes

Production Test IP-565-AM, "Installation of Zirconium Process Tubes at KW Reactor", authorized a pilot zirconium tube installation at KW Reactor. A total of 56 zirconium tubes were installed in a random pattern above row 20.

Corrosion

The early spring thaw occurring about 2-5-63 required exceptionally high alum feed rates for a short period to produce reactor quality water at F Reactor. The feed rates exceeded 18 ppm for about 48 hours (up to 25 ppm) and 10 ppm for another five days. This event had the effect of delaying the low alum test starting date by about one month.

REACTOR PHYSICSZirconium Tubed K Reactors

Latest physics calculations indicate that the retubing and refueling of the K Reactors with zirconium tubes and KV fuel will result in a reactivity gain of between 0.6 and 0.7 per cent $\Delta k/k$. The reactivity gain is quite constant over the reactors' temperature and operating ranges; that is, the exposure and dependent effects will not be appreciably different than at present with

STATUS REPORT OF PRODUCTION TESTS

<u>Test No.</u>	<u>Type Metal</u>	<u>Tubes</u>	<u>Reactor</u>	<u>Goal Exposure</u>	<u>Current Exposure</u>	<u>Remarks</u>
IP-216-A	Normal prod. natural & enriched fuel elements	50	All	Normal variable goal		Provides for monitoring the performance of a sample of all normal production material to assist in development of a Quality Index for production fuel. Test is continuous.
IP-272-A	I&E self-supported fuel	69	C	Variable +200		Provides for testing of CIVN geometry fuel in C Reactor ribless zirconium tubes.
IP-381-A & IP-431-A	I&E self-supported fuel overbore size	62	C	800 MWD/T		Provides preliminary qualitative data regarding irradiation behavior of larger fuel element designs.
IP-409-A	I&E self-supported fuel	2	KW	800 MWD/T	50 MWD/T	Provide qualitative data to confirm the fuel geometry design. Two columns discharged on 2-9-63.
IP-423-A	Oil-quenched natural uranium I&E fuel elements	150	F	Variable		Provide a comparison of dimensional stability of standard water-quenched uranium fuel cores and oil-quenched cores.
IP-572-A	I&E self-supported fuel	10	KW	Variable	50 MWD/T	Evaluation on temperature distribution of eccentric placement of fuel elements in smooth process tubes.

the KIV fuel geometry and aluminum process tubes. The effect of this reactivity gain will mean that some of the spike E-columns in the K Reactors can be replaced with natural uranium. The reactivity gain upon loss of coolant in the KV lattice is calculated to be less by 0.5 per cent $\Delta k/k$ in the cold reactor and 0.35 per cent $\Delta k/k$ in the hot reactor. Thus, the new K lattice will be more fail-safe upon loss of coolant than the present lattice.

Effective Delayed Neutron Fractions

As part of the information being collected for the Hazard Summary Reports, the delayed neutron fractions for the present reactors have been calculated from the most recent data. The total delayed fractions are listed below for several cases.

<u>Fuel Exposure</u>	<u>Delayed Neutron Fraction</u>	
	<u>OIIIN Fuel</u>	<u>KIVN Fuel</u>
0 MWD/T	0.00695	0.00691
200 MWD/T	0.00666	0.00658
400 MWD/T	0.00642	0.00632
600 MWD/T	0.00621	0.00606
800 MWD/T	0.00603	0.00590
1000 MWD/T	0.00588	0.00574

RADIOLOGICAL ENGINEERING

Radiation Control Experience

The following table summarizes the radiation exposure experience of critical IPD classifications through the first four weeks of the 1963 badge year:

<u>Classification</u>	<u>Total Dose</u>	<u>No. of Employ- ees</u>	<u>Average Dose/ Employee</u>	<u>Extrapolated Year End Average</u>	<u>No. of Employ- ees over 3r Extrapolated Exposure</u>
Radiation Monitors	20545 mr	80	257 mr	3335 mr	46
Processing Operators	54674	267	205	2660	113
Pipefitters	23254	129	180	2341	31
Millwrights	21577	101	214	2774	32

Lapse of Radiation ControlDistribution by Reactor and Component

	<u>B</u>	<u>C</u>	<u>D</u>	<u>DR</u>	<u>F</u>	<u>H</u>	<u>KE</u>	<u>KW</u>	<u>IPD Totals</u>
Processing	0	1	1	0	0	1	0	1	4
Maintenance	0	0	0	0	0	0	0	2	2
Supplemental Crews	0	0	0	0	0	0	0	0	0
Applied Reactor Engr.	1	0	0	0	0	1	0	0	2
Research and Engr.	0	0	0	0	0	0	0	0	0
Facilities Engr.	0	0	0	0	0	0	0	0	0
Central Maintenance	0	0	0	0	0	0	0	0	0
Reactor Areas	0	0	0	0	0	1	0	0	1
Assigned Totals	1	1	1	0	0	3	0	3	9
IPD General						1			1

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

Effluent Activity Data

The table below shows average reported concentrations of selected radionuclides from reactor effluent samples taken during January, 1963. All units are 10⁻¹² curies/ml.

<u>Reactor</u>	<u>P32</u>	<u>As76</u>	<u>Zn65</u>	<u>Np239</u>	<u>Cr51</u>
B	4.0	44	8	75	160
C	3.9	34	11	60	265
D	6.5	52	15	80	205
DR	4.5	65	19	135	325
F	6.4	55	12	100	245
H	6.9	37	No	Valid	Samples
KE	12.3	39	26	115	285
KW	6.9	38	12	60	250

The nominal high alum feed rate (18 ppm) was continued in treating water in all areas, except at 100-F where under a production test starting on the 17th of January, alum was added to the far side coolant at one-third the nominal rate.

PROCESS TECHNOLOGYREACTOR POWER LEVEL LIMITATIONS

During this report period, the primary limits to reactor power levels for B, C, DR, and F Reactors has been tube outlet temperature limits to control tube corrosion. D and H Reactors' power levels have been restricted by bulk outlet temperature limits. Power levels at the K Reactors are currently restricted by the AEC administrative limits.

PROCESS STANDARDSHW-46000 B, Process Standards - Reactor

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

Process Standard C-040 - "Graphite Temperature Limits"

The revision provided thermocouple stringer graphite temperature limits for C Reactor. A specification was added which prohibits the use of poison splines or poison columns adjacent to graphite stringer columns, and tube power limitations for charges adjacent to an uncooled process tube were substituted for the previously specified fixed temperature limit.

Process Standard C-140 - "Speed-of-Control Criterion"

The standard was revised to present new power level limit curves as a function of VSR insertion speed and metal exposure. Included in the standard were: VSR serviceability requirements, testing frequency, and approved VSR replacement drawing numbers.

HW-46000 D, Process Standards - Reactor

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

Process Standard C-040 - "Graphite Temperature Limits"

Revisions to this standard were essentially identical to those for HW-46000 D, above.

Process Standard F-010 - "Process Material"

The standard contains specifications on fuel elements, dummies, poison materials, and decontaminating agents. The standard was completely rewritten. A new chemical decontaminating agent was added and a previously used agent deleted. Print numbers on other materials were updated.

HW-46000 F, Process Standards - Reactor

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

Process Standard C-040 - "Graphite Temperature Limits"

Process Standard C-140 - "Speed-of-Control Criterion"

Revisions to the above two standards were essentially identical to those for HW-46000 B, above.

Process Standard H-010 - "Storage and Handling of Unirradiated Enriched U-235 Slugs"

The standard was completely rewritten. Basic changes were: A new section for transporting enriched slugs between the 100 Areas or to the 300 Area. The storage limit for 0.96 per cent enriched slugs was changed from a number limit to a density limit and limits for storage of enriched slugs up to 5 per cent U-235 were added.

HW-46000 H, Process Standards - Reactor

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

Process Standard C-040 - "Graphite Temperature Limits"

Process Standard H-010 - "Storage and Handling of Unirradiated Enriched U-235 Slugs"

Revisions to these standards were essentially identical to those for HW-46000 H, above.

Process Standard C-060 - "Vertical Rod Withdrawal"

Permissive bypassing of the LXX trip function of the seismoscope during cold startup was deleted from the standard.

HW-46000 K, Process Standards - Reactor

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

Process Standard A-020 - "Tube Outlet Water Temperature Limits - Trip After Instability"

The revision provided specifications for exit coolant temperature limits for smooth-bore process tubes.

Process Standard C-140 - "Speed-of-Control Criterion"

Revisions to this standard were essentially identical to those for HW-46000 B, above.

HW-27155 Rev1, Process Standards - Water Plant

Two revised standards were issued for this manual during the month. These were:

Process Standard 190-B-040 - "Reserve Process Water Storage"

The revision incorporated revised water storage requirements to provide for expected reactor flow increases. The bases for calculating required water storage requirements were changed to allow a 10 C higher ΔT rise across the reactor.

Process Standard 190-B-090 - "Emergency Water Requirements - K Water Plants"

This revision specified a minimum value for air pressure used to start the emergency diesels at the K Reactors.

HW-41000 - "Process Equipment Standards"

This manual was revised to delete one standard. The standard was D-020 - "Properties of Vertical Rods." Portions of this standard deemed pertinent to reactor life and safety were transferred to Process Standards - Reactor, HW-46000 series.

PROCESS CHANGE AUTHORIZATIONS

Six Process Change Authorizations were issued during the report period to permit temporary deviation from Process Standards - Reactor, HW-46000. These were:

PCA #3-7 - "Ball 3X Automatic Trip Settings - K Reactors"

The process change provided ball 3X water pressure trip settings compatible with the process water pumping characteristics which were altered under Project CG-883.

PCA #3-8 - "High Tank Level Reduction During Operation - F Reactor"

The standard requires the high tanks to be maintained within three feet of full level. To determine the elevation of the raw water Grove valve sensing line in the tank, the PCA authorized dropping the level of one tank at a time to not less than six feet of full level. Maximum high tank water temperature and reactor power level limits were specified in the process change.

PCA #3-9 - "Water Leak - C Reactor"

C Reactor was authorized to continue operation with a water collection rate in excess of the rate permitted by standards. Specifications designed to minimize moderator damage were stated in the process change which expired on February 4, 1963.

PCA #3-10 - "Orsat Gas Analysis Requirement - KW Reactor"

In a program of locating air leaks into the reactor, it was found desirable to remove the Orsat gas analysis instrument from the gas stream. The process change authorized removal of the equipment from service provided both the O₂ analyzer and the gas chromatograph were in service and provided Orsat analyses

would be made if either of the above instruments became unserviceable.

PCA #3-11 - "Bottom Thermal Shield Backup - KW Reactor"

The PCA extended the provisions of PCA #2-154, which authorized the use of service water coolant to the bottom thermal shield in place of process water effluent coolant with service water backup. The process change required the low pressure crosstie between the two K Reactors service water systems to be maintained in service.

PCA #3-12 - "Gas Atmosphere - F and H Reactors"

The PCA provides more restrictive limits for O₂ and N₂ concentrations in the reactor gas atmosphere and lowered the normal inlet dewpoint specification from +15 F to -5 F.

MEMORANDUM OF PROCESS STANDARDS RELAXATION

One Memorandum of Process Standards Relaxation was issued during the report period authorizing temporary deviation from Process Standards - Reactor, HW-46000. This was:

Graphite Temperature Limits - H Reactor

Process Standards require that graphite temperatures adjacent to an uncooled process tube be maintained below the melting point of aluminum. A small amount of aluminum tubing remains in channel 2356. Authorization was given by means of this memorandum to exceed the specified graphite limit if necessary to prevent significant production loss. Exceeding graphite temperatures as limited by gas composition, or other factors, was not authorized.

REACTOR AUDITS AND INSPECTION

One engineer audited conformance to Process Standards on all Processing Operations' shifts. Eighteen inspections were made at each reactor during the report period.

RUPTURE EXPERIENCE

<u>Failure Date</u>	<u>Tube Number</u>	<u>Lot Number</u>	<u>Type of Material</u>	<u>Tube Power at Failure (kw)</u>	<u>Exposure MWD/T</u>	<u>Type of Failure</u>
2/2/63	1362-DR	KY-211-D	I&E EB (0.94%)	1005	963	Hole
2/2/63	1475-DR	KZ-493-G	I&E NB	969	756	Hole
2/3/63	2466-D	KZ-416-D	I&E NB	1244	927	Hole
2/6/63	4065-KE	KK-893-A	I&E E (0.94%)	1883	589	Side
						Hot-Spot
2/9/63	3457-H	KY-340-E	I&E EB (0.94%)	1107	84	Mech. Damage

<u>Failure Date</u>	<u>Tube Number</u>	<u>Lot Number</u>	<u>Type of Material</u>	<u>Tube Power at Failure (kw)</u>	<u>Exposure MWD/T</u>	<u>Type of Failure</u>
2/10/63	3584-C	CT-812-D	I&E N ¹	1349	738	Split-Long.
2/14/63	2079-DR	KZ-452-D	I&E NB	1226	999	Hole
2/19/63	0682-D	KZ-455-D	I&E NB	1189	878	Side-Other
2/24/63	4272-C	KC-172-A	I&E E (0.94%)	1370	625	Side Hot-Spot
2/26/63	2759-D	KZ-456-G	I&E NB	1263	1030	Hole

Legend

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

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

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

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

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

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

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

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

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

¹ Production test of internally and externally cooled self-supported fuel elements.

OPERATIONAL PHYSICS OPERATIONPILE PHYSICS ASSISTANCE

Two operational problems of special physics significance occurred during the report period. B Reactor, in starting up from a long tube outage, was limited to a 550 MW turnaround level by the severe flux distortion caused by a large amount of water in the graphite; a cycling tendency was overcome, the flux distribution improved, and normal level was approached during the second day of operation. KE Reactor was shut down due to insufficient control at turnaround; the shutdown can be at least partially attributed to an inability to insert splines into appropriate locations due to a large percentage of "no-go" spline caps. New conservative startup procedures have been temporarily imposed at KE as a result of the latter problem.

In addition, several loading configuration and component modifications during the period will have direct physics implications: A change in the KE equilibrium rod configuration, to the front outboard pattern, was initiated as a measure to reduce maximum graphite temperatures; the third E-N loading in the series was charged into H Reactor; 56 zirconium tubes were installed in KW Reactor as the pilot step in the retubing program; and the third "override core" was charged into B Reactor. No unusual physics problems associated with these changes were observed.

SUMMARY OF OPERATING DATA OF PHYSICS INTEREST
FOR THE MONTH OF FEBRUARY, 1963

Reactor	B	C	D	DR	F	H	KE	KW
ECT in February (1)	-*	1660	1515	1460	1480	1510	2600	2485
12-Month Average ECT	1507	1650	1485	1490	1480	1515	2500	2540
Equil. Scram Time, Minutes (2)	23-27	18-22	18-22	16-20	15-20	25-30	20-25**	25-30**
Recording Period -								
From:	1-24	1-23	1-22	1-22	1-22	1-23	1-22	1-22
To:	2-15	2-16	2-17	2-18	2-15	2-18	2-15	2-15

*Tube-replacement outage - no equilibrium operation during period.

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

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

B Reactor - J. R. Fredsall

A tube replacement outage kept the reactor down during most of the report period. On the subsequent startup of 2-12-63, the reactivity status at critical was approximately 15 mk lower than predicted. Observations in the low power range indicated a large amount of water in the stack. The flux distortion and reactivity shortage allowed a power level of only 550 MW at time of turnaround. A cycling tendency due to the relatively large control manipulations required to compensate for moisture removal was satisfactorily overcome (aided considerably by the exceptionally low residual pile exposure), much of the water in the stack was dissipated, the excess reactivity to be held in control rods approached normal, and a reasonable equilibrium power level was attained. However, persistently high water collection rates eventually led to suspicion of another water leak, calling for another shutdown.

C Reactor - D. W. Constable

Operation was relatively uneventful, except for a fuel element rupture in a zirconium tube. Flattening efficiency was slightly above average, with some credit due to the effective use of "grey" splines (splines of less than 100 per cent neutron absorption properties).

D Reactor - D. G. Albertson

A new operating level record of 2005 MW, plus above-average ECT, made for a successful production period which included relatively few shutdowns. A tube replacement outage is scheduled for March, with accompanying extensive loading changes.

DR Reactor - S. M. Skidmore

Flattening efficiency was generally lower than average during the month, due to a reactivity shortage caused by incomplete enrichment compensation for the several dummy-charged "problem" tubes left for later replacement. Steps have been taken to restore the reactivity to normal; also, the enrichment ring is being revised into a more optimum configuration to improve flattening.

F Reactor - A. W. Medcalf

Otherwise satisfactory operation was adversely affected by the extended presence of full column of poison and the occurrence of a slight flux distribution cycle. The poison, charged for turnaround control, was stuck for 12 days in a PCCF column equipped with an experimental discharge nozzle; the poison and nozzle were removed during the next shutdown. The distribution cycle tendency was effectively compensated over a period of a few days time with the use of splines; operation was continuous during the rest of the report period.

H Reactor - E. L. Conner, Jr.

The third E-N loading was charged into the central zone during the latter part of January; the subsequent startup on 1-30-63 was relatively uneventful, with total reactivity and flattening efficiency being about normal. The over-all temperature coefficient of reactivity for the new load is very close to zero, based upon observations just prior to and just after startup on 2-10-63; the small moderator coefficient effect has made operation of the reactor unusually smooth, since the more rapid negative metal effect tends to result in self-damping of local disturbances.

KE Reactor - L. L. Grumme

Operation was characterized by high flattening efficiency during equilibrium operation, but frequent outages significantly reduced over-all efficiency. A flux distribution cycle developed during startup on 1-27 as a consequence of splining difficulties, augmented by the high exposure of the loading; the cycle was overcome by considerable splining activity (but the reactor was shut down later by a Panellit scram).

Operating difficulties resulting from "no-go" splines have adversely affected startup efficiency; a manual scram due to insufficient rods at turnaround on 2-7-63 was at least partially caused by inability to charge splines as required. Until the mechanical problems are resolved, conservative startup procedures are being imposed.

The equilibrium rod configuration has been changed from a predominantly front "inboard" to a front "outboard" pattern. This configuration change has been effected in order to reduce maximum graphite temperatures; subsequent operation has been reasonably stable.

KW Reactor - R. A. Chitwood

The KW Reactor experienced a long operating interval during the report period with slightly below-average ECT but with desirably low nonequilibrium losses.

During the last outage of the report period, 56 zirconium tubes were installed in the reactor, approximately half the number for which physics plans were prepared. Preliminary estimates of the physics effects of full pile retubing have been catalogued; work is continuing on flattening and total control implications.

The control and safety system was upgraded during the tube-replacement outage by preventive and corrective maintenance on one HCR and five VSR's.

PROCESS PHYSICS STUDIES

Reactor Safety Studies

A study was carried out and is in the rough draft document stage defining the effects on total control of the use of shorter rods and smaller rods in the C Reactor VSR system. The document is intended to define relationships between additional supplementary control requirements and enrichment ring inventory and geometry characteristics.

Work is proceeding on the hazards evaluation of the xenon override loading concept in the older reactors. This study will cover the incremental effects associated with the enriched core loading as they differ from the normal reactor loading.

Accountability Studies

The master tape records for fuel element parameters for the accountability computer program were examined and updated. Product buildup tables for self-supported fuel elements in zirconium tubes have been prepared for insertion into the documented tables (HW-50300). Test runs on the intended normalization have been completed; the net effect of a slight increase in plutonium yield predictions from natural uranium and a slight decrease in expected plutonium yields from enriched uranium will be negligible in terms of total IPD predicted yield. The prediction of Plutonium 240 buildup will be revised slightly upward. A talk was given to CPD Research and Engineering personnel on February 19 on the IPD measurements affecting product accounting and their expected accuracy.

Control Efficiency Studies

The automatic distribution control demonstration system assembled by Instrument and Electrical Development Operation of Facilities Engineering Section has been generally performing well under laboratory test conditions. The first phase of a production test for obtaining useful parametric data prior to the installation of the demonstration system is currently circulating for signature. Work has started on documentation for the second phase of the automatic control distribution test which will call for on-reactor installation of the demonstration system.

Document HW-76101, Advancements in Reactor Control Efficiency - Poison Spline Supplementary System, dated 1-3-63, was issued during the report period; this document summarizes concisely the improvements of operating efficiency achieved through spline usage. A second document, HW-76470, Poison Spline Supplementary System - History and Application, dated 2-5-63, describes in considerably more detail the development, procurement, and application phases of poison spline use.

Operation of the E-N load, charged in the H Reactor in the latter part of January, is proceeding smoothly. Experience during both the startup and subsequent operation has agreed closely with advance reactivity predictions.

Initial experimental use of reduced-strength splines ("grey" splines) has indicated that the desired flattening effects will be achieved by this fine-control measure.

Reactor Fundamentals Training

Four two-hour sessions on reactor operating physics were completed for all of the reactor Specialists and first-line Supervisors during January and February. Each of the four classes was given a total of eight times to permit attendance flexibility on each of the four shifts. An hour-long quiz was given during the fourth session to provide an indication of each person's readiness for the physics portion of the operator certification test.

The material for the three formal lectures given during this series has now been permanently recorded; two of the lectures are recorded on tape and slides, and one is in the form of a sound movie. In the classes for reactor Operators during the period March through June, 1963, the instructor will use the recorded material as visual aids.

TESTINGIRRADIATION TESTING OPERATION

Irradiations - Sample and experiment irradiations were handled as follows:

Reactor	Test Hole	Facility	Request Number	No. of Samples	Material-Purpose
KE	2D	Quickie	HAP0-184	24	Washington Designated Program
KW	2A				
F		Process Channel	HAP0-098	15	Graphite (burnout rate study)
KW	2B	Hot Graphite	HAP0-177	15	Graphite (radiation damage study)
	2C				
KW	4B	Snout	HAP0-249	1	Boron-carbide-graphite (heat generation rate and radiation damage study)
KE	2D	Quickie	Reed College	1	Tissue (activation analysis study)
KE	2B	Magazine	Oregon State University	2	SmO ₂ and GdO ₂ (sample irradiations)
KW	4C	Snout	HAP0-243	2	Iron (fast fission damage study)
KE	2D	Quickie	HAP0-252	3	Arsenic (tracer isotope production)
KW	2A				
KW	4B	Snout	HAP0-258	3	Molybdenum (fast fission damage study)
KW	4C	Snout	HAP0-270	3	UO ₂ (crystal structure formation study)
F	E	Quickie	HAP0-272	1	GRAPHIKOTE (radioactive build-up of process tube lubricant)
F	E	Quickie	HAP0-223	4	Cobalt (isotope production)
		*Gamma	HAP0-171	2	Plastics and rubber (damage study)
		*Gamma		1	Silicone covered wire (damage study)

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

HAP0-222 - Two uranium swelling capsules were discharged and two more charged, in test holes 3674 and 3865 KW Reactor. New heater temperature controller-recorders and the new data logger were placed in operation.

Borescoping Activities

Process Channels, KW Reactor - A number of channels were examined and bore-gaged during the KW zirconium tube outage to determine the condition of the channels before and after boring.

Vertical Safety Rod Channel 28, C Reactor - This channel was examined to determine the cause of the rod sticking. Between block layers 10 through 15

down from the top of the stack, the blocks had moved into the channel 2-3/4 inches from the far side.

Removable thermocouple stringer channel 2, KE Reactor - This channel was examined to determine whether or not removal operation of the stringer channel had been effective. The first examination revealed a large amount of wire and ceramic beads. After a second removal attempt, the channel was clear and in good condition.

Horizontal Rod Channel 17, KE Reactor - This channel was examined to determine the condition of the graphite sleeve. Except for fairly heavy rub marks on the sleeve between 18 and 32 feet, the sleeve was in good condition.

Vertical Bowing

Tube 4674-D	Up .11" at 9-1/2' since 10-16-62
	Up .04" at 22' since 10-16-62
Tube 4453-D	Up .16" at 10' since 2-8-62
	Down .04" at 22' since 2-8-62
Tube 4494-D	Up .15" at 9'6" since 2-8-62
	Up .02" at 22' since 2-8-62
Tube 4574-B	Up .18" at 9' since 9-30-62
	Down .07" at 19' since 9-30-62
Tube 2860-KW	No previous data
Tube 4059-KW	No previous data
Tube 4087-KW	No previous data
Tube 3862-B	No previous data
Tube 3784-B	No previous data
Tube 4453-H	No previous data
Tube 4494-H	No previous data
Tube 4674-H	Down .03" at 7' since 9-20-62
	Down .15" at 19' since 9-20-62

H-1 Loop

Corrosion test H-1-3 was charged into the H-1 Loop on January 25. This test is very similar to the previous corrosion test H-1-2, operating at 550 F with pH controlled at 4.5 by the addition of phosphoric acid. Goal exposure at reference conditions is 1440 hours. To date, 276 hours have been accumulated.

COOLANT TESTING OPERATION

KER Loop Operation

KER-1 - Twelve 17-inch NIEL fuel elements were charged during the February 13 reactor outage as authorized by PT IP-536-A. Two coupon holders were charged as authorized by PT IP-567-D. The objective of this test is to determine the effects of crud release during in-reactor recirculation after chemically cleaning the out-of-reactor portion of the system as authorized by PT IP-551-A. The information acquired is to be used in establishing the required care and

cleaning of N Reactor primary loop piping prior to startup.

KER-2 - Testing of eight 17-inch NIEL fuel elements with modified end closures as authorized by PT IP-536-A, Supplement A continued. The objective of the test is to evaluate the irradiation behavior of N Reactor inner fuel tubes at conditions equivalent to those expected at N Reactor.

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

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

1706-KE Single-Pass Tube Operation

<u>Tube (KE Reactor)</u>	<u>Production Test</u>	<u>Water Supplied</u>	<u>Corrosion Inhibitor</u>	<u>pH</u>
SP-1 (2952)	IP-476-AL	Deionized		
SP-2 (3050)	IP-524-AL	Normal process	1.8 ppm dichromate	6.6
SP-3 (4355)	IP-520-A	Pilot plant	1.8 ppm dichromate	6.6
SP-4 (4456)	IP-520-A	Pilot plant	1.8 ppm dichromate	6.6
SP-5 (4557)	IP-524-AL	Service	0.2 ppm quachrom glucosate	6.6
SP-6 (4863)	IP-524-AL	Service	0.2 ppm quachrom glucosate	6.6
SP-7 (4963)	IP-541-A	Deionized (Zr-2 clad fuel elements)		
SP-8 (5063)	IP-541-A	Deionized (Zr-2 clad fuel elements)		

KE Reactor Outage Time Requirements

One unscheduled reactor shutdown was charged to production testing. The February 13 shutdown was a result of a fluctuation of instrument electrical power due to a loose neutral wire lug screw on the instrument electrical power main disconnect switch. The reactor remained shut down for a scheduled outage. A total of 27.6 outage hours was charged to production tests as listed below:

<u>Production Test</u>	<u>Description</u>	<u>Hours</u>
IP-449-A	Charge-discharge single-pass tubes	5.4
IP-520-A		
IP-520-AL		
IP-476-AL	Repair SP-1 front face piping leaks	5.0
IP-477-A	Set KER-4 emergency water back-up valve flow stop	7.1
	Install tray discharge equipment	
	Miscellaneous maintenance	
IP-477-A	Reactor scram	5.0
IP-536-A	Install tray discharge equipment	5.1
	Charge KER-1	

Out-of-Reactor Facility Operation

TF-1 - Cyclic decontamination testing continued. The objective of this test is to determine the effect of extended decontamination solution contact times and extended periods of high temperature operation on various decontamination processes. Operating conditions are 270 C, 1700 psi and pH 10.0.

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

TF-3 - Testing to evaluate the effect of nucleate boiling in a crevice obtained by welding an NPR support on the surface of a heater element continued. Operating conditions are 596 F, 1985 psi and pH 10.0.

TF-4 - Cyclic decontamination testing to evaluate single-step carbon steel decontamination procedures utilizing ammonium citrate was continued. Normal operating conditions are 300 C, 1650 psi and pH 10.0.

TF-5 - Testing of the corrosion inhibiting characteristics of ammonium hydroxide as compared to those of lithium hydroxide in a carbon steel system was continued. Operating conditions are 290 C, 1400 psi and pH 10.0.

TF-7 - Testing was continued to evaluate the integrity of mechanical seals on special Zircaloy-2 capsules. The operating conditions are 200 F to 500 F (cyclic), 1125 psi and pH 10.0. The test sections contain the following:

- Five Zircaloy-2 clad capsules for mechanical seal testing.
- A PRTR fuel element for fretting corrosion studies.
- Two NIN fuel elements and two dummy fuel elements for corrosion testing.
- A KSE3 fuel element for corrosion testing.
- Six Zircaloy-2 clad fuel elements for braze closure testing.

TF-8 - Uniform corrosion testing of A-212 carbon steel, 304 stainless steel and Zircaloy-2 was continued. Operating conditions are 700 F, 3300 psi and pH 10.0.

TF-9 - Testing was started to evaluate the closure mechanism on two special stainless steel clad thermocouple elements. Operating conditions are 300 C, 1650 psi and 50 gpm flow rate.

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

TF-15 - Corrosion testing continued at operating conditions of 1100 F, 3300 psi and pH 9.0 with ammonium hydroxide and hydrazine added. Coupons of 304 and 316 stainless steel, welded 316 stainless steel, zirconium alloys, Hastelloy-X, Stellite and D-979 alloys are being tested.

Design Test 1134 - Hydrostatic Cycling of NPR Pipe Sections - Testing of the nineteenth specimen is in progress. Testing of one specimen was completed during the report period.

COMPONENT TESTING OPERATION

Irradiated IPD Fuel Element Examination - 105-C Facility

Examinations were completed on the fuel elements from 55 tubes, requiring 259.1 fuel examination units. Total number of individual examinations completed was 8105.

<u>Number of Tubes</u>	<u>Production Test</u>
51	IP-216-A, Quality Certification Program
3	IP-409-A, Pilot Test of Self-Supported Fuel Elements in K-Size, Smooth Bore Zirconium Process Tubes
1	IP-475-A, Corrosion Testing on 1706-KE Single-Pass Tubes with Low pH and Reduced Dichromate

A photograph of one rupture from KE Reactor was taken. Colored photographs of 17 fuel elements were taken in support of PT IP-409-A and 449-A.

Irradiated NRD Fuel Examination - KE Facility

Four outer elements from KER-4 charge-discharged September 24, were visually re-examined for locking clip damage. None was apparent.

Process Tube Corrosion Monitoring Program

<u>Reactor</u>	<u>Number of Tubes Protologged</u>	<u>Report Number</u>	<u>HW Number</u>
B	491	8	76444
H	284	9	76445
D	70	10	76575
C	247	11	76576
KW	85	12	76577
KE	410	13	76659

Visual examination was completed on nine process tubes.

<u>Reactor</u>	<u>Number of Tubes</u>	<u>Reason Removed</u>
H	7	Routine corrosion studies
H	2	Sector probe calibration

Measurements were taken every foot on three BDF-type unirradiated process tubes for Process Analysis Unit.

Critical Reactor Component Examination

Examination was made of all the front-face flexible connectors at KW Reactor. None were found with broken strands resulting from other than mechanical damage.

Panellit System Programs

Gauges repaired, calibrated by Maintenance	79	
Gauges meeting calibration criteria	75	(95%)
-previous month		(98%)
In-board gauge reliability examination	285	
Gauges meeting examination criteria	277	(97%)
-previous month		(98%)
-average for past year		(95%)
Response time determination	285	
Gauges meeting response criteria	285	(100%)
-previous month		(100%)
-average for past year		(99.7%)
In-board Bourdon coil examination	4032	
Non-leaking coils	4019	(99.7%)
-average rate past two years		(99.8%)
Gauges receiving failure analysis	59	
2B-XI switch examination	500	
-acceptance rate		(88%)
-previous month		(83%)
Gauges received from vendor and examined	710	
-acceptance rate		(81%)
-previous month		(57%)

O. H. Greager, Manager
Research and Engineering

FACILITIES ENGINEERING

DESIGN ENGINEERING

Graphite Distortion Problem - VSR Design

The VSR channel thermal shield boring machine modifications were completed, and machine operation was demonstrated for Maintenance personnel. One cast iron thermal shield block was bored at a feed rate of .006 inch per revolution of cutter. An attempt was made to bore the 3/8-inch thick steel ball guide plate. A new cutter body was installed and two of the three required boring operations were accomplished with little apparent difficulty at a feed rate of .003 inch per revolution of cutter. The third boring operation was not successful due to excessive carbide cutting tooth insert breakage. New cutter inserts of an alternate grade of carbide have been ordered.

The modified VSR tip was used in a successful series of VSR liner drop tests. VSR drops were simulated using channel liners of polycrystalline graphite, aluminum oxide and pyrolytic graphite. Both the first two liner materials successfully withstood 1000 drops, which is about 25 years life, without major damage. The pyrolytic graphite test sleeve failed after about 900 drops. Failure was attributed to flaking off of the plate type structure of the sleeve material. A development contract DDR-163 has been negotiated with an off-site vendor for the fabrication of pyrolytic graphite sleeves with the graphite material being deposited in the interstices of graphite felt cloths and substrates. This should prevent the flaking type of sleeve failure.

Detail designs are being prepared for standard VSR seals, bushings, cable guides, adapters, et cetera, which will be suitable for use at all reactors with the recently adopted standard flexible VSR design. These components will be utilized during installation of the new VSRs which are currently being procured.

C Reactor Rear Face Leak Repair

No significant water leaks have appeared on the rear face of 105-C Reactor following the installation of the modified connectors and adapter fittings. The few leaks found were due to installation oversights. The design and fabrication of the new "quickie" discharge funnel has been completed. This funnel is unique in that it will fit all of the various rear face assemblies installed at 105-C Reactor. Satisfactory on-reactor performance of the new funnel design was demonstrated during a recent outage.

105-K Reactor Zirconium Tube Program

During the tube replacement outage at the 105-KW Reactor, the inlet gunbarrels were regrooved on-reactor to permit the installation of the thick section retaining ring. Three outlet gunbarrels were also regrooved due to excessive corrosion of the existing ring grooves.

Because of the recent failure of a cast inlet nozzle at KE Reactor, design has started on an impact extruded aluminum nozzle for use on the aluminum fringe and spline tubes of the K Reactors. This new nozzle will be similar to the nozzles used with the zirconium tube nozzle and will have superior strength and ductility characteristics as compared to the present cast nozzles.

Evaluation of Radioactive Materials Off-Site Shipping Containers

The design criteria to be used as a basis for the cask evaluation program has been issued for comments. Pending resolution of comments, evaluation studies of the presently utilized shipping casks are under way.

In conjunction with the cask evaluation program, a draft issue of an IAEA-United Kingdom shipping container test proposal has been reviewed and comments forwarded to RLOO-AEC. In general, the proposed tests appeared to be satisfactory, but should be limited to containers other than the special large source category.

EQUIPMENT DEVELOPMENT

105-K Reactor Zirconium Tube Program - Development

On-reactor testing of the production model boring bar developed for use on the 105-K Reactor process tube channels was performed during the week of February 11. Fifty-six channels were bored and retubed with smooth-bore Zircaloy-2 process tubes. Bore gage and traverse data taken during the outage indicate that zirconium tube life of a minimum of ten years will be realized. Procurement of tools and equipment for the first major tube outage is progressing as scheduled. A design and development contract to explore alternate methods of graphite removal from process tube channels is being negotiated with the A. D. Little Company, Cambridge, Massachusetts.

Self-supported Fuel Element (SSFE) Charging

Two SSFE prototype charging machines were tested on 105-KW Reactor on February 16-17. A total of 50 tubes were successfully charged with the two prototypes. A third prototype machine is scheduled for delivery early in March, at which time laboratory testing will be initiated.

Prototype High Speed Scanner

The high speed scanner prototype continued uninterrupted operation, bringing the total operating hours to 18,015 without incident.

Design Test Service

The N-Reactor program utilized 626 hours of engineering effort for design test service.

PROJECT ENGINEERING

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

The vendor completed the parallel operation test of two modified 275 HP loop pumps. Shipment is now expected in March.

The RLOO-AEC has contacted three vendors and requested proposals for the purpose of negotiating a contract for procurement of safety circuit instrumentation. Proposals have been received and were reviewed by our personnel. All proposals are technically acceptable. RLOO-AEC is preparing for negotiation.

CGI-844, 100-K Area Coolant Backup

Flow tests of the cleaned cross-tie piping system were conducted February 16. A preliminary review of the test data indicates that the cleaned lines will permit the diesel pumps to provide approximately 31,000 gpm flow to either reactor with approximately 10,000 gpm bleed to the non-stricken reactor. Raw test data indicate that the design criteria flow of 32,000 gpm was achieved.

Construction of the corrosion inhibitor system is 20 per cent complete. The project has been closed out with minor exceptions.

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

The final ATP for the 100-K Area electrical distribution system has been conducted to verify the ability of the 4160-volt emergency electrical system to separate from the normal power system upon loss of BPA power. The system functioned as intended during the testing.

Temperature monitoring equipment has been installed on two low lift motors in 190 KE and KW. The meters for the remaining motors are installed and will be connected during the next scheduled outage. One additional low lift pump motor was found to have an imbalance in the windings and was returned to the vendor for repair and installation of an equalizer connection.

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

The project proposal is being revised to request additional capital funds. Although beneficial use was obtained, physical completion is only 96 per cent. In addition, a decision as to the need of additional air valves in the export line cannot be made until system tests are made during March.

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

The second area installation of an Analog-to-Digital Converter was made at 105-DR during the last two weeks of February.

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

Detailed design is four per cent complete vs four per cent scheduled. A design criteria and certified design progress schedule have been approved by RLOO-AEC. A review of the proposed synchronization and anti-cocking system is being conducted by the Haughton Elevator Company but has not been completed. Comments on their review are expected in March.

A construction estimate is being prepared.

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

Procurement delays continue to prevent progress.

Revision 1 of the design progress schedule has been forwarded to RLOO-AEC, reflecting the design lag resulting from the rewrite of the specifications requested by RLOO-AEC.

MJA-44, Inlet Chute Modification and Repair, 107-KE and KW

The job was completed February 15 1963.

R-20520, K Retubing

Six hundred thirty-seven zirconium tubes have been received. Both ends of the tubes are being annealed at White Bluffs prior to the Van Stone flanging. The vendor has requested a revision to the progress payment schedule to provide a two months' delay for complete delivery of the tubes, based on the difficulties encountered in manufacture and inspection of these tubes during the first several months of production.

Two hundred eighty-four nozzles have been received from the Gougler Machine Company.

CPFF Construction Service Contractor-Liaison

Issued eight new work orders and supplemented seven old jobs for a total of \$82,749 to J. A. Jones Construction Company.

Plant Forces Work Review

The Labor Standards Board approved three jobs for assignment to plant forces, estimated to cost \$45,289.

Manager, Facilities Engineering

RT Jessen:dgm

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HR.

FINANCIAL

ACCOUNTING

The Department's budget activity for the FY-1964 and 1965 budgets is now in progress. Personnel estimates have been consolidated for final review and preliminary figures submitted to Contract Accounting. Essential material and planned maintenance requirements are currently under review as a part of budget activity.

The IPD research and development FY-1965 budget and FY-1964 revision assumptions and requests for AEC Schedule 139 proposals were discussed with Research and Engineering Section personnel January 30, 1963. The duplomat masters which prescribe the form for the data and the proposals were discussed and will be completed in March 1963.

A study was prepared on the annual cost of aluminum sulphate and bauxite-sulphuric acid feed. It is estimated that the 18 ppm feed required by the AEC for the reduction of effluent contamination cost IPD about \$600 000 more in CY-1962 than would have been spent had feed continued at the rates formerly used.

A study of cost control documents available to IPD is in progress. Completion will be delayed by the increased budget activity during the third and fourth quarters.

BUSINESS AND INFORMATION SYSTEMS

The essential materials program for Production Fuels Section has been completely revised so that it will integrate with the existing program in the Manufacturing Section. This program will utilize pre-punched cards similar to those presently in use.

SH Small

Manager, Finance

SH Small:slb

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REF ID: A66587

HW-76769

SIGNIFICANT REPORTS ISSUED

<u>Number</u>	<u>Class'n.</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-76310	Conf.	PH Hutton	2/6/63	Budget Study, FY-65, Renovation of Horizontal Rod Channels and Installation of Flexible HCR Tip Sections - K Reactors
HW-76106	Unclass.	NF Fifer	1/30/63	Design Test 1153, Rupture Removal Test of 105-C Overbore Zircaloy-2 Process Tubes
HW-76332	Secret	KD Coughren	2/8/63	Summary of K Reactor Graphite Treatment for the Zirconium Tube Program
HW-76001	Secret	EL Etheridge	1/14/63	Preliminary Engineering Report - Bauxite Sulfuric Acid Coagulant Feed Systems - 100-K
HW-76231	Unclass.	JE Boyd	1/15/63	Project CGI-960 Representatives Meeting No. 1
HW-76296	Unclass.	JE Boyd	1/21/63	Reactor Work Platforms - Safety and Synchronization System
HW-76419	Unclass.	LB Brinkman	2/1/63	Modifications to the 105-K Downcomer Expansion Section
HW-76457	Unclass.	JR Clark	2/12/63	2400 Volt Ground Detector - Preliminary Engineering Report
HW-76608	Unclass.	LB Brinkman WB Thompson	2/18/63	190-F Steam Turbine Pump Tests
HW-76421	Secret	JM Goff, Jr.	2/14/63	Test Results for Unrestrained Gunbarrel-Nozzle Assemblies
HW-75400	Unclass.	FG Howden FJ Kempf A Russell	2/20/63	PT IP-542-AE, Installation of Channel Lining Sleeves in Two VSR Channels at C Reactor
HW-75788	Unclass.	JP Cooke	12/10/62	Design Change No. 627, Gas System Blower Bypass No. 4 and No. 5 Blowers, 115-B Building
HW-74443 Sup 7	Unclass.	EF Arnold	1/2/63	Operation and Maintenance Instructions for the 100 Area Process Tube Effluent Water TC Temperature Monitoring System

REF ID: A66587

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<u>Number</u>	<u>Class'n.</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HWS-7304	Unclass.	OR Longmann	1/15/63	Rough Draft - Specification for Dose Rate Telemetry
HWS-7308	Unclass.	GL Erickson	2/1/63	Specification for a Gross Gamma Trend Monitor for Rupture Confirmation
HW-76702	Unclass.	AW Herwin	2/20/63	100-K Zirconium Retubing Program, Results of PT IP-565-AM, Installation of Zirconium Process Tubes, 105-KW Reactor
HW-76101	Secret	GC Fullmer RD Carter	1/3/63	Advancements in Reactor Control Efficiency - Poison Spline Supplementary System
HW-76470	Secret	GC Fullmer RD Carter	2/5/63	Poison Spline Supplementary System - History and Application
HW-76545	Unclass.	A McDonald	2/11/63	History - Modification of 4500 HP Motors
HW-76429	Secret	RH Wheaton	2/4/63	Increased Length Fuel Elements
HW-76507	Secret	WN Mobley	1/25/63	Uranium Delivery Schedule
HW-76533	Conf.	WN Mobley	2/11/63	Classification of C-6 Residues
HW-76503	Conf.	GB Hansen	2/7/63	Uranium Quality Control Analytical Results
HW-76585	Conf.	GB Hansen	2/14/63	Uranium Quality Control Analytical Results
--	Undoc.	WF Stevenson	1/25/63	Economic Control of Quality
HW-76555	Unclass.	VP Thomas	2/20/63	Comments on Engineering Audit Reports of Non-destructive Testers
HW-75797	Unclass.	JJ Wick	12/3/62	AlSi Fuel Element Autoclave Rupture Incident
HW-75998	Unclass.	JJ Wick	12/19/62	AlSi Fuel Element Autoclave Rupture Incident

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TRIPS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
H. W. Heacock	Travelers Insurance Co. Seattle, Washington	2/1/62 to 2/3/63	Discuss Third Party inspection of process work platforms - CGI-960.
R. Sherrard	GE Adv. Tech. Lab.	1/30/62 to 1/31/62	Discuss experience with elec- tronic components, electrical noise, and its control in large systems.
	Kearfott, Inc. Littlefalls, New Jersey	2/1/63	Discuss various instrumenta- tion problems with potential suppliers and attend AIEE Workshop.
	AIEE Workshop Princeton, New Jersey	2/2/63	Workshop.
	Sigma Inst., Inc. South Braintree, Mass.	2/3/63	Same
	RDF Company Hudson, New Hampshire	2/3/63	Same
F.A.R. Stainken	So. Dakota School of Mines Rapid City, South Dakota	2/18/63 to 2/19/63	Participate in Company's BS/ME Recruiting Program as Manu- facturing Services Representa- tive.
	North Dakota State Univ. Fargo, North Dakota	2/20/63	Same
	University of North Dakota Grand Forks, North Dakota	2/20/63	Same
J. H. Cox	General Electric Co. Idaho Falls, Idaho	2/1/63	Observe and discuss testing techniques.
W. A. Blyckert D. W. Constable	UCLA Los Angeles, California	2/4/63 to 2/15/63	Attend short course in Numerical Methods for Nuclear Reactor Calculations.
D. W. Constable	GE-APED San Jose, California	2/18/63	Discuss reactor physics calculational methods.
C.F. Quackenbush	New York City, New York	2/5/63 and 2/6/63	Attended American Standards Association meeting.

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<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
A. McDonald	Westinghouse Electric Portland, Oregon	2/19/63 and 2/20/63	Inspect a 1500 HP pump re- moved from K Area.
R. D. Duncan	Die Mold Company Plastic Model Eng. Co. Aero Kraft Plastic Products Co. Los Angeles, California	2/5/63 to 2/9/63	Consult with vendor on quotations for cast-in- place bellows boots.
T. M. Clement	Matheson Co., Inc. Newark, California Loenco Plant Altenda, California	2/19/63 to 2/23/63	Discuss calibration of gas mixtures.
J. T. Stringer F. W. Knight	National Lead Company of Ohio Fernald, Ohio	2/18/63 to 2/20/63	Technical discussions with NLO personnel.
F. W. Knight	Mallinckrodt Chemical Wks St. Louis, Missouri	2/21/63	Technical discussions with MCW personnel.
C. A. Burgess	Battelle Memorial Inst. Columbus, Ohio	2/4/63 and 2/5/63	Discuss gas pressure bonding.
C. A. Burgess	Savannah River Plant Aiken, South Carolina	2/6/63 to 2/8/63	Technical discussions with SRP personnel.
C. H. Allen	R&R Tool & Die Corp. North Hollywood, Calif.	2/10/63 to 2/13/63	Negotiate design change on fuel element component.
L. L. Samford	R&R Tool & Die Corp. North Hollywood, Calif. Harvey Aluminum Torrance, California	2/11/63 2/12/63	K-5 support development. Discuss aluminum components for fuel elements.
R. G. James	General Electric Mt. Vernon, Indiana	2/6/63 to 2/8/63	Interview.

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VISITORS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
W. R. Ebling	Metallurgical Products Department Detroit, Michigan	2/28/63	To discuss the development work on pyrolytic graphite sleeves that we plan to have them conduct under contract now being negotiated through the AEC.
W. F. Rehmke	Union Machine Works, Inc. Seattle, Washington	2/8/63 and 2/9/63 2/12/63 and 2/13/63 2/16/63 and 2/17/63	Run tests on charging machine fabricated by Union Machine Works. Same Same
R. Williams	International Nickel Palo Alto, California	2/20/63	Inconel metallurgy.
A.L. Daniels	Bailey Meter Company Denver, Colorado	2/12/63 to 2/16/63	Calibrate instruments for power houses in support of safety optimization program.
R. W. Powell D. Thompson	Brookhaven National Lab.	2/25/63 to 2/26/63	Discuss reactor confinement ventilation and filtration facilities and exchange information on the Reactor Certification Program.
R. Wilkens	Wilkens & Associates Tacoma, Washington	2/1/63	Steel sleeve welding problems.
L. L. Becker	Bridgeport Brass	2/5/63	Discuss aluminum components.
D. M. Guy	Alcoa Seattle, Washington	2/21/63	Discuss aluminum components.
R. C. Yule	Oakite Products, Inc. Spokane, Washington	2/1/63	Oakite No. 34 as an aluminum deoxidizer.
R. Mickelson R. W. Barnes	Diversey Corporation Chicago, Illinois	2/11/63 and 2/19/63	Cleaning components.

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<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
F. Mickelson	Diversey Corporation Chicago, Illinois	2/18/63 and 2/19/63	Testing of Diversey Corporation products.
Dr. K. Newman	Turco Corporation Los Angeles, California	2/19/63	Technical discussions.
G. I. Parker	Lepel High Frequency Laboratories, Inc. Woodside, New York.	2/19/63	Discuss induction heating equipment.
D. L. Moore	Bannock Steel Company Boise, Idaho	2/1/63	Consultation on steel building construction.
R. L. Meyers	Betz Laboratories Olympia, Washington	2/12/63	Consultant on water treatment.

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2 / 11 / 93