DECLASSIFIED

HW--75931

DE93 003175

IRRADIATION PROCESSING DEPARTMENT

MONTHLY REPORT

DECEMBER, 1962

HANFORD ATOMIC PRODUCTS OPERATION

GENERAL ELECTRIC

RICHLAND, WASHINGTON

MASTER

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED
DATE 12-12-81 BY 1045

DECLASSIFIED

DECLASSIFIED

HW-75931

This document consists of
pages. No.
Series

IRRADIATION PROCESSING DEPARTMENT
MONTHLY REPORT
DECEMBER, 1962

83966

Compiled by
IPD Personnel
January 14, 1963

RICHLAND, WASHINGTON

~~CONFIDENTIAL~~
~~IRRADIATION~~

By Authority of *J. S. Lewis*

8-4-42 PR-24 (CG-PR-2)

Jo Ballack 8-24-42

PM Eick 8-24-42

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

Route to:	P.R. No.	Location	Files Route Date	Signature and Date
<i>AEC-R66</i>				
<i>Attn: J. G. Travis</i>				

DECLASSIFIED

CONFIDENTIAL
DECLASSIFICATION BUT LEFT
UNCHANGED

By *C. Cantrell*

Date *12-5-80*
U.S. AEC Division of Classification

DECLASSIFIED

HW-75931

DISTRIBUTION

Copy Number

1	W. E. Johnson
2	A. B. Greninger
3	H. M. Parker
4	APD, F. E. Crever
5-6-7-8	AEC-HOO, J. E. Travis
9-10-11	AEC Production Division, F. P. Baranowski
12	AEC-SROO, R. C. Blair
13	R. L. Dickeman
14	O. H. Greager
15	R. T. Jessen
16	O. C. Schroeder
17	O. P. Amacker
18	W. N. Mobley
19	S. H. Small
20	300 Area Files
21	Records Center

DECLASSIFIED

DECLASSIFIED

HW-75931

TABLE OF CONTENTS

<u>SUMMARY</u>	A-1
<u>MANUFACTURING</u>	
Production Operation	B-1
Reactor Operation Statistics	B-2
Reactor Operations	B-3
Applied Reactor Engineering	B-7
<u>PRODUCTION FUELS</u>	
Manufacturing	C-1
Fuels Engineering	C-5
Quality Control	C-14
Plant Facilities	C-16
<u>RESEARCH AND ENGINEERING</u>	
Process and Reactor Development	D-1
Process Technology	D-5
Operational Physics	D-12
Testing	D-17
<u>FACILITIES ENGINEERING</u>	
Design Engineering	E-1
Equipment Development	E-3
Project Engineering	E-4
<u>FINANCIAL</u>	F-1
<u>REPORTS, TRIPS AND VISITORS</u>	G-1

DECLASSIFIED

DECLASSIFIED

HW-75931

SUMMARY

MANUFACTURING

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

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

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

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

On the tube replacement program, 251 process tubes were replaced for a total of 6,515 during the year.

PRODUCTION FUELS

A total of 588 tons of natural and enriched fuel elements was produced for 100 per cent of the forecast.

Nine canning lines were operated during the month with an operating efficiency of 98.7 per cent. A canning line operating efficiency of 97.5 per cent for the calendar year represents an all-time record high.

Three autoclave rupture failures occurred during the month. All of these resulted from malfunctions in the welding operation. Total autoclave rupture failures for the year is five.

Bare core inventory reflects a 0.9 month's supply. This figure does not include 289 tons of dingot material. Finished fuel inventory reflects a 1.7 month's supply excluding 105 tons of dingot material.

The bumper welding process has been fairly stable. Yields through the welder for the month were 97 per cent.

Circuit modifications were made on all semi-automatic welders to prevent the cycle timers from getting out of sequence with the welder spindle. This change was necessary to eliminate the possibility of an out-of-process condition and resultant weld defects which were not readily detectable at weld inspection.

DECLASSIFIED

DECLASSIFIED

HW-75931

As a temporary solution to a serious canning yield problem in the AlSi Shop, resulting from a high AlSi slopover reject rate, a technique was developed for applying an aqueous solution of an experimental commercial product to the exterior upper grooved surface of aluminum cans. This inhibits AlSi wetting and restricts AlSi flow between the cans and steel sleeves during fuel assembly. Use of the solution has reduced AlSi reject rates in the range of 4-7 per cent to less than 1 per cent.

RESEARCH AND ENGINEERING

Power levels for B, C, DR, and F Reactors have been restricted by tube outlet temperature limits to control tube corrosion. Power levels at D and H Reactors have been limited by bulk outlet temperatures; levels at the K Reactors are currently restricted by AEC administrative limits.

The failed HAPO hot press fuel element from tube 3680-C being examined in Radiometallurgy Laboratory was found to have four penetrations, each under a support rail.

Eight KE Reactor process tube channels in a 3 x 3 array were drilled with the six-foot tapered bar drill to evaluate its use in the reactor. Approximately 0.3 inches of graphite were removed from the top of the center portion of each channel. Borescope observations before and after drilling showed trunnion block fracture to be aggravated by the drilling. Front-to-rear thermocouple stringers were installed in the center of the 3 x 3 block and outside of the block in the same row to evaluate effects of drilling on graphite temperatures.

In-reactor recirculation of KER-1 and KER-2 Loops with dummy fuel elements was terminated. Out-of-reactor recirculation is in progress in Loop KER-1 to evaluate problems associated with changing from lithium hydroxide to ammonium hydroxide for pH control. Testing of eight N Reactor inner fuel tubes with contoured end closures was started in KER-2 Loop. KER-3 Loop remained shut down because of primary pump failures. Operation of KER-4 Loop continues the test of 14 prototype N Reactor fuel elements with a goal exposure of 2100 MWD/T.

Boron burnout in the DR Reactor has progressed sufficiently since the 1961 Ball 3X drop that operating efficiency is no longer significantly affected by supplementary control requirements. Reactivity effect of the residual balls has decreased from greater than 1.5 per cent $\Delta k/k$ to approximately 0.5 per cent $\Delta k/k$ at present.

Chemical analysis to support conversion ratio values for the full-reactor E-N test loading at H Reactor was completed. The weighted average results from the 18 6-8 tube batches (second core and fringe loadings) and from bulk recovery of the first core agreed closely with previously indicated conversion ratio gains relative to natural uranium loadings.

DECLASSIFIED

DECLASSIFIED

HW-75931

FACILITIES ENGINEERING

A total of 99 zircaloy process tubes has now been received for the 105-K Reactor Zirconium Process Tube Replacement Program. Sixty of these have been accepted and are ready for Van Stone flanging. Preliminary design is under way on permanent material handling system alternatives for this program. A preliminary engineering report describing the permanent material handling system is being circulated for review within the Department prior to preparation of detail design.

Laboratory testing of the six-foot long, double tapered boring bar designed for process channel conditioning has been completed. An increase of two to three years in estimated tube life has been demonstrated by the combination of current boring techniques and process tubes produced by the Wolverine Tube Company. Investigation of alternate methods of graphite removal from process channels is continuing; proposals of three vendors are being evaluated.

On December 3, fuel elements in two Zircaloy-2 standard size, smooth bore tubes were discharged during a reactor outage at 105-KW Reactor. No discharge-recharge problems were encountered. The fuel elements in tube 2557-KW were flush discharged with an approximate 200 psi pressure on the nozzle. Fuel elements in tube 3065-KW were displacement discharged utilizing the HAPO-designed self-supported fuel element charging machine, with a maximum pushing force of 1,200 pounds. Both tubes were irradiated to 40 per cent of goal exposure. A second charging cycle was performed on both tubes to permit visual examination of the fuel elements. No damage to fuel element bodies or support rails was indicated. Average time for machine-to-nozzle hookup was sixty seconds; time to charge one column of metal was thirty-two seconds. On December 27, two Zircaloy-2 process tubes in the KER facility at 105-KE Reactor were refueled using the HAPO-designed charging machine. The machine functioned satisfactorily, but due to nozzle alignment and nozzle design, perforated dummies rather than self-supported fuel elements were required to discharge the irradiated column. Fabrication of the two vendor-designed charging machines is progressing with completion of both now scheduled for January 1963.

The VSR liner installation at 105-C Reactor planned during the recent extended outage, was deferred due to delays in completion of the VSR channel enlarging tooling. Deferment of this testing work was caused by an unexpected slow cutting rate of the graphite reamer, and the late delivery of components for the cast iron boring machine which precluded adequate laboratory testing prior to on-reactor usage. New boring machine cutter heads are being fabricated in an attempt to increase tool life and graphite cutting speeds. No date has yet been established for on-reactor testing of this equipment.

Shop fabrication of a ten-foot section of the proposed replacement horizontal control rods has been completed. This HCR configuration has been designed to provide sufficient rod flexibility to accommodate current and expected graphite distortion patterns at the 105-K Reactors. The fabrication of a mockup for strength testing of this concept is under way.

DECLASSIFIED

DECLASSIFIED

HW-75931

A Physical Completion Notice, dated November 16, 1962, was issued on Project CGI-883 (Increased Process Water Flow, 100-K Area), with indicated total cost of \$3,287,500, and indicated underrun of \$1,242,500.

RESPONSIBILITY

Effective December 1, 1962, the General Electric responsibilities for the manufacture of fuel for the reactors operated by IPD will be provided by the Production Fuels Section established within the Irradiation Processing Department. W. N. Mobley is Manager of this Section.

FORCE SUMMARY

	<u>Exempt</u>	<u>Non-Exempt</u>	<u>Total</u>
General	6	1	7
Research and Engineering	85	55	140
Manufacturing	393	1408	1801
Production Fuels	106	419	525
Facilities Engineering	89	37	126
Financial	<u>17</u>	<u>13</u>	<u>30</u>
TOTAL	696	1933	2629

SAFETY, SECURITY AND RADIATION EXPERIENCE

There were 95 medical treatment injuries, three security violations, 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>
J. D. Schaffer and C. A. Burgess	12-5-62	Chemical Treatment of Aluminum X-8001 Prior to an Aluminum-Silicon Brazing Process to Prevent the Molten AlSi from Wetting the Aluminum Components.

DECLASSIFIED

AB Greninger
General Manager

AB Greninger:DLD:bm

DECLASSIFIED

HW-75931

MANUFACTURING

PRODUCTION OPERATION

There were no discharge goal exposure adjustments initiated during December. However, changes were made within the existing goal plan. At D Reactor the upper limit for low power tubes was changed from 1200 MWD/T to 1500 MWD/T compensating for a 200 MWD/T goal exposure reduction for the 200 highest power regular tubes which had exhibited a high rupture incidence. The upper limit for low power tubes at DR and the two K Reactors was raised from 800 MWD/T to 1500 MWD/T to improve the yield of unclassified plutonium.

December 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>
646	708	801	834

Rail and truck shipments of Essential Materials were as follows:

Carload shipments for IPD	- 304
Carload shipments for other Depts.	- 166
Truck shipments for IPD	- <u>88</u>
. Total	558

DECLASSIFIED

B-1

HW-75931

MONTH		REACTOR OPERATION STATISTICS - PROCESSING									
DECEMBER, 1962		B	C	D	DR	F	H	KE	KW	TOTAL	
INPUT PU (% OF FORECAST)		101.2	15.8	94.1	109.8	104.9	88.9	173.5	98.0	102.2	
TIME OPER. EFF. (% OVERALL)		85.3	10.6	76.1	92.8	86.6	79.4	78.8	81.2	73.8	
NEW TUBES INSTALLED		0	251	6	0	0	0	0	0	257	
WATER LEAKS - TUBE		1	1	0	0	0	1	0	0	3	
- VAN STONE		0	0	2	0	1	0	0	0	3	
FUEL ELEMENT RUPTURE		2	0	4	0	2	0	0	0	8	
HELIUM CONSUMED - M CU. FT.		817.9	155.8	676.3	386.7	619.4	328.9	286.6	252.9	3524.5	
UTILIZATION OF REACTOR OUTAGE HOURS											
CHARGE - DISCHARGE		29.7	35.6	63.2	25.9	12.8	19.5	56.9	43.3	286.9	
RUPTURE REMOVAL		1.4		11.6		2.8				15.8	
WATER LEAK		24.6	16.4	17.4		11.5	18.1			88.0	
TUBE REPLACEMENT		16.3	289.3	24.0	8.9		4.7	29.5	21.3	394.0	
MAINTENANCE		16.6	315.4	53.6	15.9	70.7	39.0	24.7	51.7	587.6	
STANDARD CHECK			3.0	0.4	2.5			6.5		12.4	
PRODUCTION TEST		20.9	1.8	7.2		2.0	27.2	30.9	14.2	104.2	
PROJECT WORK			4.0							4.0	
OTHER				0.5	0.3		44.4	15.4	3.1	63.7	
TOTAL		109.5	665.5	177.9	53.5	99.8	152.9	157.4	140.1	1556.6	
REACTOR OPERATION STATISTICS - POWER											
RIVER WATER PUMPED - M GALS.		5118.1	-	7224.2	-	3777.6	2978.5	8731.6	8210.5	36040.5	
WATER TREATED - M GALS.		2894.3	1597.8	4053.3	3040.1	3732.7	2877.1	8681.0	8210.5	35086.8	
WATER TO REACTOR - GPM NOR.		89000	100000	87500	86000	89100	83900	205000	205600	946100	
FINISHED WATER - ANALYTICAL DATA											
TURBIDITY PPM AVG.		.002	.003	.003	.003	.003	.003	.004	.005	-	
PH AVG.		7.00	7.00	7.08	7.07	6.92	6.99	6.60	6.59	-	
CL ₂ RESIDUAL PPM AVG.		.05	.05	.15	.15	.05	.14	.12	.09	-	
DICHROMATE PPM AVG.		.98	1.40	.98	.98	.98	1.00	1.84	1.83	-	
STEAM GENERATED M LBS.		65754	-	78336	-	39000	44121	28121	24808	-	
EVAPORATION RATE/LB. OF COAL		8.97	-	8.40	-	8.48	9.61			-	
EVAPORATION RATE/GAL. OF OIL								108.4	112.8	-	
TOTAL KW - HR GENERATED								1495200	1534400	3029600	

DECLASSIFIED . [REDACTED]

HW-75931

B-C REACTOR OPERATION

Two outages occurred at B Reactor, one to remove a ruptured fuel element and one to repair a water leak plus the removal of a ruptured fuel element. The water leak was in a recently installed tube which was charged with enriched bumper fuel.

In addition to the tube and rear face hardware replacement outage in progress at the beginning of the month, C Reactor experienced one outage due to loss of continuity on eight outlet temperature monitoring thermocouples.

At B Reactor, water mixer fuel elements are now charged in more than 50 per cent of the process tubes and bumpered enriched metal charging has been curtailed in 1961 and 1962 process tubes in an effort to reduce top-of-annulus corrosion. Tube outlet temperatures have temporarily been reduced and the pH of process cooling water lowered to 6.90-6.95 to reduce tube corrosion rates. The enriched core loading was discharged because the majority of the core tubes are scheduled for replacement in January.

At C Reactor, 251 process tubes were replaced. The following Design Changes were also completed.

No. 445, "Improved Pressure Monitor Ground Detection and By-pass Switch Revision," which provides improved ground detection and removes an unused by-pass switch.

No. 614-C, "VSR-HCR Interlock and Safety Circuit Revision," which prevents the HCR's from being pulled before the VSR's during startup and provides a manual trip button to interrupt both the positive and negative sides of the No. 1 safety circuit.

No. 660, "Outlet Elbow and Connector Replacement - C Reactor." Except for the overbore tubes, all rear face connectors and elbows, tube outlet thermocouple wells and connectors were replaced.

No. 448-C, "Process Water Orifice Replacement." Larger orifices (16.427), used for the power calculator, were installed in the six process water supply headers.

No. 667, "Low Level Neutron Monitor Cooling Water Orifice Installation," which provides a positive trip of the annunciator if the cooling water to this monitor becomes less than 1.0 gpm.

No. 618-C, "Install CG-558 Nozzles at 105-C." This Design Change replaces the OCD ball valves on the front face with CG-558 nozzles.

As a part of the over-all IPD survey of piping, radiographic checks were made of the process water, filtered water and fire and sanitary water lines at various points around the C water plant.

DECLASSIFIED

DECLASSIFIED

HW-75931

At 190-C Building, cracks were found in the impeller and the fluid drive of No. 9 process pump. Both the impeller and the fluid drive assembly were replaced.

On the No. 6C pump at the 181-B Building, the suction bowl was replaced because of a cracked vane, the bowl bearings were replaced, and a new foundation for the pump was poured to provide a level base.

Decontamination of the internal rear face surfaces of C Reactor was accomplished resulting in a 60 per cent reduction of dose rates.

D-DR REACTOR OPERATION

D Reactor experienced five shutdowns. Those which resulted in appreciable outage time were three outages due to failure of fuel elements and one outage due to process tube water leaks. DR Reactor experienced two shutdowns, a brief Panellit scram caused by failure of a spline stub retainer and a planned shutdown on December 29 for scheduled charge-discharge and firm electrical power peak control.

An electrical power surge on the BPA system was noted on December 1, but was of insufficient magnitude to cause interruption of electrically operated equipment. An earthquake was detected by galvanometer motion at both D and DR Reactors at 12:51 p.m., December 31. No other indications were observed.

At DR Reactor, six vertical rod channels were broached after the camera system revealed drop times were longer than Process Standards permit. Also high background levels were experienced in 105-DR Building on several occasions because effluent vapors, from the downcomer vents, were drawn into the building through the ventilation system. This problem is being studied.

At D Reactor, programs were completed which provide for replacement of lug rings on front nozzles with the cast stainless steel type and for the thorough reconditioning of the horizontal rod hose reel assemblies. Process water flow recorders in the D and DR Reactor Control Rooms were modified to provide water flow information under low (shutdown) flow conditions. Previously this information could only be obtained by calling the appropriate 190 Building.

Replacement of approximately 850 feet of 8-inch sanitary water pipe near Building 183-D was completed and the line was returned to service. Cast iron pipe was installed in place of the former carbon steel pipe in order to improve corrosion characteristics.

Pump No. 4 at 181-D Building was modified by adding a third impeller stage and returned to service. Detailed tests have not been conducted to evaluate the success of this effort toward providing greater pump flexibility for maintenance work.

DECLASSIFIED

B-4

DECLASSIFIED

HW-75931

F REACTOR OPERATION

The F Reactor experienced two outages in December, both caused by ruptures of enriched bumpered fuel elements charged in August, 1962 and both occurred in tubes replaced during 1962. This makes a total of nine ruptures for the year, the same number as for CY-1961.

The inadequate amount of reactivity held in control rods and flattening at the end of November was corrected early in the month.

During December, condensate collection from the reactor gas dryers in Building 115 reached the lowest rate in several years, approximately one gallon per day for several days late in the month.

The No. 1 electrical incoming line breaker in Building 182-F relayed open at approximately 5:37 p.m. on December 22, because of a short circuit caused by condensation on the cubicle room ceiling. A reclosure was attempted at approximately 1:37 a.m. on December 23. At this time, both the No. 1 incoming line breaker and the C6X15 breaker in the 151-F substation relayed out causing some damage to electrical standby equipment (No. 8 filter supply pump) in Building 182-F. The C6X15 breaker which also supplies the 183-F pump room was immediately reclosed and the three process pumps in 183-F were restarted. Temporary repairs were completed and service in Building 182-F was returned to normal on December 31.

Sodium silicate feed to the near (east) high tank was started on December 14 for corrosion control purposes.

Electrical activities included overhauling the 105-F fresh air mask compressor motor and the No. 6 fan motor. The No. 9 process pump motor in Building 181-F which failed on October 5 and had to be sent offsite for repairs was returned and is back in service.

Mechanical activities at Building 105-F included repairs to four crossheader-to-riser connections and one cracked riser; foaming the Omega gas seal at five locations; repairing a hole in the neoprene seal; repairing two cracked crossheader-to-pigtail fittings using standard snorkel fittings; and completing fabrication of storage basin mattress plate hold down clamps.

Mechanical activities in the Power facilities included overhauling the No. 9 process pump in Building 181-F, both alum pumps in Building 183-F, and No. 9 pump and turbine in 190-F.

H REACTOR OPERATION

Reactor outages included a low pressure scram caused by the H-1 Loop, two Panellit scrams, and a process tube leak outage. In addition, three short outages occurred during reactor startup periods. The reactor was also down at the beginning of the month for the remainder of the extended tube replacement outage started in November, and at the end of the month for the process tube leak outage.

DECLASSIFIED

DECLASSIFIED

HW-75931

Tests of combustible gases in the Number 2 main transformer bank at 151-H indicated concentrations higher than normal. Continued testing verified a decrease of these concentrations. A schedule of continued surveillance was placed into effect and it now appears that a stable, satisfactory condition has been achieved.

The 190 annex pump Number 3 was removed from service during reactor operation for a 16-hour period to repair a leaking carbon seal. An inspection of the pump impeller assembly revealed a loose shaft sleeve as the cause of a misalignment problem. Repairs were completed and the unit was returned to normal service.

A continuous air sample system was installed to facilitate the procurement of samples from various locations in the 105 Building as required to monitor and control air contamination.

KE-KW REACTOR OPERATION

In addition to continuation of the unscheduled outage started in November, KE Reactor experienced seven outages. Those which resulted in significant outage time were a planned outage for metal processing and a shutdown to investigate the integrity of a damaged front face connector. The five other outages of short duration were caused by a front face cap leak, insufficient reactivity at turnaround, a Panellit trip and two KER trips.

KW Reactor outages included a scheduled outage for metal processing and one caused by a Panellit trip due to a leaking Bourdon tube. The latter outage was extended approximately 14 hours to repair binding horizontal control rods and for thermal shield maintenance.

Both reactors initiated programs to correct the higher than normal thermal shield temperatures being experienced. As a part of the effort, spline caps were installed on selected process tubes at each reactor to allow for poison spline insertion, and selected shield cooling tubes were cleaned and flow checked. At KW Reactor, 20 feet of bottom thermal shield water supply line was cleared of corrosion build-up using a rotating knife and flexible cable assembly. Installation of cast stainless steel lug rings on the front face of KW Reactor was completed.

The 112-foot section of crosstie piping between the V-72 valve and the riser connection point at KE Reactor was descaled using sulphuric acid. This is the first step of a planned program to clean the entire KE-KW high pressure crosstie system. The over-all program is designed to improve the hydraulic characteristics of the 100-K coolant back-up system.

DECLASSIFIED

DECLASSIFIED

HW-75931

APPLIED REACTOR ENGINEERING

MAINTENANCE PRACTICES

The inventory of B-D-F type aluminum tubes is approximately 2,300. Other tubes on hand include 300 C-type aluminum, 319 K-type aluminum, and 99 K-type Zircaloy.

Thirteen Equipment Maintenance Standards were issued.

SPECIAL OUTAGE SERVICE

During the splitting operation on a total of 585 tubes, only two stuck splitters were experienced. No problems occurred on removal.

The newly designed gunbarrel knocker was placed in use at C Reactor. The tool performs well and largely eliminates the safety hazards previously encountered.

The personnel exposure required to date for tube replacement was 40 mr per tube for craftsmen and 13 mr per tube for supervisors.

Manager, Manufacturing

OC Schroeder:DLD:ng

DECLASSIFIED

DECLASSIFIED

HW-75931

PRODUCTION FUELS

MANUFACTURING

Current Operations

Production

Statistics - AlSi Shop

<u>Current Month's Production</u>	<u>NATURAL</u>				<u>ENRICHED</u>				<u>Total</u>
	<u>C</u>	<u>K</u>	<u>Reg.</u>	<u>Bumper</u>	<u>C</u>	<u>K</u>	<u>Reg.</u>	<u>Bumper</u>	
Acceptable Fuel Elements Produced (Tons)	99.0	167.2	143.0	2.8	1.3	22.5	12.2	139.9	587.9
As % of Forecast Production	150	93	115	3	-	150	-	130	100
Cum. % of Forecast for Current Quarter	81	139	98	73	78	100	146	97	100
As % of Past 3 Month's Average Production	341	100	119	2	6	75	53	388	105
As % of Past 12 month's Average Production	291	72	135	3	9	49	100	451	102
% of Forecast Achieved Last Fiscal Quarter	82	123	134	98	57	64	320	134	108
% of Forecast Achieved Last 4 Fiscal Quarters	75	120	126	76	77	98	145	110	105

Operating Efficiency

Current Month (%)	98.7
Forecast (%)	95.0
Previous Month (%)	99.2

Manufacturing Yield

Current Month (%)	92	87	92	97	92	91	86	84
Forecast (%)	90	90	90	85	90	90	90	85
Previous Month (%)	-	90	91	83	88	90	-	73

Bare Uranium Available for Processing (Tons)	627
Finished Products in Storage (Tons)	1145
Work in Process (Tons)	185
Special Products Finished (Pieces)	
4" Boll-I&E	2110
Uranium Utilization	97.5

DECLASSIFIED

DECLASSIFIED

HW-75931

MANUFACTURING

MATERIALS

Production

A total of 588 tons of natural and enriched fuel elements were produced during December, 100 per cent of forecast.

Yields and efficiency for December were as follows:

	<u>December</u>	<u>Forecast</u>	<u>Variance</u>
Eight-inch I&E yields	90.0%	90%	0
Six-inch I&E yields	90.1%	90%	+0.1%
Operating Efficiency	98.7%	95%	+3.7%

Projection elements produced during December totaled 140 tons of six-inch fuel and 5 tons of eight-inch fuel elements. The yield on the six-inch material was 84.1 per cent. The welding yield on this fuel was 97.0 per cent.

Production and reactor charging for December and to date are as follows:

	<u>December, 1962</u>		<u>To Date</u>	
	<u>Natural</u>	<u>Enriched</u>	<u>Natural</u>	<u>Enriched</u>
Tons Produced	5	140	1831	925
Tons Charged	33	19	1700	712
Tons Finished Inventory	131	213	131	213

Nine canning lines were operated during the month for a total of 175.5 canning line shifts operated.

Production of the enriched fuel elements and lithium-aluminum elements for the E-N test loading program has been completed.

A total of 2110 lithium-aluminum four-inch elements were placed in storage during the month.

Inventories

Bare inventory is 627 tons, a 0.9 month's supply. This figure does not include 289 tons of dingot material.

Finished inventories totaled 1145 tons, a 1.7 month's supply. This figure excludes 105 tons of dingot material.

Scrap

Three scrap shipments totaling 28 tons of natural and 19 tons of enriched scrap were made and one shipment of 420 empty boxes with lids was made during the month of December.

DECLASSIFIED

C-2

DECLASSIFIED

HW-75931

ALSI SHOP

Production

Production was scheduled through the ALSi Shop at the rate of nine (9) canning lines per day during the entire month of December. Approximately seven (7) hours of production, or 5000 pieces, were lost as a result of the shop being shut down half a day on each shift on Friday, December 21. Canning line operating efficiency for the month was 98.7%, which is down slightly from last month's record high of 99.2%. Canning line operating efficiency has averaged 97.5% for the entire year and is an all-time record high.

K5N Production

At month-end approximately 4400 K5N pieces were in process awaiting self-support rails. Emphasis will be placed on processing this material through the ultrasonic welders so that 3800 good pieces will be available for charging in the KW Reactor during the latter part of January or early February.

The production of K5N material this month revealed the following problems in the Finishing Operation:

- 1) High marred surface rejection rate due to 10 mil limit on cap end and base end mating circle. These are caused mainly by fuels bumping each other on curved conveyor sections.
- 2) Difficulty of getting lathe inserter rod into chimneys that are slightly bent.
- 3) Facing tool on #4 lathe causes chip to curl and go into the spire and mar the can wall.
- 4) Welding problems associated with self-support material have been of great magnitude. The attempt to put a sizing die on the welder was unsuccessful in that the ejector rod did not have sufficient force to push the fuel element through the die. A prototype lubrication feature was added but this also failed to accomplish the task. The latest approach is to use the shear tester rollers for sizing. This appears to be a workable solution with the exception that it is doubtful if a circle diameter of 1.712 or less can be maintained or assured. Additional engineering and development work is necessary before the present process is acceptable for routine production.

Fuel Recovery

The following pieces were processed through the Fuel Recovery facilities during December:

8" I&E	11,364
6" Enriched	<u>13,209</u>

24,573

DECLASSIFIED

DECLASSIFIED

HW-75931

MANUFACTURING MAINTENANCE

Bumper Welding

The bumper welding process has been fairly stable during the month of December. Yields through the welder have exceeded 97%.

The following modifications have been initiated to improve welder reliability and simplify set-up: (1) Installation of the key hole type slides, (2) installation of the "universal" type retractable collars, (3) installation of the "universal" floating collars, and (4) revision of control circuitry to improve welder performance.

Semi-Automatic Welders

Circuit modifications were made on all semi-automatic welders to prevent the cycle timers from getting out of sequence with the welder spindle. Since conversion to the D.C. weld current source, the welder control circuitry has been such that if the operator failed to hold the start button down for a sufficiently long period of time this out-of-cycle condition could exist. The modification eliminates the possibility of this out-of-process condition and resultant weld defects which were not readily detectable at weld inspection.

UT-2 Testers

Tester down time for December was approximately 29 tester hours and availability was slightly under 90%. The performance this month was essentially the same as last month and there were no prolonged outages sufficient to cause canning line down time.

UT-4 Testers

The tester down time for December was approximately 34 tester hours and availability was approximately 88%. This represents a 3% increase over November availability. The mechanical portion of this test needs further improvement. Replacing some of the bushings with ball bearings, revision of the test head and cam assembly will definitely improve the maintenance characteristics of this equipment.

UE-1 Testers

The tester down time for December was approximately 38 tester hours and the availability was slightly under 87%. This represents a 3% loss over the November availability; however, there were no outages of sufficient duration to result in canning line down time.

DECLASSIFIED

DECLASSIFIED

HW-75931

FUELS ENGINEERING

Rupture Summary

Eight regular production I&E fuel elements failed in the reactors during December. A summary of these ruptures is as follows:

<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>
Natural					
Non-bumper	3465-B	591	Side Hot Spot	12/13/62	5/28/62
Non-bumper	3162-B	459	*NA	12/23/62	7/31/62
Bumper	1064-D	831	Hole	12/22/62	6/22/62
Bumper	3265-D	836	Hole	12/22/62	7/16/62
Bumper	1077-D	657	Side Other	12/27/62	8/31/62
Enriched					
Bumper	1478-D	736	Hole	12/7/62	5/3/62
Bumper	0674-F	910	Side Other	12/7/62	7/26/62
Bumper	0658-F	*NA	*NA	12/30/62	7/26/62

*NA - Information not available.

There is additional evidence that the increased incidence of side other and hole failures of the past several months is corrosion related. Radiomet examination of an enriched bumper hole failure (3967-D, 10/7/62) indicated the failure was caused by groove pitting in the spire; the external can wall was also extensively groove pitted. Six other recent hole failures are scheduled for radiomet examination. Three side other failures (1364-F, 11/14/62; 3867-F, 11/22/62; and 064-F, 12/7/62) were apparently caused by groove pitting. Characteristically, the side other failures have occurred in charges without water-mix pieces, while the hole failures have occurred in charges with water-mix pieces. This suggests that the probability of failure due to this "corrosion" mechanism is extremely sensitive to temperature.

Uranium Technology

Oil Quench Ingot Program

Approximately 22 tons of hollow core blank heat treated, oil quenched natural uranium ingot fuel elements were discharged as of December 1, at goal exposure and 25 tons were being irradiated. About 75 additional tons of oil quenched cores are to be irradiated under the existing production test. Only 30 tons of this material are scheduled for delivery from NLO in December and early January. Preliminary evaluation of 14 columns of alternate oil and water quenched cores exposed to 800 MWD/T indicates that oil quenched cores are dimensionally more stable. A complete analysis of this data is expected to be completed in January, 1963.

DECLASSIFIED

DECLASSIFIED

HW-75931

Evaluation of oil quench natural ingot cores will continue in 1963 on a PITTA basis at a nominal rate of 25 tons per month. Approximately 700 oil and 700 water quenched enriched cores machined alternately from alpha rolled rods are currently being fabricated by NLO for reactor testing.

Dingot Program

As of December 1, alloyed dingot OIIIN fuel elements undergoing irradiation and discharged at goal exposure were as follows:

	<u>In-Reactor (Tons)</u>	<u>Discharged (Tons)</u>	<u>Total Number of Failures</u>
Old Reactors	15	1481	29
K Reactors	3	297	0

Although only a small amount of dingot cores remains in the reactors, 105 tons of canned OIIIN dingot fuel elements and 268 tons of bare OIIIN dingot cores are being held in storage that will ultimately be irradiated. The bare core inventory includes 50 tons of dingot cores from alpha extruded rods. In addition, the feed sites have 957 tons of dingot metal in inventory that were scheduled to be fabricated into OIIIN cores. No decision has been reached between HAPO and the AEC as to the disposition of this material.

Eight-Inch Diameter Ingots

Conversion to eight-inch diameter ingots at NLO will be completed by January 2, 1963. A blanket waiver has been issued to permit either seven or eight-inch diameter ingots to be cast for the production of uranium cores until specifications are revised. The major advantages of casting eight-inch diameter ingots are:

- 1) A 10% increase in throughput capacity without any equipment changes.
- 2) A larger diameter to height ratio which aids in removal of impurities during solidification of the ingot.
- 3) An annual savings of about \$100,000 due to generation of less scrap.

AlSi Process Development

Projection Fuel Program

Approximately 2200 tons of bumper fuel elements have been charged to date in the old reactors and 1590 tons discharged at variable goal exposure. Forty-two (42) ruptures have occurred in conventional bumper loadings and fifteen (15) in a previous H Reactor E-N loading. None of these ruptures have been of the "hot spot" type bumper fuel was designed to prevent. Six ruptures (3 natural and 3 enriched) were sustained this period at exposures ranging from 657 to 910 MWD/T. Three were classified as "hole" failures, two as "side other" and the other has not been examined. The over-all performance of bumper fuel is about 1.8 times better than non-bumper fuel.

DECLASSIFIED

C-6

DECLASSIFIED

HW-75931

About 2400 feet of elliptical bumper strip (27 rails per foot) received in November was accepted and the vendor was authorized to proceed with balance of order (-750,000 rails). The strip on hand is being used to complete testing of the prototype elliptical rail feeder. In order to further improve the reliability and operation of the feeder, the following revisions are being made:

- 1) Tooling is being modified to provide a more positive "hold down" of rail ends during welding to prevent curling.
- 2) The mechanism for punching the rails out of the strip is being revised to assure automatic indexing across missing rails in the strip. Although this feature was incorporated in the initial design, the lexan punch and sensing element did not stand up under extended use.
- 3) Design and install a better method to cut off and dispose of strip after rails are removed.

Sufficient elliptical bumper strip is expected by mid-January to begin producing preliminary quantities of elliptical bumper fuel for irradiation.

Irradiation of overbore and regular self-supported fuel elements in the C Reactor test facilities progressed without incident during this period. A summary of the irradiation status is shown below:

	<u>Total Pieces In-Reactor</u>	<u>Total Pieces Discharged</u>	<u>Ruptures</u>	
			<u>*Side Other</u>	<u>Core Split</u>
Overbore (CVIN)	1,386	4,281	2	**5
Regular (CIVN & CVN)	2,208	14,488	1	0

*External cladding corrosion failures caused by broken or damaged projection rails of former design.

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

Welding and post-sizing of projection rails on KVN fuel elements were started this period in the ALSi Shop to establish process capability for meeting specified minimum projected rail height (0.92") and maximum projected diameter (1.710"). Attempts to size the rails through a slotted die mounted ahead of the discharge conveyor on the ultrasonic welder were unsuccessful due to 1) insufficient capacity of ejection cylinder and 2) inability to control rail height and projected diameter within the specified dimensions. An alternate method of sizing is being incorporated in the rail weld shear test station for evaluation. If this method does not produce the desired results, it is planned to size the rails, as required, after final inspection.

Evaluation of a modified single-dimple, arch-type rail design as a potential alternate for the K5N three-dimple, collapsible bridge self-support rail design indicates this rail will completely collapse under static loads of about 800 pounds, as compared to 1,000 pounds for the collapsible bridge rail.

DECLASSIFIED

DECLASSIFIED

HW-75931

Lengthening the dimple did not significantly improve the strength of the arch-type rail. As previously reported, the head spacing of the ultrasonic welders requires that the length of the KVE self-support rail be reduced from 2-5/16 inches (KVN) to 1-7/8 inches. Choice of rail design for the KVE fuel model currently depends on the relative resistance of a two-dimple, collapsible-bridge rail and a single-dimple, arch-type rail to deflection loads. Fabrication of these rails for comparative tests is being expedited to finalize design early in January.

E-N Program

Fabrication of OIII enriched fuel elements for the E-N load began on November 19. Major canning process changes recommended and adopted to upgrade enriched fuel quality for this loading were: 1) increase duplex bath lead temperature from 616°C to 625°C, 2) maintain canning bath temperature above 586°C, 3) apply maximum can-sleeve assembly vibration frequency and pressure-quench pressure, and 4) reduce end-closure welder speed with double pass welding. In addition, the non-destructive testers are being operated under more stringent control procedures and tighter rejection limits. All possible data is being logged from the testers to analyze fuel lot variations. Sub-standard lots will be diverted from the E-N load.

Although it is not feasible to measure the true effects of the various process changes on enriched fuel quality either through comparison of current or past non-destructive test or reject data, the following observations have been made:

- 1) Enriched fuel quality is being more thoroughly screened and upgraded by the tighter non-destructive test reject limits.
- 2) The UT-4 closure test reject rates did not increase appreciably with tighter reject settings, indicating an improvement in closure quality.
- 3) Residual can wall is not significantly reduced by slight increases in canning temperatures. A higher tube wall reject rate is believed to be due to increased spire wrinkling at the higher canning temperature.
- 4) A canning line oriented internal bonding condition was experienced similar to that for dingot uranium. From 82-96 per cent of the internal bond rejects were from canning line 2, even though there was no apparent difference in process parameters between lines.
- 5) Weld closure pinhole rejects were significantly higher for the enriched fuel than for the natural fuel production. Slower weld speed, double pass welding, and the use of 3X magnification at weld inspection contributed to the higher rate.

AlSi Slopover Problem

A high incidence of AlSi rejects in the AlSi Shop has created a serious yield problem. As a temporary solution to this problem, a technique was developed for applying an aqueous solution (8 oz./gal.) of PX1288 (an experimental commercial product) to the exterior upper grooved section of the aluminum cans after component cleaning, and allowing to dry five (5) minutes before inserting

DECLASSIFIED

C-8

DECLASSIFIED

HW-75931

cores in sleeves for canning. Application of the solution prevents wetting of the aluminum surface with molten AlSi, with the added surface tension restricting any flow of AlSi between the cans and sleeves during canning. A feasibility test was run on December 6, in the AlSi Shop to determine the effectiveness of the PX1288 solution under actual production conditions. Canning lines 1 and 2 were chosen for the test due to the consistently high AlSi reject rate on the OIIIE E-N material being assembled on these lines. The following results were obtained:

<u>Canning Line</u>	<u>AlSi Slopover Rejects (%)</u>	
	<u>Normal Process</u>	<u>Coated Cans</u>
1	4.3	0.2
2	8.4	1.6

No increase in weld rejects was detected for the test material. Non-destructive test and autoclave test results were not affected.

On December 7, a Process Work Request was initiated to evaluate the use of PX-1288 solution on all production with the following results:

<u>Date</u>	<u>AlSi Slopover Rejects (%)</u>					
	<u>OIIIE</u>				<u>OIIIN</u>	
	<u>Line 1</u>		<u>Line 2</u>		<u>All Lines</u>	
	<u>Normal Process</u>	<u>Coated Cans</u>	<u>Normal Process</u>	<u>Coated Cans</u>	<u>Normal Process</u>	<u>Coated Cans</u>
12/7/62	5.6	0.23	6.8	0.65	2.3	---
12/10/62	1.4	0.0	1.9	0.26	3.3	---
12/11/62	---	0.08	---	0.08	---	0.18
12/12/62	---	0.64	---	0.88	---	0.06
12/13/62	---	0.40	---	3.1	---	0.10
12/14/62	---	0.61	---	1.6	---	0.29

Based on the above data, it is reasonable to expect that the AlSi slopover reject rate can be reduced to less than 0.5 per cent. The possibility of using this technique to eliminate the need for can grooves will be investigated. This would mean an additional cost savings on components, since the grooving adds about three (3) cents per can.

Overbore Fuel Process Optimization

Because of an abnormally high braze closure reject rate (10 - 33.5%) experienced during the initial UT-4 testing of overbore (CVINS) fuel elements, a program has been initiated to determine the effects of the canning and duplex furnace process parameters on braze integrity. Since the present process was developed on the basis of total bond count data, overbore fuel process parameters will be re-established to yield maximum closure quality. Preliminary data indicates a majority of the defects are in the cap end braze zone.

DECLASSIFIED

DECLASSIFIED

HW-75931

Other AlSi Bonding Studies

Heating rate measurements on all fuel component models have shown that the present 45 second canning cycle does not provide sufficient time for the base of the can to reach canning bath temperature prior to submersion. Induction heating is being investigated as a potential supplemental heating source to achieve the desired can base temperature. An initial attempt to design a suitable induction rail for this purpose was unsuccessful. A coil incorporating a flat pancake section around the can-sleeve base has been fabricated for further testing.

New Water-Mix Spool Design

A preliminary study is being made to determine the feasibility of fabricating a helical fluted water-mixer spool, which incorporates a target element. Prototypes of the spool are being fabricated for physical testing and feasibility studies. The estimated direct cost of the new spool is \$1.20, and approximately \$2.60 for assembly of target element and welding to a uranium fuel element.

Alternate Process Development

Hot Press

An order for 1000 CVE enriched (.94%) hot press bonded fuel elements was placed with Sylcor in July, 1962. Fabrication of these fuel elements was started in November. Partial delivery of approximately 500 fuel elements is expected in January, 1963.

A rupture sustained in HAPO hot-press fuel elements irradiated under IP-490-A-FP during September is being examined in the Radio-Metallurgy facility. Preliminary visual examination has revealed two additional penetrations of the cladding in addition to the two observed at the time of failure, all under unique and separate self-support rails. Examination thus far has not established a definite failure mechanism.

Fluid Pressure Bonding

Assembly of 128 fuel elements for pressure bonding in Battelle Memorial Institute facilities (Contract DDR 149) to optimize process parameters has been started. All of the uranium cores have been nickel plated. It is expected that the pieces will be ready for shipping to BMI early in January, 1963.

Hot-Die Sizing

The objective of the current testing program is to obtain an adequate end bond on fuel assemblies after sizing by end bond pressing techniques. Two tests, started in November, have been completed and evaluation is nearly complete. These tests were based upon the containment die principle using pressure, time and temperature to accomplish a diffusion bond. Variables tested were as follows:

DECLASSIFIED

DECLASSIFIED

HW-75931

Test I

Variable	Range
Pressing Time*	30, 105, 108 sec.
Bonding Die Temperature	560, 600, and 640°C
Pressure	1.7, 2.2, 2.8 tons/in. ²

*Pressing time was reduced by preheating the fuel assemblies to approximately 400°C in an auxiliary furnace at 680°C for 5 minutes.

Test II

Variable	Range
Pressing Time	5, 7, 9 min.
Bonding Die Temperature	560, 600 and 640°C
Pressure	1.7, 2.2, 2.8 tons/in. ²

Based on available data, the following conclusions have been made:

- 1) Lowest end bond counts were obtained using a combination of high temperature, long pressing time and high pressure. (End bond counts were measured with a device similar to the ultrasonic bond tester.)
- 2) There is good correlation between end bond count and destructive metallographic examination of the bond. Well bonded elements had low counts and non-bonded elements had very high counts.
- 3) External bond strengths at positions 1-1/2 inches from each end of the fuel elements were weaker than those measured 3/4 inch from each end and at the center point. A comparison of the average bond strength data for the two tests is shown below:

Test No.	*Average Bond Strength				
	3/4" From Cap	1-1/2" From Cap	Center Point	1-1/2" From Base	3/4" From Base
1	739.6	585.3	930.9	570.3	934.5
2	777.8	459.7	901.0	450.1	908.8

*Bond strength is the pounds of force required to pull a stud 0.190 inches in diameter.

- 4) Time and temperature both affected bond strength 1-1/2 inches from each end. Shorter pressing times and lower temperatures gave higher bond strengths.
- 5) Nickel-aluminum diffusion layers produced by the end bonding press resemble a typical hot press bond.
- 6) Nickel-aluminum diffusion thickness increases with time and temperature. At long time and high temperature, increased amounts of the undesirable Ni₂Al₃ layer were observed.

DECLASSIFIED

DECLASSIFIED

HW-75931

- 7) Cracking was observed in the nickel-aluminum diffusion layer. The severity of cracking increased with time and temperature. It is believed that cracking is due to stresses caused by combinations of high temperature and pressure, and the resulting increased interference fit between the fuel element and the die.
- 8) The best end bonding was produced on the base end because of less nickel oxide present. Continuity of end bond diffusion layers depends on the degree of intimate contact between the end cap and the amount of oxide present.
- 9) The most continuous end bonds were produced at high temperatures and pressures.
- 10) Cap-can and cap-spire junction closure bonding has not been completely evaluated, but appears to be good at high levels of temperature and pressure.

Preliminary end bonding runs were also made using a differential expansion die concept. End pressures up to 7 tons/in.² were applied to test pieces with good results in respect to surface appearance. During earlier tests with containment dies, pressure was limited to 2.8 tons/in.² because considerable galling and up-setting resulted. However, use of the new dies has eliminated this problem and is expected to improve operation of the end bonding press.

Die configuration in the sizing operation is believed to have a significant effect on metal flow and clad to core bonding. Nine additional sizing dies have been fabricated to test the effects of approach angle and land length variations.

Electroplating Nickel on Uranium

Metallographic examination of fuel elements prepared by three electroplating pretreatment processes revealed differences in the roughness of the uranium surfaces, but no consistent features that would account for the observed differences in bond strength. Samples examined included sections of the stud-pull area of both high strength and low strength from fuel elements prepared by the following retreatment processes:

- 1) A process (standard) - two minute water spray rinse, water dip rinse, six minute immersion in 7.5 - 8.0 M HNO₃ @ 40°C.
- 2) B process - water dip rinse, 1/2 minute immersion in 8 - 10 M HNO₃ @ 65°C, 1-1-1/2 minute immersion in 7.5 - 8.0 M HNO₃ @ 40°C.
- 3) C Process - water dip rinse, 1-1/2 minute immersion in 11 - 12 M HNO₃ @ 25°C.

Only bonds which fractured at the uranium-nickel interface were considered. The high strength (1170 - 1300 lbs. of force on 0.19 inch diameter stud) "A" process samples fractured at both the Ni-Al and Ni-U interface. There was some evidence of fracture within the nickel and within the uranium.

DECLASSIFIED

DECLASSIFIED

HW-75931

The low strength (660 lbs. of force) "A" process samples exhibited the same fracture characteristics. No significant variation was observed in type of fractures from the "B" or "C" processes. The "B" process samples exhibited the lowest median and minimum bond strengths and had the least amount of surface roughness. However, it seems unlikely that surface roughness alone could account for these differences in bond strength.

The chemical compositions of all process solutions were maintained within specified limits throughout the test, except the deionized water, which resulted in a nickel surface staining problem. Plate adhesion, as determined by mechanical removal of plate from one out of 20 pieces appeared to be excellent. Plate discontinuities, tested on pieces by a 30-minute exposure @ 600°C in an air atmosphere, had a maximum of 3 discontinuities ($\approx 1/16$ inch diameter) from rack contact points on the interior surface. Fuel elements prepared in early work exhibited a maximum of 9 discontinuities per piece.

Further testing and modification of a prototype plating rack was carried out. A total of 20 pieces were plated. Six of the fuel elements showed no discontinuities in the nickel after 30 minutes @ 600°C in an air atmosphere and two pieces showed no discontinuities after being clad with aluminum and chemically stripped three times. With minor modifications, it appears that this rack offers the necessary potential for eliminating discontinuities in the plate.

DECLASSIFIED

DECLASSIFIED

HW-75931

QUALITY CONTROL

Yield Control

	<u>November Yield</u>	<u>December Yield</u>
8-inch I&E	89.9	90.0
6-inch I&E enriched	89.6	90.1
8-inch I&E bumpered	83.1	96.7
6-inch I&E bumpered	72.9	84.1

Production of 6-inch bumpered fuels for the first E-N load was concluded on December 18, 1962. The more stringent UE-1 and UT-4 reject limits imposed on this material have caused a yield loss of approximately 6 per cent; however, the UE-1 and UT-4 rejects were retested using normal limits -- for other than the internal bond test -- and the acceptable pieces were used for non E-N load production. The E-N load limits were used for internal bond re-testing.

Porosity in the cap weld bead has been a serious problem during the month. This condition has been found in welds made at 12 rpm and in welds made at 20 rpm. Investigation of this problem is continuing with attention now being diverted to examination of possible sources of contamination in the shielding gas, uranium cores, or braze metal.

Autoclave Failure

There were three autoclave failures during the month, all of which resulted from closure welder problems.

The first failure was experienced in Lot CY-005-E on December 3, 1962. Water entry into the core was gained through a small burned area on the base end of the element. The burned area was caused by a malfunction of 1-E semiautomatic welder that permitted the mechanical portion of the welder to move into the retract position before the electric arc had been turned off.

The second failure occurred in Lot KB-092-A on December 19, 1962. Water entry occurred as the result of a welder contact pad burn near the base end.

The third failure occurred in Lot SZ-065-J on December 26, 1962. This fuel element had been welded on the edge of the base and water entry resulted from an arc strike on the can wall adjacent to the weld.

Test Reactor Operation

Routine fuel element production testing backlog has been reduced from last month's figure of 10 days to a current figure of 7 days of reactor time. This reduction was aided by the adoption of a modified testing procedure.

Approximately 18 per cent of the over-all reactor operating time was made available and utilized for special testing purposes.

DECLASSIFIED

DECLASSIFIED

HW-75931

The fourth phase of the Hanford Test Reactor training program on "Reactor Instrumentation" is currently underway with R. E. Rowley as instructor.

There was no reactor down time as a result of equipment failure or for maintenance.

Identification Stamps

The canning line identification stamps have been in use on all six lines for six weeks. The capability of the stampers to produce markings of the required depth and location has been found to be well within product specification limits.

First E-N Load

Analysis of variables data recorded at the UT-2, UT-4, and UE-1 test stations is continuing. Study of this data shows an increase in the internal bond count in the E-N material. Comparison of the internal bond count level in individual lots has resulted in a recommendation that two lots be removed from the E-N load because of questionable internal bond quality.

Fractured Internal Bond in E-N Material

Total bond count was used as a basis for rejection during testing of this material. Total count data indicates significant variation between canning lines in the quality of the internal bond. Examination of a limited number of fuel elements having a high bond count revealed that fractured bonding was a frequent cause of high total count. While the internal bond test, using total count rejection, has been effective in screening out fractured bonds and other defects, the yield has been reduced by the fractured bond type of defect.

DECLASSIFIED

DECLASSIFIED

HW-75931

PLANT FACILITIES

Status of Active Construction Projects

CAF-954 - High Pressure Autoclave Development Facility

Issuance of the design criteria for Commission approval is scheduled during January, 1963.

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

Design funds have been made available to the local AEC. However, release of these funds is contingent on current discussions and correspondence to assure that the recent reorganization in 300 Area will not affect the justification for the facility.

CAF-973 - Steam Distribution Line Modifications - 300 Area

A letter was forwarded to the Commission explaining the effect of future PRTR steam utilization on the scope of this facility. Questions from the local AEC were satisfactorily answered by this letter, and further fund authorization should be made in the very near future.

CGF-979 - Pilot Scale Plating Equipment - 300 Area

A design criteria was issued and approved by the local AEC on December 20, 1962. Further fund authorization is expected in the very near future.

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

The project proposal was returned by the local AEC on December 5, 1962, for further study relative to gas reliability, long-range pricing comparison, PRTR steam utilization, and alternate fuel sources. Answers to questions proposed in the official letter of transmittal should be ready for issuance by January 31, 1963. This project is now considered a FY 1964 PAC budget item, and we have been informally advised that construction funds would not be available prior to October, 1963.

Drafting and Duplicating

<u>Duplicating Production</u>	<u>December</u>	<u>November</u>
914 Copier Masters Prepared	348	345
914 Copier Copies	14,040	23,569
Multilith Impressions	252,326	281,431
Ozalid Copies	6,439	7,931
Number of Pages Collated	145,658	200,520
Number of Orders Processed	1,120	1,380

DECLASSIFIED

DECLASSIFIED

HW-75931

Drawings Produced

	<u>December</u>	<u>November</u>
New	44	65
Revisions	109	185
Small Charts	4	1
Large Charts	5	1
Miscellaneous	30	32

UtilitiesStatistics

	<u>December</u>	<u>November</u>
Average Steam Generated (M lbs/hr)	84	70
Maximum Steam Generated (M lbs/hr)	128	106
Total Steam Generated (M lbs)	60,323	51,928
Coal Consumed (tons)	2,902.27	2,505.45
Evaporation Rate (steam/lb coal)	10.39	10.36
Efficiency - Actual	69.9%	70.5%
Efficiency - Theoretical	74.0%	74.5%
No. of Boilers on:	2	3
Date of Change:	22	

Facilities and Equipment Experience

Major overhaul of the Number 2 air compressor is underway. It was found that the cylinder was badly scored and it was sent to the J. A. Jones shop for re-boring. A new oversize piston and rings will be installed as soon as received. Compressors number 3 and 4 were permanently removed by construction crews. These two compressors are being replaced by the new larger capacity number 6 whose installation will be completed in January. Only minor details currently delay final acceptance from the CPFF construction contractor.

Data Collection Equipment

A demonstration to show the potential benefits of data collection equipment was set up in the 313 Building. The purpose of the demonstration is three fold: (1) to show that data collection equipment can be quick, accurate, and effectively utilized for all information currently collected on time distribution cards, (2) to demonstrate that pre-punched cards utilized in the test can provide additional information easily and automatically that could not be obtained otherwise without considerable effort, (3) to illustrate that work measurement, utilizing average historical task times, is a feasible and productive manner to approach the problem of controlling maintenance costs and laying a foundation for planning, scheduling, and measuring approximately 75 per cent of all manufacturing maintenance craft activity. If the demonstration is fully successful, item 3 will provide justification for the procurement of data collection.

Wm Mobley
Manager, Production Fuels

WM Mobley:PCR:mflj

DECLASSIFIED

DECLASSIFIED

HW-75931

RESEARCH AND ENGINEERING

PROCESS AND REACTOR DEVELOPMENT

REACTOR FUELS

Projection Fuel

The two columns of self-supported KVNS elements in KW Reactor are currently estimated to have an average tube exposure of 100 MWD/T. To date, a total of 532 fuel elements have been discharged from the two smooth-bore zirconium tubes in KW Reactor.

Alternate Process Development - Diffusion Bonding

The HAPU hot press failure from tube 3680-C is being examined in Radio-metallurgy Laboratory. The element had been initially identified as having two failure areas, each located under a support rail with the ruptured areas no larger than a dime. Examination has revealed that a total of four penetrations of the cladding occurred. The two, newly-found ruptured areas are in the same general locations as the other penetrations - under a support rail.

REACTOR ENGINEERING

Zircaloy-2 Process Tubing Deliveries

Two shipments of Zr-2 process tubes have arrived on-site, for a total delivery of 99 tubes. Approximately 50 more tubes have been accepted at the vendor's plant.

On-Reactor Drilling Tests - K Reactor Retubing

Eight channels were drilled with the six-foot tapered bar drill at KE Reactor in November, under authorization of PT-IP-547-A. Difficulty in inserting the drill through the front gunbarrels necessitated the use of a universal joint between the drill and the drive shaft instead of the intended solid coupling. Channel diameter measurements after drilling showed that approximately 0.3 inches of graphite had been removed from the top of the channel in the center.

Borescope observations before drilling showed about the same extent and type of trunnion block fracture as had been previously observed at both K Reactors. Borescope observations after drilling showed again that block fracture was aggravated by drilling.

The eight drilled channels are located in a 3 x 3 block. A front-to-rear thermocouple stringer has been installed in the center of the drilled zone. A similar thermocouple stringer was installed on the same row for purposes of evaluating the effects of drilling on graphite temperatures.

DECLASSIFIED

DECLASSIFIED

HW-75931

STATUS REPORT OF PRODUCTION TESTS

Test No.	Type Metal	Tubes	Reactor	Goal Exposure	Current Exposure	Remarks
IP-216-A	Normal prod. natural & enriched fuel elements	90	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		Provide preliminary qualitative data regarding irradiation behavior of larger fuel element designs.
IP-409-A	I&E self-supported fuel	2	KW	600 MWD/T	100 MWD/T	Provide qualitative data to confirm the fuel geometry design. Two columns discharged 12-3-62, short of attainment of goal exposure in test of new charging machine.
IP-423-A	Oil-quenched natural uranium I&E fuel elements	120	F	Variable		Provide a comparison of dimensional stability of standard water-quenched uranium fuel cores and oil-quenched cores

FUEL DESIGNATION CODES

N1E1 N Reactor, inner tube, enriched uranium, first model
 N1N1 N Reactor, inner tube, natural uranium, first model
 NAE1 N Reactor, concentric tube assemblies, enriched uranium, first model
 O1IN Old Reactors, second I&E model, natural uranium element
 O1IINB Old Reactors, third I&E model, natural uranium bumper rail element
 O1IIEB Old Reactors, third I&E model, enriched uranium bumper element
 C1IN C Reactor, second I&E model, natural uranium element
 C1IVNS C Reactor, fourth I&E model, natural uranium self-support element
 C1VNS C Reactor, fifth I&E model, natural uranium self-support element
 C1VINS C Reactor, sixth I&E model, natural uranium self-support element
 KVNS K Reactor, fifth I&E model, natural uranium self-support element

DECLASSIFIED

D-2

DECLASSIFIEDREACTOR PHYSICSUranium Recycle

The per cent of recycle fuel in the enriched fuel present in the reactors at the end of November and discharged during November are given below.

Per Cent of Recycle Fuel in Enriched Fuel

	<u>B</u>	<u>C</u>	<u>D</u>	<u>DR</u>	<u>F</u>	<u>H</u>	<u>KE</u>	<u>KW</u>
Nov. 30 Status	~100	100	100	99	100	96	100	100
Nov. Discharge	~100	100	100	97	97	100	100	100

New Digital Kinetics Code

The space-dependent, reactor kinetics, digital computer code CLUMSY continues to provide results which agree very closely with previous analog calculations. For example, an eleven-node reactor simulation was used to study a nuclear transient which had previously been studied on the analog computer. The analog gave a maximum outlet coolant temperature of 145 C in the excursion; CLUMSY gave 146.8 C, well within the accuracy of the analog results.

RADIOLOGICAL ENGINEERINGRadiation Control Experience

The following table summarizes the radiation exposure experience of critical IPD classifications through 48 weeks of the 1962 badge year.

<u>Classification</u>	<u>Total Dose</u>	<u>No. of Employ- ees</u>	<u>Average Dose/ Employee</u>	<u>Extrapo- lated Year End Average</u>	<u>No. of Employ- ees over 3r Extrapolated Exposure</u>
Radiation Monitors	209004 mr	81	2580 mr	2795 mr	9
Processing Operators	578625	269	2151	2330	3
Pipefitters	272457	122	2233	2419	17
Millwrights	213355	104	2051	2222	11

DECLASSIFIED

DECLASSIFIED

HW-75931

Lapse of Radiation Control

	<u>B</u>	<u>C</u>	<u>D</u>	<u>DR</u>	<u>F</u>	<u>H</u>	<u>KE</u>	<u>KW</u>	IPD <u>Totals</u>
Processing	0	5	0	0	1	3	0	0	9
Maintenance	1	4	0	0	1	0	0	1	7
Suppl. Crews	0	1	0	0	0	1	0	0	2
Applied Reactor Engr.	1	0	0	0	0	3	0	0	4
Research & Engineering	0	0	0	0	0	1	0	0	1
Facilities Engineering	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	1	0	2
Assigned Totals	2	9	0	0	1	8	1	1	22
IPD General									

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 November 1962. 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	1.7	27	57.0	83	450
C	4.8	47	15.0	105	567
D	3.9	56	7.6	184	1900
DR	3.4	60	27.0	119	525
F	6.7	35	21.0	130	1030
H	6.1	52	7.4	54	285
KE	7.5	45	21.0	116	1320
KW	6.6	32	10.0	59	387

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

DECLASSIFIED

DECLASSIFIED

HW-75931

PROCESS TECHNOLOGY

REACTOR 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 STANDARDS

HW-46000 H, Process Standards - Reactor

One revised standard was issued during the month. This was:

Process Standard A-030 - "Pressure-Flow During Reactor Shutdown"

Changes made in this revision to the standard are as follows:

1. Minimum flow requirements to the reactor were lowered.
2. Initial flow reductions to crossheaders must now be made according to ΔP gauges in conjunction with the ΔP tables.
3. Crossheader throttling valves are now required to be opened upon failure of ΔP gauge during throttling operation.
4. A setting was specified for the ΔP gauge low flow alarm.
5. The ΔP table was expanded to include higher tube powers.
6. Anticipated pressure drop values were given for each process tube cap removed.
7. A rear riser water level was specified for use when on the crossunder line.
8. ΔP gauge settings for the bottom three crossheaders were specified for use while on crossunder line.
9. Reference to the Process Guides was deleted. Basic considerations attending a ruptured tube were included in this revision.

HW-46000 K, Process Standards - Reactor

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

Process Standard K-010 - "General Requirements"

The following changes were made to this standard:

DECLASSIFIED

DECLASSIFIED [REDACTED]

HW-75931

1. System integrity requirements now refer to current OPG's governing control of boilers, pressure vessels and systems instead of the previous numerical reference.
2. Pressure and temperature limitations defined in HW-71634 were added to the standard.
3. A high pressure dump requirement was added to replace the former tube power restrictions. Functional tests for dump valve operation were included.
4. Specifications were provided to limit the degree of closure of the backup process water valve.
5. Process tube pressure test specifications based on thermal stress configurations were re-defined.
6. Specifications affecting process tube life were clarified.

Process Standard K-030 - "Single-Pass Operation - Fissionable Material Charged"

The following changes were made to this standard:

1. Bypassing of parallel loop safety circuits was prohibited.
2. High flow trip settings were re-stated in terms of per cent of chart.
3. Single-pass outlet temperature limit was increased 15 C.
4. Rupture monitor operating range requirements were liberalized for system one.
5. Trip settings for rupture monitor system two were revised.
6. Fuel element corrosion limits were deleted for single-pass operation.

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

The following changes were made to this standard:

1. Safety circuit trip settings were revised for conformance to those specified in HW-71634.
2. Low pressure trip requirements were changed as a result of sensor relocation.
3. High flow trip settings were re-stated to per cent of chart.
4. Manual scram requirement was deleted as a result of valve travel stop installation of the process water backup valve.

DECLASSIFIED [REDACTED]

DECLASSIFIED

HW-75931

5. Loop pressure relief requirements were revised as a result of dump valve installation.
6. Continued recirculation operation with minor system leakage is now permitted since excessive leakage will initiate a low-pressure trip which automatically places the loop on single-pass operation.
7. KER Loops 3 and 4 minimum tube exit pressure limit was reduced from 1000 to 600 psig as a result of system changes effected under Project CGI-839.
8. PS-1 switch settings for loops 3 and 4 were decreased from 500 to 400 psig.

PROCESS CHANGE AUTHORIZATIONS

The number of process change authorizations issued this month were: one to permit temporary deviation from Process Standards - Water Plant, HW-27155 Rev1; one to permit temporary deviation from Process Equipment Standards, HW-41000; and 15 to permit temporary deviation from Process Standards - Reactor, HW-46000. These were:

PCA #2-139 - "Emergency Cooling Water Requirements - K Reactors"

This PCA provides supplemental information to Process Standard A-030 which contains requirements for last-ditch water to the reactor based on anticipated performance of equipment installed under CGI-844.

The PCA also provides specifications for an alternate source of backup water to the reactor during an outage, and, in addition, describes the required flushing techniques for the crosstie line.

PCA #2-140 - "Ball 3X Automatic Trip Settings"

Process Standard C-110 specifies the LP-VLP trip settings that are designed to drop the 3X balls if process water pressure drops significantly faster than the normal drop anticipated from a BPA failure.

Following a recent startup at C Reactor, it was discovered that the top-of-riser pressure (TORP) was six psig higher than usual due to a combination of re-tubing part of the reactor and increasing the load on the 190 pump motors. This resulted in LP-VLP trips set six psi lower than the standard requires. The net effect would be a slight delay time for automatic ball insertion should the need arise. Authorization was given to continue operation with LP trips six psi lower than specified by standard until the next minimum outage.

PCA #2-141 - "V-72 Valve Check, K Reactors"

V-72 and V-73 valves in the high pressure crosstie line are required to be open at all times during reactor operation to provide access for last-ditch water should primary and secondary water sources to the reactor fail. Mod-

DECLASSIFIED

DECLASSIFIED

HW-75931

ifications to recently installed V-72 valves became necessary and it was desirable to test the valve actuation mechanism. Authorization was given to close the V-72 valve a maximum of four times at each K Reactor provided personnel were immediately available for manual operation of the valve, and the valve would be re-opened within five minutes or the reactor losing backup would be shut down.

PCA #2-142 - "Excessive VSR's Out of Service - C Reactor"

Process Standard C-090 specifies that only two VSR's may be out of service during reactor operation.

During an outage in November, it was discovered that three VSR's failed to enter the reactor their entire length of travel.

Authorization was given to resume operation with three faulty VSR's provided the following conditions were met:

1. Power level restrictions were observed during the rise to level according to stipulations of the PCA.
2. A maximum equilibrium power level limit was observed.
3. VSR rehabilitation would be initiated on all faulty VSR's the next minimum outage.

PCA #2-143 - "Thermal Shield Pressure Relief Valve, F Reactor"

The thermal shield cooling water pressure relief valve pressure setting is specified in Process Equipment Standard A-040 as 100 ± 5 psig. A preventive maintenance check disclosed this valve is rated at 150 ± 15 per cent.

Authorization was given to continue operation until the first outage after February 25, 1963, with the pressure relief setting at 135 psig provided water supply to the loop was provided by a source operating at less than 100 psig.

PCA #2-144 - "Temperature Monitoring During Shutdown, C Reactor"

Process Standard C-050 prohibits further crossheader throttling when all temperature monitoring equipment is removed from service.

Authorization was given to permit valving of crossheaders at C Reactor during the thermocouple replacement program provided the substitute temperature monitoring specifications in the PCA were met.

PCA #2-145 - "Graphite Thermocouple Stringers, F Reactor"

Process Standard C-040 specifies that F Reactor contain seven serviceable graphite thermocouple stringers. The standard also requires replacement of faulty stringers within three months from the time of failure. During May,

DECLASSIFIED

D-8

DECLASSIFIED

HW-75931

1962, a graphite thermocouple stringer failed, resulting in F Reactor having less than the required number of stringers. Fabrication of a replacement stringer was nearly completed when a second stringer failed. It was assessed as more desirable to replace the second failed stringer first.

Authorization was given until January 13, 1963, to operate without the required number of graphite stringers until a second replacement can be fabricated.

PCA #2-146 - "Last-Ditch System Backup - K Reactors"

The PCA authorized the removal of one of the three last-ditch diesel pumps from service without continuous operation of the remaining two diesel pumps, provided manual start of the remaining diesels is prepared for as specified in the PCA.

PCA #2-147 - "Bottom Thermal Shield Cooling, KW Reactor"

Process Standard A-070 specifies that the temperature rise in any bottom thermal shield cooling tube shall not exceed 40 C.

Recently the strainer screen in the water supply to the bottom thermal shield was replaced with a finer mesh screen which resulted in less flow than normal through these tubes. Consequently, outlet temperatures on a few bottom thermal shield cooling tubes were over the required limit.

The bottom thermal shield limit was increased 5 C until the fine mesh strainer can be replaced. This authorization will expire on the first outage after December 28, 1962.

PCA #2-148 - "Rupture Monitoring, D Reactor"

Process Standard D-020 specifies that effluent water activity on both sides of each rear crossheader shall be constantly monitored by the gamma monitor system or samples shall be taken at least once every three hours and analyzed for rupture debris.

During a recent operating period one of the rear crossheader effluent activity sample lines ruptured making it impossible to monitor the water activity on the affected crossheader.

Authorization was given until the next minimum outage to continue operation with the ruptured sample line, provided specific requirements listed in the PCA were met.

PCA #2-149 - "Crossunder Line Use, B, C, D, DR, and H Reactors"

Requirements of Process Standard A-030 pertaining to the newly installed crossunder line were based upon the supposition that the flow capacity of the line would be approximately five times greater than actually experienced under test conditions.

DECLASSIFIED

DECLASSIFIED

HW-75931

This PCA, based on actual flow capacity, permitted use of the crossunder line until February 19, 1963, under the specific conditions listed in the authorization.

PCA #2-150 - "Gas Atmosphere, D, F, and H Reactors"

Process Standard B-010 specifies the operating limits for the reactor gas atmosphere. Limits are placed on the per cent O₂, N₂, and the gas dewpoints. Recent evaluation of graphite burnout samples taken from the various reactors indicate that the graphite burnout rate is increasing significantly. To avoid excessive damage to the moderator, this PCA specified more restrictive limits on O₂, N₂, and dewpoints of the reactor gas atmosphere.

PCA #2-151 - "Thermal Shield Cooling, K Reactors"

Process Standard A-070 specifies that side thermal shield cooling shall not exceed 25 C.

Recently, outlet temperature limits were exceeded on a few thermal shield cooling tubes even though the temperatures in the thermal and biological shields were acceptable. Investigations disclosed that some of the high coolant temperatures of these tubes were due to parts of disintegrated supply header screen lodging in flow orifices and corrosion product buildup at the tube inlet.

Authorization was given until March 4, 1963, to operate with up to three non-adjacent plugged thermal shield cooling tubes, according to provisions of the PCA.

PROCESS ASSISTANCE

One engineer audited conformance to process standards on all Processing Operations' shifts by making 14 inspections 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>
12/7/62	1478-D	KY-885-D	I&E EB (0.94%)	1261	736	Hole
12/7/62	0674-F	KY-237-D	I&E EB (0.94%)	1130	910	Side-Other
12/13/62	3465-B	KZ-364-A	I&E N	1281	591	Side Hot-Spot
12/22/62	1064-D	KZ-416-D	I&E NB	1277	831	Hole
12/22/62	3265-D	KZ-450-D	I&E NB	1279	836	Hole
12/23/62	3162-B	KZ-446-A	I&E N	1134	459	Unknown
12/27/62	1077-D	KZ-453-D	I&E NB	1240	657	Side-Other
12/30/62	0658-F	KY-237-D	I&E EB (0.94%)	1020	1180	Side-Other

DECLASSIFIED

D-10

DECLASSIFIED

HW-75931

Legend

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

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 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.

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

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

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

Unknown - Failed piece could not be located or had not been examined at the time of writing.

DECLASSIFIED

DECLASSIFIED

HW-75931

OPERATIONAL PHYSICS

PILE PHYSICS ASSISTANCE

The incentive for increasing flattening efficiency has again assumed priority; at five of the eight reactors the operating level is currently dependent on maximum individual process heat column generation rates. During the extended period of operation under bulk limitations, there has been a trend toward reduction in flattening efficiency (as shown by ECT figures in the table below).

Two instances of unusual control situations occurred during the report interval, one an excessive rate of rise at the H Reactor and the other a short unplanned shutdown at KE due to insufficient turnaround control. In neither event were specific heat generation limits exceeded, but steps have been taken for corrective action and emphasis on operator training for averting such situations.

Nonequilibrium (startup) losses were low during the report period.

SUMMARY OF OPERATING DATA OF PHYSICS INTEREST
FOR THE MONTH OF DECEMBER, 1962

Reactor	B	C	D	DR	F	H	KE	KW
ECT in December (1)	1455	1615	1475	1500	1465	1515	2405	2515
12-Month Average ECT	1490	1665	1480	1485	1485	1520	2510	2540
Equil. Scram Time (2)	23-27	23-27	18-22	18-22	15-18	14-20	20-25*	25-30*
Recording Period -								
From:	11-19	11-23	11-21	11-21	11-16	11-17	11-20	11-19
To:	12-18	12-23	12-18	12-16	12-18	12-17	12-16	12-18

*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

The second xenon-override core was discharged this report period; due to the tube corrosion problem, the core will not be recharged until after the February tube outage.

In an effort to reduce corrosion rates, mixers are being added to each fuel charge, and an outlet tube temperature limit (average of 10 highest) has recently been imposed which will be more limiting to total power than the previous bulk outlet limit.

DECLASSIFIED

DECLASSIFIED

HW-75931

C Reactor - D. W. Constable

A large tube replacement outage began 11-29-62 at C Reactor, in which over 251 tubes were replaced.

Operating difficulties, including rod sticking, have made it necessary to replace number 14 half-rod with the half-rod currently in number 5 position, and to replace number 5 rod with a full-length rod. It is planned to convert number 11 rod, symmetrical in the pattern to number 5 rod, to full length in the near future, also.

An administrative limit on tube outlet temperature (average of 10 highest) is now in effect at C Reactor also.

D Reactor - D. G. Albertson

Reasonably stable operation was experienced during this report period, with about average ECT and lower-than-average nonequilibrium losses. The reactor has been operating at the bulk outlet temperature limit.

A new process standard regarding poisoning near a graphite thermocouple has necessitated the relocating of a few PCCF tubes; during the pattern change four will be eliminated.

DR Reactor - S. M. Skidmore

An administrative limit based on the average of the 10 "hottest" tubes is now limiting reactor power.

A calculation of reactivity and poison inventory indicates that of the estimated 1700 c-mk reactivity effect of the balls originally in the stack following the Ball 3X drop in mid 1961, only 500 c-mk of poison still remains. The burnout has progressed sufficiently that operating efficiency is no longer significantly affected by supplementary control requirements; this would still be true if poison credit were no longer assumed for any of the residual balls.

F Reactor - A. W. Medcalf

An administrative limit on pile power based on the average of the 10 "hottest" tubes is now in effect.

Nonequilibrium operating efficiency has been improving; the two startups this month averaged 0.22 equilibrium day's production per startup. A low reactivity status, resulting from the simultaneous occurrence of a large discharge, the resumption of mixer slug usage, and an E-metal inventory reduction program has been largely corrected.

H Reactor - E. L. Conner, Jr.

Several outages occurred during the report period; of four recent hot recovery attempts, three were successful. On 12-6-62 a scram recovery attempt resulted in a rapid startup; an excessive rate of rise was observed but halted before

DECLASSIFIED

DECLASSIFIED

HW-75931

temperature limits were exceeded, however, and the flux distribution was observed to be favorable. The startup then progressed as normal.

A large tube replacement outage was scheduled this report period; it brings the fraction of tubes in H Reactor this year to 77.8 per cent.

A slight limitation has been imposed on total pile power (based on the average of 10 highest tube temperatures).

KE Reactor - L. L. Grumme

Very little equilibrium operation occurred during the report period due to an unusually high number of unplanned outages. Reactor equilibrium was attained during only one operating period.

A hot startup was made on 11-30-62 at a time when the reactor was just short of the production limit for hot startup attempts. The hot startup was successful, but the reactor was shut down some four hours later because of high graphite temperatures. A re-evaluation of scram recovery rod configurations has subsequently been made.

During a later startup the reactor was shut down because of insufficient turnaround control. Some additional reactivity problems were experienced during the subsequent startup, but small power cuts and conservative operation for a few days smoothed out the reactor for the present operating period.

An analysis of flux traverse data has yielded good agreement between spline traverses and PT 216-A material.

KW Reactor - R. A. Chitwood

Operating experience has been good during this report period. Horizontal rod problems have been troublesome; number 19 rod is presently out of service, having been broken off and the tip left in the thermal shield in a recent attempt to remove it. It will be removed after cooling early in 1963.

Nonequilibrium losses have been low even though the absence of number 19 rod has required some additional degree of conservatism and special splining and HCR techniques. Most of the gains have come from use of a technique of rising to about 90 per cent of the equilibrium level before withdrawal of turnaround splines is commenced.

High thermal shield temperatures have required the use of high helium concentrations; it may be desirable at a later date to charge fringe poison and/or reduce the size of the flat zone (i.e., move the E-ring inward).

DECLASSIFIED

D-1

PROCESS PHYSICS STUDIES**DECLASSIFIED**Reactor Safety Studies

The final report on D-DR vertical system comparison tests has been completed and will be issued shortly with appropriate concurrence signatures. The tests were originally carried out to provide a basis for counting residual ball shadowing effects following the 1961 Ball 3X drop. Test results demonstrated that the shadowed DR vertical system was at least as strong as the unshadowed vertical system in the older reactors and thus justified not counting that enrichment which compensated residual balls in total control limitations. The boron burnout has proceeded sufficiently that the above allowances will no longer be required in the administration of total control in the DR Reactor; the reactivity effect of the residual balls has decreased from an original value greater than 1.5% $\Delta k/k$ to a current effect of approximately 0.5% $\Delta k/k$.

Test cases run on the new multinodal digital program for linear-rate-of-rise and exponential period calculations agreed closely with corresponding analog program results. The excursion peak in one case was 1% greater and in the other case 1% less than analog results. The digital program is an extension of the instrumentation criteria study being carried out with the Reactor Physics Unit.

Control Efficiency Studies

Analysis of representative plutonium samples from the full-pile E-N test loading at H Reactor was completed during the month and reported in HW-73615, Supplement 3. Recovery results from the E-N striped columns at goal exposure in the second core were consistently higher than would be predicted by current accountability curves. The weighted-average results from the 18 6-8 tube batches and from bulk recovery of the initial core load irradiated under PT IP-350-C agreed closely with previously indicated conversion ratio gains relative to natural uranium loadings. This document completes the reporting of conversion ratio data from the full-pile E-N test in the H Reactor.

Shield Protection Studies

Spline cap locations were recommended recently at the K reactors for possible interim shield-protection use. Splines may be inserted in those locations if necessary to reduce fringe heat generation rates for keeping thermal shield temperatures within limits. Because of a jammed rod tip at KW Reactor spline caps were similarly located before the rod tip position and cooling status were satisfactorily established.

DECLASSIFIED

DECLASSIFIED [REDACTED]

HW-75931

Reactor Fundamentals Training

Pile Operator and Reactor Specialist classes on reactor fundamentals were continued during the month, and the program of voluntary quiz review was also continued.

The instructor attended a 4-day series of classes sponsored by the Manufacturing Section on "Fundamentals of Instruction."

Preparations are underway for providing four class sessions on reactor physics for the supervisor-specialists classes to be started by Manufacturing Section early in 1963. A half-hour instructional movie on the chain reaction process, lecture number two of this series, has been completed and appears to be satisfactory for class trial. An alternate approach of a film strip presentation is under study for visual aid presentation of one of the other lectures. It is intended that such visual aids would be used in conjunction with written questions and subsequent discussion under a session leader.

DECLASSIFIED [REDACTED]

D-16

DECLASSIFIED

HW-75931

TESTINGIRRADIATION TESTING OPERATION

Irradiations - Sample and experiment irradiations were handled as follows:

Reactor	Test Hole	Facility	Request Number	No. of Samples	Material - Purpose
KE-KW	2D, 2A	Quickie	HAPO-184	22	Washington Designated Program
KW	2A	Quickie	HAPO-172	1	Tissue (determine elemental components of cancerous and normal tissue)
F	E	Quickie	HAPO-219	3	Strontium (tracer isotope production)
KW		Process Channel	HAPO-098	10	Graphite (burnout rate study)
DR		Process Channel	HAPO-098	13	Graphite (burnout rate study)
KW	4C	Snout	HAPO-249	1	Boron-graphite (heat generation rate and radiation stability study)
C	B	Bare Channel	HAPO-250	1	Ceramics (radiation stability of rod channel liner material)
KE-KW	2D, 2A	Quickie	HAPO-252	8	Arsenic (tracer isotope production)
KW	0065	Magazine	ORNL-184	35	Beryllium nitride (production of carbon 14 for Radioisotopes Distribution Program)
KE	2B	Magazine	ORNL-204	4	Mercury (isotope production)
F	E	Quickie	HAPO-272	3	GRAPHIKOTE (radioactive buildup of process tube lubricant)
KW	4C	Snout	HAPO-270	5	UO ₂ (crystal structure formation study)
KE	2B	Magazine	HAPO-265	1	Boron-aluminum spline (boron burnout rate study)
DR		PCCF	HAPO-254	4	Effluent water salts (effluent water radioisotope reduction study)
KW	3865 3674	General Purpose	HAPO-222	3	Uranium (swelling test capsule)
		*Gamma	HAPO-171	5	Plastics and rubber (radiation damage study)
KW	4B	Snout	HAPO-243	3	Molybdenum (fast fission damage study)

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

H-1 Loop

Corrosion test No. 2, authorized by PT-IP-450-D, Irradiation of Corrosion Specimens in the H-1 Loop, was operated 836 hours at the following reference conditions: temperature - 500 F, pressure - 1200 psi, and coolant pH - 4.5 adjusted with phosphoric acid. One coupon holder from this test was discharged after 787 hours. The goal exposure for the remaining sample is 2160 hours.

DECLASSIFIED

D-17

DECLASSIFIED

HW-75931

Borescoping Activities

HCR Channel No. 2 at KW Reactor was examined to determine the cause of the rod sticking. The rod was rubbing the top of the channel from four feet to nine feet and from 26 feet to 36 feet into the graphite.

HCR Channel No. 14 at C Reactor was examined to determine the cause of the rod sticking. The rod had rubbed the top of the channel from 18 inches to 35' 6" into the graphite. Galling of the rod was evident by the rub mark.

Process Channels 1282 and 2488 at C Reactor were examined to determine their condition prior to retubing. Channel 1282 was found to be in good condition. In Channel 2488, the first ten inches of the first tube block were badly broken and the trunnion block at 26 feet was cracked.

COMPONENT TESTING

Irradiated IPD Fuel Element Examination - 105-C Facility

Examinations were completed on fuel elements from 43 tubes requiring 239.66 fuel examination units.

<u>Number of Tubes</u>	<u>Production Test</u>
12	IP-12-A, Evaluation of Aluminum Components From Alternate Vendors
25	IP-216-A, Quality Certification Program
2	IP-409-A, Pilot Test of Self-Supported Fuel Elements in K-Size Smooth Bore Zirconium Process Tubes
4	IP-468-A, Evaluation of Alpha Extruded Fuel Cores

Photographs of three ruptures were taken: two from F Reactor and one from B Reactor.

Irradiated N Fuel Examination - KE Facility

Double-throw warp measurements and snap-gauge outer diameter measurements were completed on 14 NAEI fuel element assemblies discharged from KER-4 on September 24, 1962. Five outer elements and two inner elements were measured in the profilometer.

Process Tube Corrosion Monitoring Program

In-reactor measurement of 1512 process tubes was completed. The number of tubes measured for each reactor and document numbers of the reports issued are as follows:

DECLASSIFIED

D-18

DECLASSIFIED

HW-75931

<u>Reactor</u>	<u>Number of Tubes Probologged</u>	<u>Report Number</u>	<u>HW-Number</u>
F	144	79	75659
B	97	80	75678
C	261	81	75870
KW	469	82	75871
D	128	83	75872
KE	72	84	75930
B	341	85	75964

Visual examination was completed on six process tubes:

<u>Reactor</u>	<u>Number of Tubes</u>	<u>Reason Removed</u>	<u>HW-Number</u>
H	6	5 - corrosion studies 1 - leaker	75965

Critical Reactor Component Examination

All of the Truarc snap rings and flexible connectors on the front-face of KE Reactor were examined. No Truarc snap rings were broken or had pieces missing.

Panellit System Programs

Gauges repaired, calibrated by Maintenance	74	
Gauges meeting calibration criteria	58	(88%)
-previous month		(75%)
In-board gauge reliability examination	1238	
Gauges meeting examination criteria	1094	(88%)
-previous month		(96%)
-average for past year		(93%)
Response time determination	1238	
Gauges meeting examination criteria	1238	(100%)
-previous month		(99.9%)
-average for past year		(99.7%)
In-board Bourdon coil examination	4428	
Non-leaking coils	4419	(99.8%)
-average rate for past two years		(99.9%)
Gauge failures receiving analysis	121	

COOLANT TESTING OPERATION

KER Loop Operation

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

DECLASSIFIED

DECLASSIFIED

HW-75931

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

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

KER-4 - Testing of fourteen 23-inch 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</u>	<u>Production Test</u>	<u>Water Supplied</u>	<u>Corrosion Inhibitor</u>	<u>pH</u>
SP-1 (2952-KE)	IP-476-AL	Deionized		
SP-2 (3050-KE)	IP-524-AL	Normal process	1.8 ppm dichromate	6.6
SP-3 (4355-KE)	IP-520-A	Pilot plant	1.8 ppm dichromate	6.6
SP-4 (4456-KE)	IP-520-A	Pilot plant	1.8 ppm dichromate	6.6
SP-5 (4557-KE)	IP-524-AL	Service	0.2 ppm quachrom glucosate	6.6
SP-6 (4863-KE)	IP-524-AL	Service	0.2 ppm quachrom glucosate	6.6
SP-7 (4963-KE)	IP-449-A	Deionized		
SP-8 (5063-KE)	IP-449-A	Deionized		

KE Reactor Outage Time Requirements

One unscheduled outage was charged to production testing. The November 30 outage was a result of loss of control of the KER-4 heat exchanger outlet temperature. A total of 44.6 outage hours was charged to production tests as listed below:

<u>Production Test</u>	<u>Description</u>	<u>Hours</u>
IP-477-A	Installed new tray discharge equipment	10.3
	Reactor scram - unscheduled outage(11-30-62)	24.0
IP-520-A	Reactor scram (11-29-62) - recovered	0.8
	Reactor scram (12-2-62) - recovered	0.4
IP-536-A	Charge-discharged and pressure tested KER-2	5.1
	Discharged KER-1	
	Installed KER-1 nozzle connectors	4.0

Out-of-Reactor Facility Operation

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.

DECLASSIFIED

D-20

DECLASSIFIED NW-75931

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

TF-4 - Cyclic decontamination testing using the alkaline permanganate-dibasic ammonium citrate procedure without nitrogen purging was continued. Six cycles have been completed.

TF-5 - Testing to compare the corrosion inhibition of ammonium hydroxide versus lithium hydroxide in a carbon steel system was continued. Operating conditions are 290 C, 1400 psi and pH 10.0.

TF-7 - Testing to evaluate fretting corrosion on a PRTR process tube at PRTR operating conditions continued. The operating conditions are 530 F, 1125 psi and pH 10.0. The test sections contain the following materials:

1. A PRTR fuel element for fretting corrosion studies.
2. Two NIN fuel elements and two dummy fuel elements for corrosion testing.
3. A KSE3 fuel element for corrosion testing.
4. Three 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 - Tests were conducted to determine the effects of iron and silica additions to uranium core material. Operating conditions were 300 C and 1800 psi.

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

TF-15 - Corrosion testing of stainless steel, Zircaloy-2 and Stellite was continued. Operating conditions are 900 F, 4800 psi and pH 9.0 with ammonium hydroxide and hydrazine added.

TF-17 - NPR Secondary System Prototype - The acceptance tests have been delayed due to necessary instrumentations revisions. The acceptance tests are scheduled to be completed by January 4, 1963.

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

Manager, Research and Engineering

DECLASSIFIED

DECLASSIFIED

HW-75931

FACILITIES ENGINEERING

DESIGN ENGINEERING

Graphite Distortion Problems - VSR Design

The VSR liner installation at 105-C Reactor, planned during the recent extended outage, was deferred due to delays in completion of the VSR channel enlarging tooling. Mockup testing of the cast iron boring equipment has indicated satisfactory performance with cutting rates of 1/2 inch per minute. Testing has also indicated a maximum graphite cutting rate of from 1/8 to 1/2 inch per minute, which would require an excessive amount of reactor outage time for performing the required channel enlargement. New boring machine cutter heads are being fabricated in an attempt to increase tool life and graphite cutting speeds. No date has yet been established for on-reactor testing of this equipment. All flexible "B" size VSR testing and shop work in support of the planned VSR channel liner installation has been completed, with additional testing dependent upon the on-reactor installation of polycrystalline graphite liners. Detailed design drawings have been completed for a flexible "B" size VSR which will be suitable for installation as a standard vertical safety rod in all reactors. This design has been prepared for use in the procurement of replacement VSRs and spare parts.

Flexible Horizontal Control Rods

Shop fabrication of a ten-foot section of the proposed replacement flexible horizontal control rods has been completed. This HCR configuration has been designed to provide sufficient rod flexibility to accommodate current and expected graphite distortion patterns at the 105-K Reactors. Fabrication of a mock-up for strength testing of this concept is underway. Preparation of specifications for procurement of components for assembly of a full-length rod section has been started. Fabrication of a full sized rod will be deferred until successful completion of testing of the ten-foot prototype.

Reactor Process Piping System Evaluation

A document (HW-75608) describing the planned program for evaluation of the adequacy and safety of the reactor inlet water process piping system has been completed. Work is underway as outlined, with current efforts directed toward the detailed definition of proposed piping sampling and inspection locations, as well as the definition in greater detail of the inspection and testing procedures to be followed on each sample obtained. In conjunction with plant maintenance activities, samples have been obtained from several process water storage tanks and piping sections; however, no evaluation of the samples has yet been performed.

DECLASSIFIED

DECLASSIFIED

HW-75931

Evaluation of Radioactive Material - Off-Site Shipping Casks

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

DECLASSIFIED

DECLASSIFIED

HW-75931

EQUIPMENT DEVELOPMENT

105-K Reactor Zirconium Tube Program - Development

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

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

Self-supported Fuel Element Charging (SSFE)

On December 3, 1962, fuel elements in two Zircaloy-2 standard size, smooth bore tubes were discharged during a reactor outage at 105-KW Reactor. No discharge-recharge problems were encountered. The fuel elements in tube No. 2557 were flush discharged with an approximate 200 psi pressure on the nozzle. Fuel elements in tube No. 3065 KW were displacement discharged, utilizing the HAPD-designed SSFE charging machine, with a maximum pushing force of 1,200 pounds. Both tubes were irradiated to 40 per cent of goal exposure.

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

On December 27, two Zircaloy-2 process tubes in the KER facility at 105-KE Reactor were refueled using the HAPD-designed charging machine. The machine functioned satisfactorily, but due to the nontypical nozzles on these tubes perforated dummies rather than self-supported fuel elements were used to discharge the irradiated column.

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

Prototype High Speed Scanner

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

Design Test Service

The N-Reactor program utilized 435 hours of engineering effort for design test service.

DECLASSIFIED

DECLASSIFIED

PROJECT ENGINEERING

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

Final testing of the modified first-stage impeller and modified thrust bearing for 275 HP pumps was performed satisfactorily December 14, 1962. Latest schedule from the vendor shows delivery of two modified and repaired pumps by January 15, 1963.

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

The Physical Completion Notice has been issued. All work was completed, except for miscellaneous exceptions, with an indicated total cost of \$3,287,500 and a \$1,242,500 underrun.

The Financial Plan indicated an estimated total cost of \$3,300,000. Detail, including an item of contingency for the difference in estimates and subsequent credits, has been provided supporting that figure.

The most significant exception item involves the rework associated with the vibration problem of the 1500 HP low lift pump motors. The first reworked motor has been returned and installed. Results to date have been satisfactory. The second motor was returned from the vendor's plant on December 28.

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

All work is now completed with the exception of the raw water orifice installation which must be integrated with reactor outages. Final testing has been scheduled for January, 1963.

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

Field preparation work has been completed at D and DR Reactors (F was completed previously). Construction work will now be shifted to actual ADC installations at F, DR, and D, respectively. The first ADC unit arrived on plant December 5, was tested at B Reactor substituting for their full reactor prototype, and was moved to F Area and successfully tested on several F Area stepping switches. Preliminary drawings and manuals for the ADC units were received from the vendor December 19.

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

The process and functional criteria document has been approved. The Title I design criteria document has been issued in draft form for comment. A study of alternative methods of providing the platform synchronization function has been completed.

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

Additional justification for the restrictive specification was assembled with the bid package and submitted to WPAO Purchasing December 21.

DECLASSIFIED

DECLASSIFIED

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

The revised specifications are ready for forwarding to Purchasing. Detail design cannot continue until placement of the order for the electronic components.

R-20520, K Retubing

Ninety-nine zirconium tubes have been received from the vendor. Sixty of these tubes have been accepted and are ready for Van Stoning at one end of the tube. Two new borescopes have been received at Hanford; one has been set up at the inspection station.

Preliminary design is underway on alternate permanent material handling systems for each of the charging machine concepts. A preliminary engineering report describing the permanent material handling system is being circulated for review prior to preparation of detail design.

The four boring bar drives for channel conditioning were received and are undergoing laboratory testing.

CPFF Construction Service Contractor-Liaison

Issued four new work orders and supplemented two old jobs for a total of \$61,289 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 \$211,695.

Manager, Facilities Engineering

RT Jessen:dgm

DECLASSIFIED

FINANCIAL

DECLASSIFIED

GENERAL AND PERSONNEL ACCOUNTING

Final action on missing plant and equipment disclosed by the recent physical inventory will write-off 206 units of property valued at \$501,486. This represents one-tenth of one per cent of the total Department's plant investment. Additional items picked up during inventory were valued at \$294,000 and have been added to our plant investment. The necessary property disposal documents and missing plant and equipment reports are being processed.

Project CGI-791 - Reactor Confinement - was unitized and added to IPD plant investment in November 1962. Total asset \$7.3 million.

BUSINESS AND INFORMATION SYSTEMS

Considerable time was spent on the Preventive Maintenance Program to develop a numbering system which will provide an alphabetical order within the various processing and power systems and tie into the spare parts and supplies codes. It is anticipated that actual work in the B-C Area will begin approximately January 1.

Because of a change in the organization that prepares process tubes for replacement, a new accounting procedure is being established so that the cost of the tube and the related preparational labor will be charged to the customer using these tubes.

PRODUCT COST AND BUDGETS

The midyear budget review was completed for all components except the Production Fuels Section. There is still some question as to the distribution of Department and HAPO overhead between irradiation and fuels preparation cost. When this question is resolved, there may be some adjustment to the midyear budget for irradiation.

A report on IPD waste disposal cost was prepared at the request of the AEC.

A cost reduction item was prepared showing a CY-1962 Manufacturing Section decrease of 60,000 overtime hours from CY-1961. Justification was included to substantiate \$282,000 of the resultant savings as a cost reduction.

The results of the precious metals physical inventory taken in September were tabulated. Except for five grams of platinum not previously recorded, all items were in balance. The adjustment of book to physical was made in November 1962.

AUDITING

During the month, revisions of four HAPO Organization and Policy Guides were issued. Comments were submitted for the Department relative to revision of HAPO OPG - Handling of Unsolicited Disclosures of Technical and Business Ideas.

SH Small:ch

SH Small
Manager, Finance

DECLASSIFIED

DECLASSIFIED

HW-75931

SIGNIFICANT REPORTS ISSUED

<u>Number</u>	<u>Class'n.</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-75043	Unclass.	JE Boyd GE Peck	11/27/62	Owner-Operator Process and Functional Requirements for Project CGI-960.
HW-75608	Unclass.	DF Watson	11/29/62	Engineering Review of Critical Process Piping Proposed Program Outline and Schedule.
HW-75744	Unclass.	GE Peck	12/5/62	Program Outline for Evaluation of IPD Off-Site Shipping Casks.
HW-75763	Unclass.	FE Haun, Jr.	12/7/62	Proposed H Thermocouple Well Test Report.
HW-75525, Sup 1	Unclass.	WEB Lander	12/14/62	Design Test 1136 - Interim Test Report No. 2 - 105-K Reactor Zirconium Tube Channel Mock-up.
HW-74443, Sup 5	Unclass.	DF Arnold	12/5/62	Installation Steps for CGI-939, DC-631, D, DR, F and H; Post 939.
HW-74443, Sup 4	Unclass.	DF Arnold	11/16/62	Installation Steps for CGI-939, DC-631, B and C.
--	Unclass.	JL Rand	12/10/62	Measurements Made on PT-IP-338-A.
--	Unclass.	JL Rand	12/17/62	184-B and D Power House Testing.
--	Unclass.	WEB Lander	12/19/62	Vibration Test to Determine Impeller Resonant Frequencies.
HW-73615, Sup 3	Secret	WA Blyckert RD Carter	12/14/62	Final Report on E-N Conversion Ratio Data.
HW-75748	Unclass.	DE Blahnik	12/13/62	Proposed Replacement of Semi-Automatic Welders - 313 Building.
HW-75758	Conf.	TW Gore	12/10/62	Design Criteria for Pilot Scale Plating Equipment.
HW-75908	Conf.	GB Hansen	12/17/62	Uranium Quality Control Analytical Results.
HW-75999 RD	Secret	WN Mobley	12/26/62	Uranium Delivery Schedule.

DECLASSIFIED

DECLASSIFIED

HW-75931

<u>Number</u>	<u>Class'n.</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-69886	Conf.	JT Stringer	12/3/62	Provisional Process Specifications for the Attachment of Projection Rails by Ultrasonic Spot Welding.
HW-75722	Unclass.	RM DuPerre	12/5/62	Evaluation of Possible Modifications to the K Reactor, Inlet and Outlet Nozzle Assemblies.
HW-75903	Secret	JR Young	12/17/62	Third Generation Central Tube Life, 100-B, D, DR, F and H Reactors.
HW-75724	Unclass.	PE Lindstrom	12/5/62	Proposed Control Circuit Modifications, Steam Driven and Electric Driven Low-Lift Pumps - 190 KE and KW Buildings.

DECLASSIFIED

DECLASSIFIED

HW-75931

TRIPS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
L. M. Keene	Atomic Energy Commission Germantown, Maryland	12/1/62 thru 12/6/62	To attend AEC Symposium on Packaging and Regulatory Standards for Shipping Radioactive Materials.
F. J. Kempf	National Carbon Co. New York City, New York	12/3/62	Discuss pyrolytic graphite fabrication problems and suggest alternate directions for continuing and expanding current sleeve problems.
	General Electric Co. Schenectady, New York	12/4/62	
	General Electric Co. Detroit, Michigan	12/5/62	
	High Temp. Materials, Inc. Brighton, Massachusetts	12/6/62	
G. L. Erickson	Keithley Instruments Cleveland, Ohio	12/2/62 thru	To contact vendors regarding clarification of Specification HWS-5991, Rev. 1; review progress of work; review vendor facilities and production techniques.
	Ohmart Corporation Cincinnati, Ohio	12/6/62	
	GE-APED San Jose, California		
	E. H. Research Lab., Inc. Oakland, California		
D. L. Hovorka	Union Machine Works, Pacific Steel Products, Norfin, Inc., Seattle, Washington	11/26/62 and 11/29/62	To contact vendors regarding design development work in connection with K tube replacement program.
D. M. Diediker	Byron-Jackson Co. Los Angeles, Calif.	12/13/62 thru 12/16/62	To consult with vendor on modifications of 275 HP pumps for 1706-KER.
J. M. Fox, Jr.	Gray Tool Co. Houston, Texas	12/10/62 thru 12/14/62	Discuss Grayloc connector tubing.
R. T. Jaske	American Institute of Chemical Engineers, Chicago, Illinois	12/1/62 thru 12/5/62	Attend National Committee Session of AIChE Annual Meeting.
T. W. Gore	Udylite Corp. Detroit, Michigan	11/26/62 to 11/27/62	To discuss electro-plating equipment.

DECLASSIFIED

DECLASSIFIED

HW-75931

Name	Firm & Location	Date	Purpose
T. W. Gore	Hanson-Van Winkle-Muning Co. Matawan, New Jersey	11/27/62 to 11/29/62	To discuss electro-plating equipment.
T. W. Gore	Sylvania - Corning Hicksville, L.I., N.Y.	11/28/62	To discuss electro-plating equipment.
T. W. Gore	General Electric Co. Lynchburg, Virginia	11/30/62	To discuss electro-plating equipment.
T. W. Gore	Meaker Company Nutley, New Jersey	12/3/62	To discuss electro-plating equipment.
E. S. Bell	Rucker Company Seattle, Washington	12/26/62	Discuss hydraulic system to be used on automatic end cap welders.
E. S. Bell	C. P. Parsons Co. Seattle, Washington	12/26/62	To witness operation of photo-electric timing controls and transistorized photo-electric controls for possible use in fuel element indexing.
L. L. Samford	Alcoa Vancouver, Washington	12/19/62	To inspect aluminum can re-grooving operations.
L. L. Samford	Rem Inc. Portland, Oregon	12/19/62	To discuss aluminum supports
J. T. Stringer	United Kingdom AEC Harwell, England	12/3/62	Proposed agenda.
J. T. Stringer	Central Electricity Generating Board Berkley, England	12/4/62	Irradiation examination of metallic U fuels.
J. T. Stringer	Nuchem Plant Gunther Wirth Hanaw, Germany	12/6/62 to 12/7/62	Technology of Karlsruhe fuel elements - bond characteristics and equipment.
W. G. Jolley	Bridgeport Brass Co. Bridgeport, Conn.	12/13/62 to 12/14/62	Attend a meeting of X-ray committee on preferred orientation in uranium.
T. L. Deobald	Chicago, Illinois Oak Ridge National Lab. Oak Ridge, Tennessee	12/1/62 to 12/8/62	Attend AIChE Meeting. Discuss reactivation of the DR-1 Loop.

DECLASSIFIED

DECLASSIFIED

HW-75931

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
S. S. Jones	Chicago, Illinois	12/1/62	Attend AIChE Meeting.
	GE General Engineering Lab. Schenectady, New York	to 12/8/62	Technical discussions concerning contract.
R. W. Reid	Atomic Energy Authority Calder Hall, Scotland	12/3/62 to 12/6/62	Attend US-UK Reactor Information Exchange Meeting.
	Central Electrical Generating Board Bradwell, England	12/7/62	Visitation, tour, and discussion with CEGB personnel.
D. H. Curtiss	Wolverine Tube Co. Detroit, Michigan	12/9/62 to 12/14/62	Discuss fabrication of ZR-2 process tubes.
R. S. Bell	Reactor Sites in England & Scotland	12/3/62 to 12/7/62	A U.S. participant in cooperative discussions with UK-AEA personnel concerning production reactor operation.
J. H. Hoage	Syl-Cor Division, Sylvania Electric Prod. Hicksville, New York	12/10/62 to 12/13/62	Discuss fabrication of poison splines.
	Jerex Corporation Amityville, New York		
	Sintercast Division Chromalloy Corporation West Nyack, New York		
	General Astrometals, Inc. Yonkers, New York		
F. F. Vlacil	Reynolds Metal Phoenix, Arizona	12/10/62 to 12/14/62	Discuss aluminum process tube specifications and materials.
H. N. McIntire	General Electric Co. Seattle, Washington	12/12/62	Discuss Laser applications at HAPO.

DECLASSIFIED

DECLASSIFIED

HW-75931

VISITORS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
H. J. Leutzow	Wolverine Tube Co. Detroit, Michigan	12/3/62 to 12/4/62	Discuss fabrication of Zr-2 process tubes.
W. H. Cook D. H. Imhoff	GE-APED San Jose, California	12/6/62 to 12/7/62	Discuss reactor control and instrumentation.
A. C. Crawford P. S. Olson	Atomics International Canoga Park, California	12/11/62 to 12/12/62	Discuss irradiation program.
Mr. Arsenault	Atomic Energy Commission Washington, D.C.	11/30/62	Visit arranged for by RL Plum, AEC-HOO, regarding items made by industry which should be classified for national security
Dave Tuel Jim Kelly	Wyandotte Chemicals Wyandotte, Michigan	12/1/62	Observe decontamination test at 105-C.
Ken Newman Frank Morris	Turco Products Los Angeles, California	12/11/62	Review chemical testing and maintain personal liaison.
V. McCormic	Ingersoll-Rand Co. Portland, Oregon	12/12/62	Discuss special air motors required for tooling being developed at HAPO.
Ed Legas	Chicago Pneumatic Seattle, Washington	12/13/62	Discuss special air motors required for tooling being developed at HAPO.
R. Marshall	Miller Fluid Power, Portland, Oregon	12/5/62	Discuss hydraulic power equip- ment cylinders and controls.
R. H. Linton	Industrial X-ray Co. Portland, Oregon	12/13/62	Prebid inspection (HPCT line cleaning at 100-K)
J. A. Frank	National Water Main Cleaning Co. New York City, New York	12/15/62	Inspection of job site prior to contract negotiation. (HPCT line cleaning at K)
G. Latham	Gray Tool Company Houston, Texas	11/30/62	Grayloc connector tubing.
D. Lomax	Industrial Air Company Portland, Oregon	12/4/62	Discuss argon gas.

DECLASSIFIED

DECLASSIFIED

HW-75931

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
A.R. VanVorst	Alcoa Edgewater, New Jersey	12/11/62	Discuss aluminum caps and cans.
D. M. Guy	Alcoa Seattle, Washington	12/11/62	Discuss aluminum caps and cans.
J. Coyne	Alcoa Seattle, Washington	12/11/62	Discuss aluminum caps and cans.
R. Wilkins	Wilkins and Assoc. Seattle, Washington	12/13/62	Discuss steel sleeves.
R. Gordon	J. C. Corrigan Company Boston, Massachusetts	12/10/62 to 12/14/62	Consultation relative to billet furnace operation in Coextrusion Shop.

DECLASSIFIED

END

**DATE
FILMED**

1 / 14 / 93