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HW-9922-A

P DIVISION

APRIL - 1948

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I. GENERAL

The D and F Piles operated at 275 M.W. throughout April except for scheduled outages. Each operating area had an extended outage to remove a portion of the brick from the wall which runs across the rear edge of the top of the unit and to replace the vertical neoprene seal between the front face and the experimental side shields. This program is described in detail under Mechanical Experience. The B-Pile was maintained in standby condition with a water flow of 10,150 g.p.m. The 100 Area discharge rate continued at 60 tons per month.

The exclusive use of lead dipped 4" slugs fabricated from alpha rolled or alpha extruded metal was started effective April 1.

Work was started April 12 in the 500 Area on a program of decanning 160 tons of 8" gamma extruded triple-dip canned pieces which were not considered good risks for pile operation. The slug recovery operation was placed on a 2 shift per day schedule on April 19 to expedite this work so that the metal can be recast and rolled at the earliest moment.

The 300 Area canning production of 90 tons was governed by the receipt of rolled rods. At month end a backlog of about 30 tons of rolled rods was on hand.

II. ORGANIZATION AND PERSONNEL

In conformance with the general reorganization of the General Electric Company Nucleonics Program on April 9, the P Department became the P Division of the Manufacturing Divisions.

Number of Employees on Payroll - April

Beginning of Month:	295
End of Month:	<u>308</u>
Net Increase:	13

A total of nine clerical personnel were transferred on April 5 from the Accounting Division to the P Division as follows:

Classification Cancelled (Change to

Declassified)

By Authority of RLO-CG-4

AE E. L. 11/1/90

S. C. 11/27/90

PN E. L. 11-21-90

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PAL 11-40

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100-F Area - 2
 100-D Area - 2
 300 Area - 5*

- * One male clerk of this group was transferred to the Construction Division on April 19 and was replaced. Two new clerical personnel were hired for the 300 Area and are awaiting clearance.

One Chief Operator from 100-D Area was transferred to the 300 Area, and two experienced 300 Area operators were transferred to the 100 Areas in preparation for the 100-B Area startup.

Four new operators were hired and assigned to the 300 Area.

H. L. Henry, Assistant Chief Supervisor, Process Control Group, was transferred to 100-D Area.

H. E. Berg, Shift Supervisor, was transferred from 100-D Area to the 300 Area.

R. G. Swift and B. E. Dalton completed their training periods and were assigned as Shift Supervisors to the 300 Area.

III. AREA ACTIVITIES

<u>FILE SUMMARY</u>	<u>FILE B</u>	<u>FILE D</u>	<u>FILE F</u>
Time Operated (%)	-	74.6	75.8
Operating Efficiency	-	72.8	71.9
*Power Level (M.W.)	0	275	275
*Inlet Water Temperature (°C)	9.3	7.4	8.2
*Outlet Water Temperature (Maximum °C, 10 tubes, .240" zone)	9.4	48.0	54.1
Number of Scrams	0	0	0
Number of Purges	0	1	1
**Helium Consumption (cu. ft.)	32,406	75,258	71,530
Metal Discharged (tons)	0	38.8	19.2
Inhours Gained (this month)	0	1	12
*Inhours Poisoned	-	358	288
*Inhours in Rods	-	63***	65

*Month end figures.

**High helium consumption attributed to purging required following neo-prene seal replacement work.

***Twenty-five inhours of this attributed to the use of carbon dioxide in the gas circulating system.

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PILE BUILDINGOutage Breakdown:

<u>Date of Outage</u>	<u>Scheduled</u>		<u>Unscheduled</u>	<u>Length of Outage (Hours)</u>
	<u>Metal Discharged</u>	<u>Maintenance</u>		
4-4-48*	D			23.7
4-4-48*	F			23.7
4-5-48**	D Area shutdown to discharge temporary poison column			1.4
*4-11-48***	D	D		136.6
4-11-48*	F			23.2
4-17-48	D Area shutdown to discharge temporary poison columns			4.0
4-25-48***	F	F		127.5
4-27-48	D			19.0

*These shutdowns were scheduled on consecutive Sundays to allow special tests on the B.P.A. system.

**The length of the allowable shutdown time on 4-4-48 was insufficient to complete the work load; an extended shutdown was required necessitating a subsequent shutdown on 4-5-48 as indicated.

***Extended outage for brick removal and seal replacement.

Operating Experience

A number of Special Request samples were processed during April; details of their irradiation may be found in the Technical Section of this report.

Production Tests having operational significance during the month are reported below:

- 105-75-P (Exposure of 4" Slugs)
Two tubes of 4" slugs were successfully discharged at 250% of normal concentration at F Area.
- 105-80-P (Measurement of Slug Temperatures)
Tube No. 2579-F, containing a thermocouple slug and 16 pieces of regular 3" metal, was discharged normally on April 11 at twice normal concentration.
- 105-119-P (Effect of Fabrication Temperature on Blistering)
A total of 26 tubes containing various combinations of alpha and gamma fabricated metal, both lead dipped and triple dipped, was discharged on April 4 and 11 at D Area with no difficulty. Twenty-six tubes containing similar

material were discharged at F Area on April 26. Difficulty was encountered in discharging six of these tubes as detailed under Mechanical Experience.

105-168-P (Replacement of Pile Helium Atmosphere with Carbon Dioxide)

The percentage of carbon dioxide in the D-Pile atmosphere was maintained at 25% except during the extended shutdown of April 11-16.

105-180-P (Irradiation of an Experimental Beta Slug)

A second experimental beta type slug was discharged without difficulty from the center of dry tube No. 1481-F on April 27.

105-180-P, Supplement A (Irradiation of a Beta Slug)

Tube No. 1481-F was replaced with a new tube having no front Van Stone to allow for expansion. The tube was then charged with a Beta slug on April 29.

105-183-P (Radiation from Uranium Slugs)

On April 25, the special shielded plug was removed from the front end of Tube No. 1266-F and a uranium slug shielded by a single lead dummy was moved to a position 14-3/4" from the front face shield. A maximum reading of 54 mr/hr was obtained four inches from the biological shield. A maximum beam of 4 mr/hr (uncorrected) was observed through the lead dummy.

Two additional bismuth columns were charged at F Area making a total of 24.

The filter capacity tests at Buildings 183-D and 183-F were continued during April.

Two fringe tubes which had been previously damaged and two fringe tubes which were being used with special rear aluminum nozzles were removed from service at F-Pile making a total of 78 such tubes.

Mechanical Experience

All horizontal and vertical safety rods are in satisfactory operating condition at month end. Considerable work was done at F Area on vertical rods as follows:

Rod guides were re-aligned on rods Nos. 11, 13, 14, 20, 27, 31, and 33. A new tip was installed on rod No. 30 and the original tip from No. 31 was reinstalled following buffing of the tip and rod guide.

Rods Nos. 10, 13, 14, 15, 20, 21, 26, 30, 34, 37, and 38 failed to enter their thimbles by from 1/4" to 2 1/2" on the April 25 shutdown.

It was determined that the bottom of the thimbles contained very fine iron dust which could only be partially removed by a magnet. A program for removal of this material is being formulated.

At D Area vertical rods Nos. 11 and 16 were satisfactorily loosened and all vertical rods were again treated with rust preventive oil. The periodic pneumatic testing of the rod thimbles was completed.

Horizontal rod "A" at F Area was found to have several deep scratches on April 30 and it was given a coating of Aqua-Dag. Adjustment of the hose reel tension on No. 5 rod at F Area relieved the binding previously encountered.

A layer of brick was removed from the wall between the top of the unit and the discharge face at D Area from April 11-16 and at F Area from April 25-30. This work was done to allow equal upward expansion of the top shields. A canvas curtain was installed over the front of the opening to avoid ventilation disturbances, and lead brick was placed behind it to reduce radiation from the rear face during discharge operations. During the same shutdowns the front vertical neoprene seals at the experimental side shield were replaced because of excessive stretching. Considerable difficulty was experienced at F Area in obtaining a proper fit.

Difficulty was experienced at F Area in discharging 8 tubes. Special equipment and extensive oiling were required on April 25 to discharge Tubes Nos. 1078, 1166, 2785, 3483, 3570, and 3770, all containing metal irradiated in accordance with Production Test 105-119-P. Regular metal charges in Tubes Nos. 2481 and 3576 also required special equipment for discharging. Forces up to 3000 pounds per square inch were necessary to move the charges in Tubes Nos. 1166 and 3576. Tube No. 3576 was damaged and it was filled with dummies prior to replacement. Tube No. 1166-F and Tube No. 1431-F, which was used for Production Test 105-130-P, were replaced during the April 25 shutdown with tubes of the type intended for DR pile.

The 0.175" orifices in Tubes No. 1090-F and 1190-F were replaced with 0.200" orifices and Tubes Nos. 0985-F, 1086-F, and 1283-F were changed from 0.200" to 0.240" orifices on April 25 to relieve high temperature startup conditions.

Work was started on the installation of the new sewer line between Buildings 105 and 107 at F Area. The sewer line from Buildings 105-B to 107-B was laid bare at three points with one slight crack being visible. Further investigation will be made.

The voids under the floors of the 105-F Building were filled with clay and cement thus completing this work which was brought about by underground water leaks.

During routine flushing of the fly's eye at 100-B Area, the 1" plate-glass

outer lens disintegrated with considerable force. It appears that the glass was under internal strain. Plexiglass has been installed in all 100 Areas at this location and the use of this equipment has been limited to emergency work only.

The check valves in the A, B, C, and D risers at F Area were tested and found to operate satisfactorily.

A manometer traverse was made on Tube No. 4674-D on April 14 concurrently with transit surveys of the discharge and experimental faces and the unit top.

Pile Development

Work continued by the Process Control group on the development and evaluation of possible rear face charging machines. Extensive study by the same group reveals that considerable helium economies can be realized by modifying certain operating techniques during shutdowns. Essentially, the change which has been adopted as standard involves addition of helium makeup until the graphite temperature has cooled to equilibrium. Then a small helium flow is fed directly into the system.

The north retention basin at Building 107-D was pumped down and the known leaks were treated with P & B paint thus stopping six of the nine leaks.

In the south section of the Building 107-B basin, which was treated with chlorine in April, it was observed that the algae are dead but no marked peeling from the walls has yet resulted. Calcium hypochlorite, used in the north section of the basin, killed the algae much more rapidly than did the chlorine and with smaller quantities. Further observations are in progress.

GAS PROCESSING BUILDING

The first car of 99.8% purity helium was unloaded at Building 110-F without purification, thereby saving about 15,000 cubic feet of helium.

SPECIAL HAZARDS

Continued surveys of the experimental side top neoprene roll indicated a reading of 29 mr/hr as compared to 17 mr/hr in March. Film surveys show the beam to be about 30 inches in width.

The lead bricks placed on the discharge area side of the openings cut in the wall across the unit top do not give adequate shielding and will be replaced with sheet steel.

300 AREA - METAL FABRICATION

Production Statistics:

Production for the month of April was as follows:

Billets Produced	63 Tons
Billets Extruded	0 Tons
Rods Machined	131 Tons
Acceptable Pieces Canned	90 Tons

Melt Plant

The casting yields were as follows:

	% Yield		To Date
	March	April	1948
Billet	69.1	73.7	71.1
Solid Metal	85.2	89.1	87.5

Operation was on a three-shift, five-day week schedule throughout the month. The use of solid scrap only as charge material was made standard temporarily to reduce the crucible breakage which results from the use of briquettes. This condition will be relieved during May when additional crucibles are received.

On April 1 the No. 4 coil in the B furnace began arcing after two hours and thirteen minutes of heating. The power was shut off immediately and the crucible charge was poured. An inspection of the furnace revealed no reason for the arcing.

On April 12 the No. 3 coil in A furnace arced. After the furnace was opened for inspection, it was found that a definite arc had occurred across the top of the coil and had burned a small hole in the coil lead. The coil was repaired in position and all coils were cleaned. The furnace was operated again on April 13 and the No. 2 arced on the first run. No apparent reason was found. After the coils were cleaned the furnace was operated without further difficulty.

The power input was reduced from 112 to 100 KWH on April 2. This was done to determine if a lower power input would decrease the carbon content of the billets produced. Difficulty was encountered in pouring as a result of what appeared to be incomplete melting of the crucible charge. The pouring stream was slow and fan shaped. The power input was gradually increased until a normal pour was reached. Satisfactory results were obtained at 108 KWH and this power input was maintained for the balance of the month.

Extrusion, Outgassing, and Machining:

Extrusion, Machining, and Billet Yields were as follows:

	% Yield (4" A's)		To Date 1948
	March	April	
Extrusion	--	--	93.9
Machining (Extruded Rods	79.0	--	79.3
(Rolled Rods	66.0	66.5	66.4
Billets	73.7	--	--

The annealing temperature for rolled rods was reduced from $1110^{\circ}\text{F} \pm 20^{\circ}$ to $1020^{\circ}\text{F} \pm 20^{\circ}$ on April 6. It was found that the grain structure was satisfactory in the lower range which offered an operational advantage by controlling the temperatures well below the maximum temperature of the alpha range.

Lots 586, 587, and 588, which were annealed at 1000°F on April 14, were found to be under-annealed. This was not reported until April 22 and the lots had been processed through canning. The canned pieces have been set aside and samples have been taken for metallographic examination to determine if sufficient annealing occurred during canning to gain the desired grain characteristics.

Seventy receptacle slugs $5.00" \pm 0.10"$ in length, $1.353" \pm .001"$ in diameter, and having $21/32"$ axial holes drilled through them were machined. They were processed from alpha rolled rods in conformance with Metal Fabrication Request No. 25.

Four shipments of rolled rods were received in April. Two hundred and eleven rods were received April 7, 116 on April 14, and 661 on April 23, from Joslyn Steel Company, Fort Wayne, Indiana. The fourth shipment, containing 633 rods, was received from Simonds Saw and Steel Company, Lockport, New York, on April 14.

The machining yield continued to be low on rolled rods primarily as a result of the larger diameter as compared with extruded rods. Some difficulty has been encountered in machining rolled rods due to the irregularity of rod diameters. Solid scrap has increased as a result of some sections of rods being very porous and failing to clean up to 4" "A" specifications.

Chip Recovery and Oxide Burning

The Chip Recovery yield was as follows:

% Yield		To Date 1948
March	April	
90.4	88.9	89.4

Chip Recovery operated 15 eight-hour shifts and processed 37,561 pounds of briquettes in April.

The Chip Recovery press was shut down for repairs twice during the month. On April 2 it was necessary to resurface the bed plate and replace the insert which had cracked. On April 23 the insert cracked again and was replaced with a softer steel faced with stellite.

The material burned in the oxide burner was as follows:

<u>Weight Out - Lbs.</u>		
<u>March</u>	<u>April</u>	<u>To Date</u> <u>1948</u>
6042	6473	22084

The oxide burner was operated on a daily schedule.

Canning Operation

The canning yield was as follows:

<u>% Yield (4")</u>		
<u>March</u>	<u>April</u>	<u>To Date</u> <u>1948</u>
90.2	83.6	87.1

Canning rejects, by cause, were:

	<u>% Total Canned (4")</u>		
	<u>March</u>	<u>April</u>	<u>To Date</u> <u>1948</u>
Non-Seating	4.6	9.5	5.2
Marred Surface	1.1	1.0	1.2
AlSi on Outside of Can	.7	2.0	1.5
Frost Test	1.2	1.6	1.6
Bad Welds	.8	1.3	1.3
Miscellaneous	<u>1.4</u>	<u>1.0</u>	<u>2.1</u>
	9.8	16.4	12.9

The difficulty from non-seating, discussed last month, was encountered again throughout this period. A Brown recorder was substituted for the Micromax in the AlSi thermal analysis apparatus in an effort to improve reproducibility of results. The trials in which the Brown was used were unsatisfactory and the instrument is now being remodeled to improve sensitivity. Chromel-Alumel lead wire has been received and plans are being made to replace all furnace thermocouple lead wires as soon as possible. It has been observed that a number of rolled slugs having very small longitudinal surface cracks have a frosty appearance after being preheated in the Pb bath. This also has contributed to non-seating. A study of the possible causes for this condition is currently being made.

Work was resumed on the recovery phase of Production Test No. 313-94-M, "Development of Lead Dip Process" on April 13. The purpose of this phase of the test is to develop a process for recovering canned rejects by the lead dip process to supplement the standard chemical recovery process. Results thus far indicate that recovery can be accomplished by piercing a hole through the base of the aluminum can, preheating the reject in the lead bath for thirty seconds, then removing from the bath and using special tongs for removing the can from the slug. The slug can then be agitated in the AlSi layer on the lead bath for three seconds, transferred to the AlSi canning bath, agitated in the bath for three seconds, and recanned in the regular manner.

One piece each of Special Request 77 and 78 (radium chloride) were successfully canned after the mushroomed bottoms on the pieces had been spun down to the correct diameter. Seventeen pieces of Special Request No. 53 (Uranium enriched with U235) were canned. Four pieces failed to pass the bubble test before canning and will be returned to the vendor.

A total of 2,211 poison slugs was canned during the month.

Recovery Operation:

	<u>% Recovered</u>		<u>Average Wt. - Lbs.</u>	
	<u>April</u>	<u>To Date 1948</u>	<u>April</u>	<u>To Date 1948</u>
Z Slugs	66.9	74.0	3.912	3.909
X Slugs	22.0	17.9	3.851	3.853
Rejects	<u>11.1</u>	<u>8.1</u>	--	--
	100.0	100.0		

The recovery of all gamma extruded 8" triple dip canned pieces (160 tons) was started on April 12. These pieces are being converted to solid scrap for remelting. On April 19 the operation was placed on a two shift per day basis.

Inspection and Testing

Autoclave rejects were as follows:

<u>March</u>	<u>April</u>	<u>To Date 1948</u>
0.49/M	0.51/M	0.47/M

Twenty autoclave failures occurred during the month; six of these were completely destroyed.

The "As Received" quality of cans, caps, and sleeves inspected during the month was as follows:

	<u>3 Useable (4M)</u>		
	<u>March</u>	<u>April</u>	<u>To Date 1948</u>
Aluminum Cans	93.3	83.7	88.3
Aluminum Caps	98.9	95.0	98.1
Steel Sleeves	72.4	82.1	75.8

The final inspection results on the 9880 "commercial grade" aluminum cans received last month was as follows:

	<u>Number</u>	<u>Percent</u>
Accepted	5297	53.6
Rejected	4583	46.4

The breakdown of rejects was as follows:

	<u>Number</u>	<u>Percent</u>
Marred Outer Surface	1694	17.1
Mandril	77	0.8
Thick Bottom	2368	24.0
Thin Wall	144	4.5

305 Area Test Pile

This unit was operated on a one-shift five-day week schedule in April, making 82 tests on canned slugs, 55 on billet eggs, 470 on graphite bars, and the following additional tests on special work requests:

<u>Request Number</u>		<u>Number of Tests</u>
19	To determine whether rubber knee pads used in Construction contain elements poisonous to piles.	2
20	To obtain absorption cross-sections of samples of horizontal rods for new pile construction.	6
21	To determine accurately the quality of four "Finished" bars for use as standards.	16
22	To irradiate and then count the irradiations from a sample of Lithium Hydride.	2

All routine canned slug and graphite tests were made in April using two two-minute drifts rather than two three-minute drifts.

Four bar testing was adopted as standard procedure for all routine graphite tests on April 5. Previously two bar tests were run on the

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CS, KS, and KC types of graphite and single bar tests on all "Finished" graphite. In addition, the number of sample bars from each heat has been reduced from twenty-two to sixteen. Based on the above it now appears that the present operating schedule for the test unit will be adequate to cover all tests scheduled in the coming months.

The classification of graphite bars was changed from the E, D, H, M, and P classes to the following on April 17:

<u>Grade</u>	<u>< 1h Range</u>
Red	less than + 0.08
Blue	+ 0.08 to 0.20
White	+ 0.20 and above (+ 0.20 to 0.60 for "Finished" only)
Green	+ 0.60 and above for "Finished" only

After testing, all sample bars are stamped conforming with the above < 1h ranges and in accordance with the following table to facilitate the handling at the 101 Building.

<u>Type of Graphite</u>	<u>Grade of Graphite</u>			
	<u>Red</u>	<u>Blue</u>	<u>White</u>	<u>Green</u>
CS	R-1	B-1	W-1	G-1
KS	R-2	B-2	W-2	G-2
KC	R-3	B-3	W-3	G-3

Note:

All "Finished" graphite falling into the white grade is identified by WF plus the number.

Development Work

On April 9 a test was made to determine the value of helium as a cooling medium to reduce the melt furnace cooling cycle. The furnace temperature was reduced to 785°C in one hour and forty minutes. On April 19 B furnace was purged with 535 cubic feet of helium fifteen minutes after pouring the final charge. In one hour and ten minutes the furnace was cooled to 780°C. The normal time required to cool the furnaces to 800°C without helium is approximately two hours and fifteen minutes. It is evident that the cooling cycle can be decreased appreciably through the use of helium but its use does not appear to be economical at the present time.

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An additional attempt was made to determine the feasibility of alpha extrusion with present process equipment on April 9. The press was equipped with a container having a diameter of 4.650" and a shear-face three hole die. The first billet was preheated for seventy minutes at 1150°F in the rotary furnace. It extruded about 3/8" at a pressure of 1000 tons; the second billet was preheated for two hours and ten minutes at 1150°F; only 3/4" of rod was extruded. The third billet was preheated two hours at 1150°F and one hour at 1180°F. Approximately 3 1/4" of rod was extruded.

It is now planned to make an additional trial using a bell-mouthed triple hole die and a polished container to determine if friction can be sufficiently reduced to extrude in the alpha range.

An operator's suggestion to increase the steel sleeve length so that the aluminum can would be 1/8" shorter than the sleeve was accepted. This type of can and sleeve assembly eliminates the flared mouth of the canned piece, which results from crimping the can in the shorter sleeve, and subsequently eliminates the cut-off saw operation. In addition, it will decrease rejections of canned pieces for AISI on the outside of can and the possibility of marred surfaces in handling pieces at the cut-off saw.

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