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FUELS PREPARATION DEPARTMENT

MONTHLY REPORT

MAY
1962

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HANFORD ATOMIC PRODUCTS OPERATION

RICHLAND, WASHINGTON

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FUELS PREPARATION DEPARTMENT
MONTHLY REPORT --- May JUNE 1962

HAN - 82270

Compiled by Fuels Preparation Department

June 7, 1962 - Richland, Washington

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

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DECLASSIFIEDMANUFACTURINGProduction - AlSi Process

1. The plant operated on nine canning lines per day for a period of twelve days during the month, which resulted in the production exceeding the forecast. High efficiency and yields contributed to the increased output.
2. A new record high operating efficiency of 97.7 per cent was attained in May. The previous high was experienced in March, 1962.
3. The inventory of finished fuels at month end reflected a 2.3 month supply based upon projected reactor usage.
4. Bare core inventory at the end of May reflected a 1.5 month supply.
5. No autoclave failures occurred in May and none have been experienced during this calendar year.

Production - Coextrusion Process

1. Uranium input of 18.4 tons resulted in 102 production extrusions. Seventeen additional extrusions were completed for engineering development use, of which two were primary extrusions.
2. Failure of the exhaust system in the chemical process area required movement of the chemical processing operation to the Pilot Plant while repairs were made.

ENGINEERINGPresent Reactor Fuels

Approximately 321 tons of alloyed dingot are being irradiated and 1483 have been discharged. No dingot cores were canned this month since a two month moratorium for the canning and charging of dingot metal is in progress. This delay was initiated to enable the development of improved etching, canning, and metal fabrication techniques. Comparative studies of dimensional changes and weight loss of dingot and ingot cores through canning indicated that improvements in etching and canning were possible.

A metallographic examination was performed on several dingot fuel elements which had been purposely defected and autoclaved to ruptures. This examination revealed attack by hydride formation in all directions. HLO has demonstrated that this type of attack is typical for low carbon uranium such as dingot metal. MCW is currently experimenting with additives to the dingot metal and an alpha phase precipitation anneal at 10000F after beta heat treating in conjunction with vacuum outgassing. Both of these programs are designed to improve etching and possibly the molten metal reaction in the canning baths. It is currently planned for the feed-sites to resume

shipments of dingot metal to HAPO in August, 1962, at a rate of 25 tons per month of alpha extruded rod material and 50 tons per month of alpha rolled material for six months. The initial quantity of 4.2 tons of additive dingot cores fabricated from alpha extruded rod was reactor charged this month. The remaining alpha extruded rod dingot metal in bare inventory (about 50 tons) will not be canned until at least July, if then.

Recent Quality Certification data of "K" size normal ingot elements after irradiation has revealed that warp has leveled out at between five and six mills and that OD₂ change has leveled out about five mills for cores shipped to HAPO from March through August, 1961. Pre-irradiation core measurements have not changed appreciably since March, 1961, which may indicate that the warp and OD₂ values will stay about constant.

NLO has recently proposed a carbon sampling plan that should prevent acceptance of high carbon cores. This will require the analysis of approximately one-quarter of NLO's ingot production and will increase our core costs about 0.2 cents per pound.

Post-irradiation examination of 35 columns of overbore fuel, discharged in April from the 44-tube control block loading because of ruptures associated with a heat cycling incident, has been completed. A more detailed examination of two pieces each of dingot and ingot fuel elements with and without "worm tracks" is scheduled to determine the effects of heat cycling on the uranium. It is believed that stresses induced by the incident were sufficient to cause core failures at the exposures (500-766 MWD/T) reached by this material. Projection rails on the overbore fuel examined were in good condition except for cracks being noted at the bridge-tab juncture of some pieces having rails of the initial 40 mill thick, 69 mill high design. Pieces having rails of the same thickness, strengthened at the juncture, showed little damage. On this basis, rails of the present design (45 mill thick, 65 mills high) are expected to perform reasonably well.

Post-irradiation examination of five columns of elliptical bumper fuel and five columns rectangular bumper control fuel exposed to 800 MWD/T goal shows the corrosion on pieces in the higher temperature and flux positions is less on the test material. Anticipating early conversion to take advantage of the lower hydraulic resistance of this rail design, dies have been developed and successfully tested to stamp the rails in "tape" form for feeding into the ultrasonic welders. Design of a prototype "tape" feeder has been completed and fabrication initiated.

The planned retubing of the K Reactors with ribless zircaloy tubes, starting with 200 tubes this fall and large-scale change-out during CY 1963, has required a revision of both the natural and enriched fuel models for these reactors. Component designs have been revised to facilitate procurement. Optimization of projection rails for these fuel models in the Hanford Laboratories has progressed sufficiently to initiate fabrication of a preliminary arch-type design.

The design for the K Reactor self-supported fuel component has been completed and transmitted to component vendors for comment. This fuel element has a flat end rather than the normal interlocking contour of other I & E elements.

Components for this fuel incorporate a built-in weld relief accomplished by modifying the existing contour base can and adding a depression to the cap.

The conversion of the A-C welding machines to D-C in the AlSi shop was continued during the month with four additional machines being converted. One machine in the finishing area and two machines in the special products area remain to be converted.

Circuitry was provided for the installation of ultrasonic weld monitors in the AlSi shop. Installation of this equipment has been deferred until adequate filters are provided to shield out noise and vibration interference.

A proposal to produce up to 1000 CIVE fuel elements by the Sylcor hot press process was sent to the Sylcor Division of Sylvania Electric Products. A bid of \$13,660 to produce 1000 CIVE fuel elements was received and found to be acceptable.

The irradiation test IP-490-A-FP comparing Sylcor hot press, HAPO hot press and HAPO AlSi bonded fuel elements was charged in C Reactor on June 3, 1962.

Improvement of the process for electro-deposition of nickel on metallic uranium included (1) the development of a rapid and reliable plate adhesion testing procedure and (2) plating process improvements to assure uniform good adhesion. Present results are preliminary but encouraging. Development of improved plate adhesion test procedures was considered mandatory to further process improvement and control, since existing procedures only qualitatively detected grossly poor adhesion.

Initial work in improving the nickel plating process is being confined to the pretreatment of the uranium surface. The present electrolytic etch (anodic), although widely used, produces a heavy smut film which must be removed by either a single or double etch in nitric acid. Plate adhesion is influenced not only by the electrolytic etch, but also by the subsequent desmutting steps in a somewhat erratic fashion. Based upon work carried out in chemical milling of uranium on NPR fuel, it appeared that a smut-free finely-plated uranium surface could be obtained without electrolytic etching. Preliminary results indicate this to be true since adhesion testing of nickel plate on chemically milled surfaces has been favorable. Evaluation optimization and simplification of this pretreatment process is continuing.

The initial bonding studies for producing fuel assemblies by the Hot Die Sizing process will begin in the near future. The design of the initial test, the engineering data studies to determine the time-temperature relationships, and the theoretical equations for processing the data using computers have been developed (by the Operations Research and Synthesis Operation of HLO). The engineering data is now in computer and the results are expected during the first week of June.

The necessary parts to complete the installation of the sizing press are now on site. The end bonding press fabrication is nearing completion. The completion date of this work is uncertain because of the present labor dispute involving the construction workers.

A total of seven regular production I&E fuel elements (five natural, one enriched, and one unknown) failed in the reactors during May. No significant changes in the fuel performance trends were noted.

N Reactor Fuels

KER Loops 1 and 2 have been shut down until some time after August 1, 1962 for planned pump modifications.

Twenty N inner tube, enriched 0.95 per cent, (NIE-1) heater fuel elements with zircaloy-2 sleeves are being fabricated for use in the loops to test pump modifications. The "tapered end closure" test is available for testing in these loops as space becomes available.

Fabrication of a new fuel design, KSE-5, has started. This fuel will be used to study the swelling problem in the single tube design for N application. The enrichment is 1.6 per cent.

A charge of 14 N fuel assembly, enriched 0.95 per cent, (NAE-1) fuels has been fabricated and is available for charging in KER Loops 3 and 4. A backup charge for these tests is in the final stages of fabrication, and will be used to replace 11 NAE-1 prototypic fuels in KER Loop 3 which have reached an exposure of 525 MWD/T. Since a large percent of this exposure was under "cold" water conditions, it is planned to discharge these elements at the next shut down and to replace with the backup charge. Fourteen NAE-1 prototype fuels in Loop 4 are operating satisfactorily and exposure to 1000 MWD/T is planned.

The evaluation of the "Brandywine" material now in the final finishing stages of the N process indicates that this material will not behave significantly differently from regular enriched uranium.

About 126 N outer tube, enriched 0.95 per cent, (NOE) billets, from the four category feed-site test, involving various fabrication parameters, have been received at HAPO for coextrusion evaluation. At least 100 of the billets are to be coextruded during the first two weeks of June.

HLO has completed all necessary tooling modifications in order to expedite a six-category, solid-cast and drilled ingot test upon receipt of the production request from HAPO.

The final draft of the revised N-Uranium Billet Specification has been prepared and reviewed with NLO and BBC. These have been formally approved and are now being printed.

Engineering extrusions made during May included three primary uranium, three zircaloy billets, six composites and six copper billets and utilized 11.1", 7.6", and 6.0" tooling.

The first "British-type" alloy (nominally 400 Fe, 800 Al) ingot was extruded to N outer billet size. This single-beta heat treated ingot was extruded with an alpha-annealed, single-beta treated Fe-Si ingot as a control. The Fe-Al alloy required about 50 to 60 per cent more force to upset than the Fe-Si unit. The ingot extruded satisfactorily. Cutting and machining and evaluation of the extrusion is not yet complete.

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The extreme die pickup experienced during the past six weeks was primarily caused by the surface preparation of the copper billet can. The pickup was eliminated by abrading the entire O.D. surface of the assembled billet with emery paper prior to lubrication for preheat. It is not yet known whether this abrading removed a surface chemical effect produced during cleaning or produced a surface which retained more lubricant during the actual extrusion. In either case it is believed that this surface preparation of the copper can be refined by modifying the present copper cleaning process.

Of further interest in connection with die pickup, it is believed that warp is increased when pickup occurs. The fact that warp of NIE material has been increasing for the past two months supports this belief. Until recently the degree of warp increase has not been sufficient to increase the reject rate significantly, but the percentage of material requiring straightening after beta heat treatment had increased from approximately 20 per cent to 50 per cent. When extreme die pickup became a consistent and definite problem, the warp reject rate increased from approximately 6 per cent to 40 per cent. An additional variable had been introduced with most of this material (single beta heat treatment of billets) and the effect of this variable on warp cannot be determined due to the heavy die pickup which occurred on all of the extrusions.

The principal difficulty with horizontal milling has been in the depth variation in which the center mills deeper than the I.D. and O.D. edges. Experiments have been performed in which a rubber washer has been placed in the recess to protect the center areas. This allows the edges to be milled to sufficient depth without affecting the center. Additional tools are being made to develop this process for production application.

A flash etch solution containing the same chemicals as the current chemical milling solution, but in different proportions, has shown potential in producing a uniformly pitted uranium surface. The purpose is to produce a uniformly rough surface to improve bonding in the braze closure.

Efforts are continuing to find a technique which is more reliable than thermocouple insertion for calibration of the brazing temperature recorder-controller. The use of gold, which has a sharp melting point of 1063°C, is being investigated. Considerable effort is being made to evaluate the possibility of measuring the change in electrical impedance that is reflected into the induction heating coil by the heated fuel element, and correlating this impedance with the temperature of the fuel element closure zone. Data obtained to date are encouraging in that this effect is clearly evident. However, a one-to-one correspondence between coil impedance and fuel element temperature is made difficult to establish by other variables which cannot be controlled. Techniques for circumventing this difficulty are presently under evaluation.

Fuel element supports still continue to be a problem area in the provision of adequate numbers of acceptable supports for routine production use. Remedial changes in design are under way and purchase orders based on these changes are being issued.

It has been demonstrated in pilot plant tests that braze closed N fuels develop white weld oxide during autoclaving when processed in an etchant-contaminated

aluminum nitrate stop bath. The white oxide formation is also influenced by the type of autoclave procedure used. With a complete water fill and hot blowdown autoclave procedure, the tolerance level of stop bath contamination is considerably greater than when an incomplete water fill and hot blowdown procedure is used. Modifications of procedures have been made which should significantly reduce the white oxide problem.

Seven pieces each of NOT and NIT tubing, two inches long with 1/8 inch thick titanium closure rings have been prepared and were shipped to BMI. They are to be used for bonding, steam and water autoclave corrosion and chemical separation studies.

Ten pieces each of NOT and NIT tubing, two inches long with a 90 degree "V" type zirconium closure ring equivalent to 1/8 inch flat closure rings have been prepared and were shipped to NMI. They were prepared for bonding studies of zirconium to zircaloy-2 90 degree included angle "V" type closure ring design and chemical separation.

In order to produce the strongest diffusion bond for the N fuel end closure, it has been found that the most desirable type of bond is a solid solution type rather than a bond that is an intermetallic compound. It has been postulated that a closure ring which would have titanium in contact with the zircaloy-2 and niobium in contact with the uranium would produce a closure bond of the solid solution type. Essentially this would mean that the closure ring would be trimetal. (There is some doubt, however, as to the type and strength of the Ti-Nb bond as it may be brittle.)

Six pieces each of NOT and NIT tubing, two inches long with 1/8 inch thick niobium closure rings are ready for assembly and shipment to NMI for diffusion bonding. One piece will be assembled with a Ti-Nb assembly. They are to be used for bonding, steam and water autoclave corrosion, and chemical separation studies.

Work by Chemical Research, HLO, on the electrodeposition of copper on zircaloy-2 indicates that this approach is not feasible and the program has been discontinued. Work on contract DDR-139 with the National Research Corp. developing the vapor depositions of copper on zircaloy-2 is continuing and some progress is being made. The National Research Corp. has started a study to investigate the merits of etching at low pressure and high voltage and to determine if the present high quality diffusion bonds can be produced. Manufacturing-wise, this would provide for less argon consumption and greater ease of etching.

Operation of the N fuel tester continues on a routine basis. No attempts to further refine the equipment is presently being made. The accuracy of the cladding thickness tester (plus or minus .002 inches) is presently as good as the radiograph test and thought is being given the elimination of the latter test.

The bond test has revealed the first instance of uranium cracking in extruded N fuel. The defect, observed on only one outer tube, was a laminar crack positioned in the uranium about five mills from the internal zirconium-uranium interface.

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Fabrication of the electronic equipment for inspection of irradiated N fuel in 105 KE basin is about 75 per cent complete. A strike-caused work stoppage is delaying fabrication of the mechanical portions of this equipment and attempts are made to place some partially completed equipment in other shops in order to expedite its completion.

This system, designated UT-10, will inspect the bonding, closure, uranium core, and cladding thickness of irradiated fuel. The cladding thickness measurements will be performed by ultrasonic techniques, rather than eddy current as in pre-irradiation tests. The successful use of ultrasonics for this purpose represents a significant development accomplishment which may find application in other problems involving the measurement of cladding thickness.

PERSONNEL STATISTICS

Number of employees as of April 30, 1962 819
Number of employees as of May 31, 1962 829

	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
General	2	1	3
Manufacturing	90	355	445
Engineering	46	29	75
Financial	14	8	22
Plant Facilities	37	246	283
Employee Relations	1	0	1
TOTAL	190	639	829

<u>Employment</u>		<u>May</u>	<u>April</u>
Additions:	Exempt	2	0
	Nonexempt	14	10
		<u>16</u>	<u>10</u>
Reductions:	Exempt	1	0
	Nonexempt	5	15
		<u>6</u>	<u>15</u>

Additions to the Department payroll included six new hires for replacement purposes; one reactivate from personal illness; two rehires of former Company employees -- one as a replacement secretary and the other as a Chemical Analyst addition; one recall from ROF status as a metal handler replacement; one excess clerk from IPD to fill vacancy; a Manager, Manufacturing Engineering, transferred from IPD; an engineer transferred from Laminated Products; one CTP for final rotational assignment to fill trainee openings; one painter transferred from IPD as an addition; and a secretarial replacement transferred from the stenographic pool in CE&UO.

Reductions included one deactivate for personal illness; four craft transfers to IPD via the Request for Transfer procedure; and an Engineer to military service.

STAFF

General Manager	R. L. Dickeman
Manager, Manufacturing Operation	W. N. Mobley
Acting Manager, Engineering Operation	J. T. Stringer
Manager, Financial Operation	W. S. Roe
Manager, Plant Facilities Operation	E. Hilgeman
Manager, Employee Relations	C. O. Steinnagel
Consultant, Business Effectiveness Program	J. W. Talbott

Effective May 1, 1962, Mr. J. R. Carrell was appointed Manager, Manufacturing Engineering. Mr. J. W. Talbott was appointed Consultant, Business Effectiveness Program and is currently attending the training program at Crotonville, New York. Upon his return, he will be a Consultant to C.P.D.

PATENT SUMMARY - MAY 1962

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 May 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.

"Concept for a Closure Having Improved Shear Strength."

..... By A. E. Guay

"A Method of Employing Sonic Vibration to the N Fuel Closure Process."

..... By D. C. Worlton

R L Dickeman

General Manager
Fuels Preparation Department

RL Dickeman:mkm

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MANUFACTURING OPERATION

MAY, 1962

CURRENT OPERATIONS

Production

Statistics - ALSi

	NORMAL				ENRICHED				
			O				O		
<u>Current Month's Production</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>	<u>Total</u>
Acceptable Fuel Ele- ments Produced (Tons)	110.6	239.0	138.0	1.7	15.9	48.5	7.3	48.4	609.4
As % of Forecast Production	158	131	64	21	106	124	73	147	107
Cum. % of Forecast for Current Quarter	104	116	132	35	53	156	240	119	108
As % of Past 3 Month's Average Production	442	98	139	2	94	73	56	210	105
As % of Past 12 Month's Average Production	235	88	104	2	114	95	56	151	96
% of Forecast Achieved Last Fiscal Quarter	48	126	120	81	102	106	84	73	102
% of Forecast Achieved Last 4 Fiscal Quarters	105	112	115	91	76	103	106	104	104

Operating Efficiency

Current Month (%)	97.7
Forecast (%)	95.0
Previous Month (%)	96.2

Manufacturing Yield

Current Month (%)	93	94	93	-	94	90	91	82
Forecast (%)	90	90	90	85	90	90	90	85
Previous Month (%)	-	92	91	82	-	92	92	83

Bare Uranium Available for Processing (Tons)	975
Finished Products in Storage (Tons)	1399
Special Products Finished (Pieces) Boll	176
Uranium Utilization	97.9

Statistics - Coextrusion Production (1)

Forecast Process Input (Tons) 20
Actual Process Input (Tons) 18.4

Unit Operation	Station Throughput				Inventory of Pieces Awaiting Processing					
	Outers		Inners		Outers			Inners		
	Pieces Proc.	Defect Rate(3)	Pieces Proc.	Defect Rate(3)	24"	18"	12"	24"	18"	12"
Extrusion	64(2)	3.8	38(2)	0.7	0	0	0	0	0	0
Chemical Milling	739	0	0	0	0	0	0	208	9	2
Braze	701	10.0	1528	5.0	98	0	0	0	0	0
Heat Treat	709	0.6	512	29.0	23	0	0	0	0	0
Machining	630	0	323	0	72	0	0	38	3	0
Non-Dest. Testers	109	12.7	701	9.1	104	0	1	0	0	0
Autoradiograph	843	3.7	550	0.5	822	104	61	837	118	115
Support Weld	364	0	0	0	569	36	22	869	122	10
Autoclave	12	0	0	0	0	0	0	0	0	0

Process Inventory

Production Pieces Held for Rework	324	82	10	237	127	12
Production Pieces Awaiting Evaluation	205	34	12	194	24	7
Production Pieces - Scrap	110	18	17	113	17	8
Total Process Inventory - Pieces	2,662	276	123	2,673	427	59
Total Process Inventory - Pounds	74,217	5,785	1,728	37,315	4,475	414

Finished Production for May - None
Total Finished Inventory - None
Oxide Burned - Pounds - 256.73

- (1) Input and inventory to date consists of enriched U.
(2) Billets
(3) Includes Pieces held for rework, pieces awaiting evaluation, and scrap pieces.

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Production

Plant Operation - ALSi

The production forecast for May was exceeded as a result of the operation of nine canning lines for twelve days during the month. Higher-than-forecast yields and efficiency also contributed to the increased production.

A general increase in production yields occurred for nonbumpered material. This was primarily due to a general decrease in the CPR reject rate. Fewer problems were encountered in ALSi slopover rejects and stuck sleeve rejects. Production continues to be in the transition period to aluminum cans with tighter specifications regarding projected can O.D. plus upset metal diameter. Aluminum cans under the new specifications have performed satisfactorily with reduced ALSi slopover rejects. Problem periods which have been encountered while using such cans were primarily due to canning furnace conditions. Various unsolved problems remain concerning what the canning variables are and how they can be controlled.

Marred surface rejects and weld rejects continued to be problem areas accounting for approximately three percent of the first-run yield loss. Conveyor conditions and handling were the contributing factors in the marred surface rejects. Backlog conditions caused additional handling steps in the process and subsequent marred surface rejects.

Bumpered fuel element production was relatively low. Bumper weld rejects were high due to mechanical problems and weak welds.

Bumper welding produced 50 acceptable tons welded during May, with a yield of 86 percent. Production and reactor charging for May and to-date is as follows:

	<u>May 1962</u>		<u>To-Date</u>	
	<u>Natural</u>	<u>Enriched</u>	<u>Natural</u>	<u>Enriched</u>
F.P.D. Produced	7	48	1124	614
I.P.D. Charged	126	45	891	564
Finished Inventory	247	50	247	50
Average Welding Yield	-	86%		

There were no autoclave failures of ALSi fuels during May, and none to-date during this calendar year.

The inventory of finished fuels at month end reflected a 2.3 month supply based on projected reactor usage. Excluding dingot fuel the effective inventory is a 2.0 month supply. The month end inventory of bare cores reflected a 2.0 month supply based on anticipated fuels needs. Excluding bare dingot fuel the effective inventory is a 1.5 month supply.

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

8" Normal I&E	19,843
6" Enriched I&E	5,440
6" Water Mix	81
Total	25,364

Two shipments totaling 53.31 tons of natural and enriched uranium scrap were made during the month. Two additional shipments containing 784 boxes with lids were made.

Plant Operation - Coextrusion

A total of 119 extrusions during the month of which 38 were inners and 64 were outers for production. This represents a total input of 18.4 tons, an input slightly less than the 20 tons scheduled. Loss of the exhaust system over the chemical bay prevented assembly of billets to complete the extrusion schedule.

Seventeen extrusions were made for Engineering, including two primary extrusions. Four of the Engineering tubes were processed through the cutoff saw.

Although production was started on the support welder late in the month, it was too late to permit autoclaving before month end. Throughput through the support welder is low due to equipment debugging and data collection. Difficulties are still being experienced with the locking clip welder.

The following is the total throughput by station for the month of May:

<u>Operation</u>	<u>Inners</u>	<u>Outers</u>	<u>Total</u>
Extrusion	38	64	102
Cutup 1st	438	768	1206
Cutup Rework	2	17	19
Chemical Milling	0	739	739
Braze (ends)	1040	1386	2426
Heat Treat	512	709	1221
Machining	323	630	953
Vacu-Blast	367	509	876
Welding	238	657	895
End Test	392	408	800
Clad & Bond Test	428	622	1050
Support Weld	0	364	364
Autoclaves	0	12	12
Oxide Burner - 13 batches = 256.73 lbs.			

Manufacturing Engineering

Design and Projects

CGF-903 Projection Fuel Element Modifications - 313 Building

	<u>Scheduled</u>	<u>Actual</u>
Design	100	100
Construction	82	82

Parts of the ultrasonic welder have been received. No further progress is anticipated on this job until the third ultrasonic welder is all on site and construction personnel return to work.

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CAF-954 High Pressure Autoclave Development Facility

Action on this project proposal is awaiting the development of additional documentation.

CAF-961 Consolidated 303 Area Services Facility - Phase I

This proposal is awaiting action by the AEC.

CAF-973 Steam Distribution Line Modifications - 300 Area

This project proposal was transmitted to the AEC on May 24, 1962.

Installation of the high level radiation detector alarm system was completed in the 313, 305, 306 and 303-E Buildings. The alarms are not hooked up at the present time, and will not be hooked up until evacuation procedures have been established.

Drafting and Duplicating

Drawings Produced

New	68
Revisions	90
Small Charts	71
Large Charts	11
Miscellaneous	133

Duplicating Production

Xerox Masters Prepared	692
Multilith Impressions	423,919
Ozalid Copies	8,839
914 Copier Copies	17,976

PLANT CONDITIONS, INCIDENTS, AND IMPROVEMENTS

ALSI

A new record high operating efficiency was attained in May which slightly exceeded the previous high which was experienced in March, 1962. About 70 percent of the downtime was attributed to equipment malfunctions, the reminder being caused by operational problems.

The canning lines are being equipped with line identification stampers. These stampers will be installed at each quench tank and will provide permanent canning line identification for each fuel element. Identification numbers will be located on the cylindrical surface of the fuel element can base. Line identity stamping of each fuel element will permit relation of subsequent processing or irradiation problems to the particular canning line involved. A prime advantage will be ability to segregate out-of-process material.

Quality Control Engineering has conducted capability studies to determine whether

or not the stampers installed on Canning Lines 4 and 5 meet the engineering specifications for stamp placement. Both stampers proved successful in this respect. The four remaining stampers will be installed on the quench tanks as each tank is reconditioned and returned to production use.

The braze void study has been completed. Test results showed no significant difference in the occurrence of weld defects between fuel elements with visible voids in the braze line after facing and nonbraze void material. A report will be issued on this test.

The major cause of canning line downtime this month was the Pressure Quench Machines. A total of 390 minutes were lost due to problems ranging from pressure switch adjustment (requiring short outages) to solenoid valve failures and AlSi plugged pressure bells which required longer periods of time to correct. It has been noted that since installation of the new sealed basket bushings, thirty-three operating days have elapsed without a bushing failure or need for basket alignment due to bushing wear. As a result, there has been approximately a 40 percent reduction in canning line downtime chargeable to these machines.

On May 14, 1962, the Ajax Furnace located in the 7D recovery position failed prematurely due to AlSi penetration through to lower hearth induction coil. This furnace had been in operation in this position since it was completely rebuilt in February, 1962. The lower unit that failed was the last of the prerammed units in service. Although the prerammed spare lower hearth has potential with regard to reduced furnace outage time for lower hearth failures the practice has been discontinued until a procedure can be developed for preramming that will not produce a lower hearth with marginal performance characteristics.

The new accountability system was adopted for all production on May 14, 1962. Prior to this date only enriched production was on the system. The May month end inventory was reconciled the first working day of the month which is a marked improvement over the old system which usually took several days. To date four errors in physical inventory, two instances of model mixing, one instance of movement of pieces to Quality Control without a transfer, have caused difficulty for the new system. However, disclosure of the problem and reconciliation on a model run basis apparently has minimized month end inventory and discrepancy reconciliation problems. Emphasis is needed on accurate counts and correction of model mixing for a more successful accountability operation.

Coextrusion

Due to the loss of the chemical bay fans on May 23, 1962, a portion of the Shop personnel were assigned to swing shift. This was done in order to utilize manpower and the facilities in the 306 Pilot Plant more effectively. Five operators and one supervisor were assigned swing shift for one week. It is expected that the 333 Building chemical facilities will be available, for a limited operation, by the week of June 4, 1962.

A great deal of material is being rerun on the clad and bond tester to check the accuracy of earlier tests. No significant or unexpected errors have been found. The inner fuel bond standards were changed on May 8, 1962, from 100 to 60 mils unbonded areas.

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As reported previously, the plastic liners have been separating from the chemical tanks. Tank 27 was patched and returned to service. Since that time, tank 31, a spare tank, has been lined with another coating material. This tank will be placed in service to replace tank 27. Tank 27 will then be stripped of its liner, the tank thoroughly checked and if acceptable it will be lined with the new coating material. This pattern will be followed until all the tanks have had new lining material applied.

Further testing by the Occupational Hygiene group has determined the hoods for tanks 10 and 11 improved the flow of tank vapors. Work orders have been issued for the installation of similar hoods over tanks 17, 19, and 32 to control the tank vapors at these points.

Three of the chemical exhaust fans were damaged on May 23 shortly after 10:00 p.m. The failure of the fans apparently resulted from the failure of an impeller on one fan. The failure of this impeller either threw parts into the next fan with this fan failing and throwing parts into the next fan, or the vibration of the unbalanced fan resulted in failure of the impellers in two other fans. Since at least two fans are required for even minimal operation of the chemical area, it was necessary to repair one fan before the chemical area could operate. One fan has been repaired and is being balanced. Parts for the other two fans are on order with delivery scheduled for the middle of June.

On April 26 calibration tests were made with the braze equipment in the 306 Building. The pieces brazed were outer tubes. After brazing six ends of fuel tubes, it was established that the pilot plant equipment could not control the process temperature any more closely than the production equipment. A radiometer was set up in the lab to determine the effects of response and drift using a constant light source. The results showed that the radiometer response did not change when measuring a light source under identical conditions. This was again proven using a calibrated black body light source. The drift of the cell was negligible. Since it was established that further development work was required to establish temperature control criteria, Engineering was asked to develop further information.

Installation of a new argon gas bottle manifold was completed on May 3. The purpose of this job was to get the argon gas bottles out of the beryllium zone and to permit operations to operate longer periods before having to physically change argon bottles.

The chemical milling process used in the 333 Building is done in the vertical position with the chemical reaction occurring at the top end only. The time required for this operation could be reduced from six hours to four hours if both ends of the pieces were milled simultaneously in a horizontal position. Installation and modification of the mechanical equipment required for horizontal milling was completed in January, 1962. Two conditions have to be met to produce acceptable pieces-depth of milling and surface variation. Depth of milling has not been a problem, but the 20 mil maximum variation specification has not been met. Work done to date has reduced the average variation from 35 mils to 19 mils for outers and 25 mils for inners. The effect on surface variation and throughput rates is being studied by processing for one-half the cycle in the horizontal position and one-half the cycle in the vertical position.

Cooling rate tests for outer and inner pieces have been completed and firm estimates of process capability for the temperature control of the fuel section immediately before quenching have been established. The prequench temperature will be 680 plus or minus 9 C for outer pieces and 680 plus or minus 9.2 C for inner pieces. The average cooling rate for outer fuel elements is 2.45 C/sec with three sigma limits of plus or minus 0.66. The cooling rate for inners is 2.22 C/sec with three sigma limits of plus or minus 0.45. The variation in heating bath temperature in the working area is plus or minus 3 C.

Hydrostatic pressure tests have been run on several different configurations of fuel element samples. In general failure has occurred in the zircalloy clad and/or in the uranium. Only in the case of very poor bonds has interface failure been observed, and these failures are very localized. Tests with different samples configurations are continuing.

The tensile testing machine for use on the stud pulling tests was received and set up in the 333 Building laboratory. A fuel element holder for stud pull tests of bond strength has been designed.

Two locking clip gauges have been fabricated and are now in use. One gauge measures the distance from the end of the fuel element to the end of the near locking clip. The other gauge measures the gap between locking clips.

Sample pieces are being selected and marked at pre-mill inspection, and measured variables data is being collected at pre-mill inspection, squaring, chem mill, heat treat, and machining, clad and bond test, and autoradiograph for the NPR fuel characterization program. Collection of information at final inspection should start in the fall when the special PTM gauge and tape readout unit are completed.

An autoclave capacity report was completed which outlines equipment, manpower, and lag storage requirements for four possible levels of production. Detailed scheduling of vessel loading and unloading was established for various work shift combinations.

Design modification of the billet rotating unit was completed to facilitate its use as an inspection and assembly unit.

An informal report was issued to compare the process economics of horizontal milling versus vertical milling.

The 333 Building layout was updated to an As-Built condition.

FPD HEALTH AND SAFETY

	<u>May</u>	<u>April</u>
Disabling Injuries	0	*1
Serious Accidents	0	*1
Medical Treatment Injuries	37	*68

*Revised figures

Although safety performance reflected by a Disabling Injury, one Serious Accident and 68 Medical Treatment injuries in April was far below the usual

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for the Department, the May injury performance shows a sharp reversal with a total of 37 Medical Treatment Cases. This is the lowest number of injuries reported since January, 1959.

A memo was sent to all section and subsection managers calling attention to the hazards of portable electric fans used in offices and shops. Stores stocks a nylon mesh fan guard to protect against finger injuries. The stores caption numbers were furnished for purchase where needed.

A copy of a booklet of Chemical Safety Guides was assigned to each of 49 first line management members. The Chemical Guides were prepared and compiled by the HLO Chemical Hazards Specialist and made available to FPD. Copies have been forwarded to section and subsection managers in Manufacturing, Plant Facilities, and Engineering for review. A cover letter was included listing personnel who have copies assigned.

FPD SUGGESTION PLAN

A proposal was submitted to all departments to use a flat rate of continuity of service accrual on suggestions so each department will be fully consistent in applying the CSA. The proposal was approved and arrangements are being made to effect the change.

A total of 73 suggestions were closed out during the month, resulting in a reduction of 29 in the department backlog. One off-site suggestion and eight from other HAPO departments were evaluated during May.

Suggestion Plan Participation

	<u>May</u>	<u>April</u>
Number of eligible employees	640	631
FPD suggestions received	44	60
Annualized rate per 1000 eligible employees	825	1,141
Number of suggestions adopted	34	24
Net annual savings	\$4,124.00	\$2,766.00
Amount of awards	\$ 810.00	\$ 450.00
Percent of total awards to savings	19.6	16.3
Average amount of awards	\$ 23.82	\$ 18.75

SIGNIFICANT REPORTS ISSUED

HW 73865	Evaluation of Savings Based on Fabrication 10-Inch Versus 6-Inch Enriched I&E Fuel Elements For Fuel E-N Loadings	5/31/62	F. W. Grubb
HW 73236	Uranium Quality Control Analytical Results	4/3/62	G. B. Hansen
HW 73458	Uranium Quality Control Analytical Results	4/23/62	G. B. Hansen
HW 73507	Uranium Quality Control Analytical Results	4/30/62	G. B. Hansen
HW 73687	Uranium Quality Control Analytical Results	5/16/62	G. B. Hansen

HW 73655	Report of Isotopic Analysis	5/11/62	G. B. Hansen
HW 73338	Report of Uranium Accountability in Manufacturing Processes for Control Handling	3/31/62	W. G. Jolley
HW 73577	FPD Production Forecast	5/3/62	R. L. Dickeman
HW 73702RD	Production Assumptions and Schedules	5/15/62	H. E. Berg
HW 73555RD	Uranium Delivery Schedule	5/2/62	W. N. Mobley
HW 73718RD	Uranium Delivery Schedule	5/14/62	W. N. Mobley
HW 73749RD	Uranium Delivery Schedule	5/24/62	W. N. Mobley
HW 73768	Bare Core and Finished Fuel Inventory	5/28/62	H. E. Berg

EMPLOYEE RELATIONS

Safety

Members of the Manufacturing Operation sustained twenty-two medical treatment injuries during May.

Security

There were no security violations in the Manufacturing Operation during May.

Radiation and Beryllium Control

Seventeen air samples and thirty smear samples were taken and analyzed for beryllium during the period from April 24 through May 23. The beryllium concentration in each of the air samples taken inside the 333 Building was less than 10 percent of the maximum acceptable concentration for indoor air. Four of the air samples were taken at the 333 Building beryllium exhaust outlet on the roof and the beryllium concentration in these samples was below the maximum acceptable concentration for outdoor air. The beryllium smear samples were below the HAPD control limit or were taken on equipment in beryllium zones where contamination is known to be present and adequate safeguards are maintained.

The total of the exposures in excess of 100 mrad for Manufacturing personnel for the four-week badge period ending April 20 is 6,281 mrad compared with an average of 6,930 mrad per four-week badge period for the previous year. There were three exposures in excess of 300 mrad during this badge period.

Training

Twelve electricians received a total of 24 instruction hours on the UT-4 test tank control panel circuitry and its operation.

Eight instrument technicians were given 38 instruction hours on trouble shooting the UT-4 tester electronic circuitry.

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UT-4 electronic prints were revised, printed and issued to the instrument craftsmen during the month; however, recent changes recommended by Quality Control will require further manual revisions.

The UT-2 tester Morning Set-up procedure was revised and reviewed with all instrument personnel.

Three electricians were given 7 hours of individual instruction on set-up and troubleshooting the Vickers D.C. welder programmers.

Visits

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
A.J.Karnie	Boeing Company Seattle, Wash.	R.Lingen F. Sutch	5/8/62	Study of fluidized bed reactors
L.F.Reilly	Fairchild Air Force Base, Spokane, Wash.	Mr. Ruggles	5/10/62	Observe operation gas fired steam generating equip.
S.L.Hooper	Hallidie Machine Co. Seattle, Wash.	Jim Mohondro	5/17/62	Discuss double-end machining
	Dow Industrial Seattle, Wash.	S.M.Clark	5/18/62	Discuss double-end machining
	Circo Corp. Bellevue, Wash.	A.E.Creek	5/18/62	Discuss trichlor recovery
	Do-All Northwest Co. Seattle, Wash.	Jim Volk	5/19/62	Discuss double-end machining
F.W.Grubb	Boeing Aerospace & Transport Divisions Seattle, Wash.	H.Mattison	5/22,	Observe data collection equip. & study supporting information system
K.Drumheller	Design Engineering Show, Chicago, Ill.		4/30 through 5/2/62	Engineering show
	National Lead Co. Fernald, Ohio	J.Mitchell R.McKee P.DeFazio	5/3/62	Discuss fuel element machining

Visitors

Jim Mohondro	Hallidie Machine Co.	S.L.Hooper	5/23/62	Discuss double-end machining
J.N.Heald Bruce Crabtree	Heald Machine Co.	S.L.Hooper	5/23/62	

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
E.P. Boron	Bridgeport Brass Co. Ashtabula, Ohio	S.G. Forbes	5/29/62	Discuss electrical heating of dies & containers on extrusion presses
Mr. Stratnan Mr. DeSesa	National Lead of Ohio	H.E. Berg	5/2/62	Discuss scrap shipments
G.A. Moudry R.A. Quadt	Harvey Aluminum Bridgeport Brass	H.E. Berg	5/7/62	Discuss respective orders for zircaloy II cladding tubes
Students	Walla Walla College	F.E. Jochen	5/10/62	Tour Test Reactor
*IMOG Committee		H.E. Berg	5/9/62	Tour ALSi Shop

*C. R. Barncord
Sandia Laboratories
Livermore, California

D. M. Bassler
Dow Chemical Company
Rocky Flats Plant
Denver, Colorado

R. H. Creighton
Bendix Corporation
Kansas City Division
Kansas City, Missouri

C. A. Slater
Bendix Corporation
Kansas City Division
Kansas City, Missouri

W. A. Gardner
C. F. Hurley
R. S. Wilson
Sandia Laboratories
Albuquerque, New Mexico

A. D. McGovern
General Electric Company
X-ray Department
St. Petersburg, Florida

C. R. Poole
Mason and Hanger - Silas Mason Company
Iowa Ordnance Plant
Burlington, Iowa

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W. D. Martin
Mason and Hanger - Silas Mason Company
Pantex Ordnance Plant
Amarillo, Texas

J. W. Strohecker
G. A. Fowler
Union Carbide Nuclear Company
Y-12 Plant
Oak Ridge, Tennessee

R. J. Spies
Lawrence Radiation Laboratory
Livermore, California

Patent Summary

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 May.

WN Mobley
Manager - Manufacturing

WN Mobley:HFT:mrh

11 JAN 1968 -- 107, 89.7

8" NORMAL 8" BUMPERS 6" ENRICHED 6" BUMPERS

STATISTICS -- May, 1962

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B-15

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HW-73908

ENGINEERING OPERATIONMay, 1962VISITORS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
NF Neumann	Mallinckrodt Chemical Works, St. Louis, Mo.	JT Stringer	5-22/23	Dingot canning problems.
Mikio Horri	Olympus Optical Co., Tokyo, Japan	TB Correy	5-14	Demonstrate microscope.
CD Spurrier	Torrance Brass Fdry., Torrance, Calif.	GW Riedeman	5-16	N reactor components.
J Foss LL Becker	Bridgeport Brass Co., Seattle, Wn. and Riverside, Calif.	GW Riedeman	5-23	Routine vendor visit.
DR Jefferson EF Boron	Bridgeport Brass Co., Ashtabula, Ohio	CH Shaw SM Gill	5-28/29	Design of electrical heated extrusion dies.

TRIPS

JT Stringer	Mallinckrodt Chemical Works, St. Louis, Mo.	JA Fellows	5-1/2/3	Working Committee meeting of FEDC
GF Jacky	Seattle, Wash.		5-26	Attend Northwest Regional meeting of AES.
KW Norwood	G.E. Research Lab., Schenectady, N.Y.	WE Tragert	5-24/25	R&D development problems.
" "	Nuclear Metals, Inc. Concord, Massachusetts	P Loewenstein	5-28/29	Plant orientation
JW Nickolaus	Rem, Inc., Portland, Oregon	CA Brown	5-10/11	NPR support fabrication.
GW Riedeman	" "	" "	5-25	N reactor fuel components.
JW Nickolaus	Wah Cheng Corp., Albany, Oregon	RA Graham	5-10/11	NPR support fabrication.

PERSONNEL

E. J. Corrado, Engineer, Manufacturing Training Program, assigned to AlSi Product Engineering Operation, terminated on May 18, 1962.

W. A. Williams, Technician, transferred from Manufacturing to the Coextruded Product Engineering Operation on May 21, 1962.

R. L. Walser, Engineer, Manufacturing Training Program, was assigned to the AlSi Product Engineering Operation on May 28, 1962.

INVENTIONS

All Engineering Operation personnel engaged in work that might reasonably be expected to result in inventions or discoveries advised that to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during May, 1962, 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.

"Concept for a Closure Having Improved Shear Strength," by A. E. Guay

"A Method of Employing Sonic Vibrations to the N Fuel Closure Process," by D. C. Worlton.

SIGNIFICANT REPORTS ISSUED

HW-73674, "Progress Report - NPR Fuels Data Processing Task Force," W. R. Kirk, L. T. Hagie and T. D. Naylor, May 15, 1962.

HW-73680, "Technical Bases for O2 Metallurgy R&D Program - FY 1963 and FY-1964," K. W. Norwood, May 14, 1962.

HW-73774, "Coextrusion Interface Profile and Clad Thickness Recorder," R. L. Straley, May 28, 1962.

HWSA-2559, "Effect of Gas Pressure About Atmospheric on Rate of Etching and Surface Roughness of Cathodically Etched Metal Surfaces," T. B. Correy, May 17, 1962 (for Institute of Welding Arc Physics Symposium, London, October 29 to November 2, 1962).

SECURITY

There were no security violations in the Engineering Section during May. Total CYTD - 1.

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ADVANCE FUEL ENGINEERING

Fuel Performance

A total of seven (7) regular production I&E fuel elements (five natural, one enriched, and one unknown) failed in the reactors during May.* 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	1265-DR(1)	197	End (Female)	5/1/62	3/7/62
" "	3072-DR(1)	226	End (Female)	5/8/62	3/5/62
" "	1159-C	423	Side Hot Spot	5/11/62	11/10/62
" "	1068-B(2)	627	Unclassified	5/12/62	11/29/62
Bumper	2166-D(3)	811	Side Other	5/26/62	9/27/61
Enriched					
Bumper	0576-H	1294	Core Split	5/6/62	5/11/61
Unknown					
Non-bumper	1384-C(4)	425	Unknown	5/5/62	---

- (1) Alloyed dingot
- (2) Vendor "H"
- (3) Water Mix Piece Ruptured
- (4) Mixed enriched and natural column

* Fuel performance during May was consistent with established behavior.

Feed Site Data System

The first phase of the feed site data system has been instituted. This consists of the machine printing of a receiving-accountability report from data mailed from the feed sites at the time the material is shipped. Other facets of the data system both on-site and off-site are still being worked on.

Chemical Variability PT

A production test has been designed and proposed to evaluate the effects of within-specification variation of carbon, iron, and silicon on the mechanical properties and irradiation behavior of uranium in I&E fuel elements. A verbal presentation of the test purpose and design was given to FPD Engineering, IPD, and a representative from HOO-AEC.

Nuclear Safety

Routine nuclear safety audits of the Hanford Test Reactor and FPD Engineering facilities are now being performed by Advance Fuel Engineering.

The "Technical Specifications - HTR" has been completed and is awaiting approval.

Preparation of the AFE section of the "FPD Engineering Nuclear Safety Manual" has taken priority over work on the "Hazards Review - Fuels Plant".

ALSI PRODUCT ENGINEERING

Uranium Technology

Approximately 198 tons of alloyed dingot are being irradiated in the old reactors and 1310 tons have been discharged at goal. In addition, 123 tons of alloyed dingot are being irradiated in the K reactors and 173 tons have been discharged. Two non-bumpered alloyed dingot failures occurred this month at 197 and 226 MWD/T and both were classified as end failures. A non-bumpered ingot control failure also occurred at 627 MWD/T, but the failure classification has not yet been determined. No dingot cores were canned this month since an approximate two month moratorium is in progress in which no dingot uranium will be canned or reactor charged. This delay in canning dingot will enable improved etching and canning techniques to be developed for dingot cores.

MCW is currently experimenting with additives to the dingot metal and an alpha phase precipitation anneal at $\sim 1000^{\circ}\text{F}$ after beta heat treating in conjunction with vacuum outgassing. Both of these programs are designed to increase the chemical reactivity of the metal which will increase the susceptibility of the metal to acid attack and possibly to molten metal reaction in the canning baths. MCW has found that in nitric acid the ingot metal is attacked primarily at gross inclusions and at other sites within the grains; whereas, the dingot metal is attacked primarily at the grain boundaries due to lack of inclusions or intermetallic compounds. An alpha anneal of dingot metal following beta heat treatment precipitates an intermetallic compound, U_6Fe , which produces a change in the mode of acid attack in the dingot metal. This attack is primarily at sites within the grains and the attack on the grain boundaries is negligible. The pickled surface of the beta treated and precipitated dingot metal is similar in appearance to that of the beta treated ingot metal, except for the gross pitting caused by the removal of large inclusions (carbides) in ingot metal. However, the density of the small pits in this dingot metal is in some cases greater than the density of such pits in the ingot metal. The results obtained from the additions of carbon and sulfur to laboratory scale dingot reductions were inconclusive. MCW is proceeding with the program on carbon additions to full size dingot reductions.

It is currently planned for the feed-sites to resume shipments of dingot metal to HAPO in August, 1962, at a rate of 25 tons/month of alpha extruded rod material and 50 tons/month of alpha rolled material for six months. All of this material will be heated in hollow core blank form, oil quenched, and vacuum outgassed after beta heat treatment.

The initial quantity of 4.2 tons of additive dingot cores fabricated from alpha extruded rod was reactor charged this month. The remaining alpha extruded rod dingot metal in bare inventory (about 50 tons) will not be canned until at least July when it is expected that improved canning and testing techniques for dingot elements will have been developed.

The 5.8 tons of hollow core blank, oil quenched, normal ingot elements that were charged into the reactors in February are still undergoing irradiation without incident. An additional 7 tons of oil quenched ingot elements were reactor charged this month. It is estimated by September that a total of 25 tons of oil quenched ingot elements will have been charged and the charging rate will be increased from 5 to 25 tons per month for a four month period and then increased to a level compatible with the capabilities of the feed sites, assuming no adverse reactor performance.

Recent Quality Certification data of "K" size normal ingot elements after irradiation has revealed that warp has leveled out at between 5 and 6 mils and that OD₂ change has leveled out about 5 mils for cores shipped to HAP0 from March through August, 1961. The lowest warp period of about 3 mils occurred for "K" size cores shipped in October through December, 1960, after a gradual decrease from a high warp value of greater than 10 mils in March, 1960. The lowest OD₂ change period of about 1 mil also occurred in late 1960 after decreasing from high values of 8 to 9 mils in early 1960. Pre-irradiation core measurements, such as X-ray diffraction and grain size, have not changed appreciably since March, 1961, which may indicate that the warp and OD₂ values will stay about consistant.

NLO has recently proposed a carbon sampling plan that should prevent acceptance of high carbon cores. Under this plan every ingot having a density of 18.92 or less will be analyzed individually for carbon with a maximum acceptable top-of-ingot analysis of 654 ppm carbon. This will require the analysis of approximately one-quarter of NLO's ingot production and will increase our core costs about 0.2 cents/lb.

AlSi Process Development

Post-irradiation examination of 35 columns of overbore fuel, discharged in April from the 44-tube control block loading because of ruptures associated with a heat cycling incident, has been completed. Except for an ingot column, which sustained three longitudinal core failures and three incipient core failures with "worm tracks" on the surface, "worm tracks" were observed on two ingot, ten dingot, and one unidentified piece from other columns. All "worm tracks" were oriented in the longitudinal direction, indicating a previously observed transverse failure mechanism for dingot cores did not apply in this case. A more detailed examination of two pieces each of dingot and ingot fuel elements with and without "worm tracks" is scheduled in Radiometallurgy to determine the effects of heat cycling on the uranium. It is believed the stresses induced by the incident were sufficient to cause core failures at the exposures (500 - 766 MWD/T) reached by this material.

Projection rails on the overbore fuel examined were in good condition except for cracks being noted at the bridge-tab juncture of some pieces having rails of the initial 40 mil thick, 69 mil high design. Pieces having rails of the same thickness, strengthened at the juncture, showed little damage. On this basis, rails of the present design (45 mils thick, 65 mils high) are expected to perform reasonably well until a program being sponsored for optimizing rail design in the Hanford Laboratories can be completed.

Post-irradiation examination of five columns of elliptical bumper fuel and five columns rectangular bumper control fuel exposed to 800 MWD/T goal shows the corrosion on pieces in the higher temperature and flux positions is less on the test material. Four additional columns of test and control pieces were recently discharged at 1000 MWD/T for examination to complete the evaluation of elliptical rails. Anticipating early conversion to take advantage of the lower hydraulic resistance of this rail design, dies have been developed and successfully tested to stamp the rails in "tape" form for feeding into the ultrasonic welders. Design of a prototype "tape" feeder has been completed and fabrication initiated.

The planned retubing of the K Reactors with ribless zircaloy tubes, starting with 200 tubes this fall and large-scale change-out during CY 1963, has required a revision of both the natural and enriched fuel models for these reactors. Component designs have been revised to facilitate procurement. Optimization of projection rails for these fuel models in the Hanford Laboratory has progressed sufficiently to initiate fabrication of a preliminary arch-type design stamped from 50 mil X-8001 alloy stock. Other rail designs, including those fabricated from higher strength materials, will be evaluated as required to insure optimum strength and integrity during irradiation.

Based on current variations in finished fuel diameter (14 - 16 mils) and nominal projection rail height (4 mils) plate gaging of all self-supported fuel prior to rail attachment will be required to control OD within a desired range of 12 mils, and up to 10 - 20 percent of the rails attached to the larger OD fuel will require sizing to meet the prescribed maximum projected diameter. Control within these limits is necessary to guarantee consistent clearance for reactor charging and the degree of fuel self-centering required for annular flow and temperature balance. Potential methods for controlling fuel diameters within closer tolerances are being investigated. Techniques for rail sizing are also being developed.

Three ultrasonic welding heads have been modified to date by the vendor in an attempt to eliminate deterioration of welding efficiency (time) with extended use. One of two heads returned has been installed on a production welder for evaluation.

Circuitry was provided for the installation of ultrasonic weld monitors in the AlSi Shop. Installation of this equipment has been deferred until adequate filters are provided to shield out noise and vibration interference. Use of the monitors is expected to reduce "smashed rail tab" and "weak weld" rejects resulting from too long or too short a weld time.

A series of experiments were completed in the 306 Pilot Plant to study the etching behavior of ingot and dingot uranium. This series involved a study of the effects of agitation and of the addition of sulfuric acid to the nitric acid etching solution. A vertical 4-inch stroke every 15 seconds was employed for agitation. Sulfuric acid additions of 1/2 volume percent were used. Data from these tests showed that ingot metal loses more weight than dingot metal when etched in nitric acid; however, dimensional changes for both types of metal were identical. The additional weight loss for

ingot metal can be explained by the increased number of pits etched into the ingot metal due to the carbide inclusions. When agitation was employed, it was found that the external etch rate for both types of cores were reduced indicating a depletion of the NO_2 concentration next to the surface. Agitation did not effect the internal etch rates. The addition of 1/2 volume percent of sulfuric acid increased both the internal and external etch rates by a factor of approximately 5 and eliminated the differences in the etch rates of ingot and dingot. Several additional tests were made to investigate the effects of geometry on etch rates. Uranium washers 1/16 and 1/2 inch thick were cut from an ingot core and etched in nitric acid. For both thickness of washer it was found that the internal etch rate was higher than the external etch rate.

The study of the effects of duplex furnace variables on bonding layer formation for ingot and dingot metal is continuing. Pilot Plant testing has been completed and no significant difference was found between ingot and dingot metal based on internal and external total count. Past tests, however, have shown no correlation between total count data and the metallurgical properties of the bonding layer.

A study of the dimensional stability and weight loss of ingot and dingot cores through the canning and recovery processes has been completed. The following conclusions have been made from this data:

- a) Dingot cores warp slightly less than ingot cores.
- b) Dingot cores lose less weight per canning and recovery cycle, mostly explained by the nitric acid etch rate.
- c) The outside diameter change for dingot cores, after the first canning cycle, is less than for ingot.
- d) The internal diameter change of ingot and dingot cores are equal and less than the external surface change. This can be accounted for by the difference in etch rates in nitric acid.
- e) There is no significant difference in the internal or external total bond count for the two types of material.

The effect of lead plugging on bonding layer formation was investigated using ingot cores and it was found that there was no significant difference in the thickness of compound layers for 30, 45 and 60 seconds of lead preheat in the duplex bath. From 60 seconds to two minutes the layers increased by a factor of 1.83 for plugged cores and 1.30 for non-plugged cores. Another test is in progress to determine the effect of lead plugging on internal bonding characteristics for both ingot and dingot. This test involved 384 fuel elements and the lead and AlSi preheat times were varied for both lead plugged and normal ingot and dingot cores.

A sample of 200 fuel elements from dingot lot number HZO65D which sustained two ruptures at low exposure is being examined for possible closure or

bonding deficiencies. A 400 piece sample from other dingot and ingot material was obtained from 300 Area storage to use for comparison standards. Since all of these elements were bumpered, it was necessary to remove the rails from all 600 fuel elements prior to testing the elements in the UT-4 closure tester and the UE-1 internal and external bond tester. Initial data have been obtained from the UT-4 tester and are being analyzed.

A metallographic examination was performed on several dingot fuel elements which had been purposely defected and autoclaved to rupture. This examination revealed attack by hydride formation in all directions. V. H. Troutner* demonstrated that this type of attack is typical for low carbon uranium such as dingot metal. As this corrosion progresses, it builds up pressure by producing a wedge of corrosion product and eventually producing transverse splitting.

Preliminary investigations have been run to evaluate the effectiveness of ultrasonic cleaning and rinsing of components. These data indicate that ultrasonic cleaning does not improve wettability using the present cleaner and deoxidizes.

The design for the K Reactor self-supported fuel component has been completed and transmitted to component vendors for comment. This fuel element has a flat end rather than the normal interlocking contour of other I&E elements. Components for this fuel incorporate a built-in weld relief accomplished by modifying the existing contour base can and adding a depression to the cap. These changes will also serve as a more positive means for assuring cap and base thickness after facing than methods now in use.

The conversion of the A-C welding machines to D-C in the AlSi shop was continued during the month with four additional machines being converted. One machine in the finishing area and two machines in the special products area remain to be converted.

Several modifications and alterations are currently under way in the 306 Pilot Plant and welding laboratory. Alterations to the second welding machine in the 306 Pilot Plant were completed. These alterations involved several changes to provide flexibility needed to weld overbore elements and to perform rewelding. Only one power supply is used for supplying welding current to these two machines. An interlocking circuit automatically switches welding current to either machine upon demand from the operator. The work on the pit for the installation of the new autoclave was interrupted by a construction workers strike. The order for the autoclave has been placed with delivery expected by June 30. Fabrication work has been completed on the sonic orientation tester except for the vibrators and test heads which will be added by Testing Methods Engineering. The fabrication of an exhaust

* Troutner, V. H., Mechanism and Kinetics of Uranium Corrosion and Uranium Core Fuel Element Ruptures in Water and Steam, HW-67370, July 21, 1960. (UNCLASSIFIED)

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HW-73908

system has been initiated for the 313 Welding Laboratory. The automatic welder was moved to the south wall of the welding laboratory so that one exhaust line would service the entire weld lab. The construction strike has also interrupted this work.

During the period April 26 - May 28, a total of 6,346 pieces were processed in the 306 Pilot Plant. Of these, 4,311 were for reactor use and 2,035 were destructive tests of various sorts.

Alternate Process Development

Hot Press

A proposal to produce up to 1000 CIVE fuel elements by the Sylcor hot press process was sent to the Sylcor Division of Sylvania Electric Products, Inc. during April, 1962. A bid of \$13,660 to produce 1000 CIVE fuel elements was received from Sylcor on May 16, 1962. This bid was found to be acceptable and the contract work is presently being completed.

The irradiation test IP-490-A-FP comparing Sylcor hot press, HAPO hot press and HAPO AlSi bonded fuel elements was charged in C Reactor on June 3, 1962.

Fluid Pressure Bonding

Contract negotiations were continued with Battelle Memorial Institute to bond HAPO assembled fuel elements in their high pressure autoclave facility. A bid to carry out the optimizing tests as outlined under Phase I in HW-72417 was received. This bid was \$24,780 to pressure bond 128 fuel assemblies using sixteen different autoclave cycles. The bid also includes supporting work in examination and evaluation of the nature and quality of the diffusion bonds produced.

Electro-Nickel Plating

Improvement of the process for electro-deposition of nickel on metallic uranium included (1) the development of a rapid and reliable plate adhesion testing procedure and (2) plating process improvements to assure uniform good adhesion. At present, experimental results are very preliminary but encouraging.

Development of improved plate adhesion test procedures was considered mandatory to further process improvement and control, since existing procedures only qualitatively detected grossly poor adhesion, or could not be employed until after the aluminum jacket was bonded to the core. Plate adhesion testing methods explored included thermal cycling from room temperature to 590°C (1090°F) in molten metal (AlSi) and back to room temperature using a water quench. A similar test using molten salt (lithium-potassium chloride) at 600°C (1115°F) was used. Both of these tests were effective in causing gross blistering of nickel

plate which was known to be poorly adherent. Nickel plate prepared under conditions to give moderate to good adherence did not blister based upon visual examination. Thermal cycling of good plates in diffusion and heating studies revealed that certain areas on the fuel core were subject to plate peeling. The plate peeling or spalling off appears to be directly related to the plating rack design and its effect in plating.

The electrolytic hydrogen blister test (bubble machine) was also employed with some success in that poorly adherent plate was 30 - 60% blistered after ~ 1 hour exposure.

Initial work in improving the nickel plating process is being confined to the pretreatment of the uranium surface. The present electrolytic etch (anodic), although widely used, produces a heavy smut film which must be removed by either a single or double etch in nitric acid. Plate adhesion is influenced not only by the electrolytic etch, but also by the subsequent desmutting steps in a somewhat erratic fashion. Based upon work carried out in chemical milling of uranium on NPR fuel, it appeared that a smut-free finely-pitted uranium surface could be obtained without electrolytic etching. Preliminary results indicate that uranium can be satisfactorily etched by removal of one-half to one mil of uranium in an initial etchant, followed by removal of one to one-and-one-half mils of uranium in a final etchant, with respective compositions as follows:

<u>Constituent</u>	<u>Initial Etchant</u>	<u>Final Etchant</u>
HNO ₃	1.3 - 2.0 M	0.5 - 1.0 M
H ₂ SO ₄	5.2 - 6.0 M	3.6 - 5.75 M
HCl	0 - 0.2 M	0.2 - 1.0 M
Cu ⁺⁺	0.35-0.40 M	0.40-0.48 M
U	≥ 0.1 M	≥ 0.1 M

The initial etchant leaves the surface rough and slightly tarnished. The final etchant produces a dark smut, however; after desmutting in nitric acid, the surface is uniformly and finely pitted. The pitting is so extensive that the surface appears to be dull gray and similar to very fine abrasive paper in texture.

Adhesion testing of the nickel plate on chemically milled surfaces has been favorable but is preliminary at this time. Evaluation optimization and simplification of this pretreatment process is continuing.

Hot Die Sizing

The initial bonding studies for producing fuel assemblies by the Hot Die Sizing process will begin in the near future. The design of the initial test has been completed. The engineering data studies to determine the time-temperature relationships during the preheat portion of the cycle have been completed. The theoretical equations

for processing the data using computers have been developed by the Operations Research and Synthesis Operation of HLO. The engineering data is now in computer and the results are expected during the first week of June.

It has been theorized that the initial diffusion between the nickel-uranium couple must take place in the preheat furnace. The evaluation and control of this phenomena is essential to producing an adequately bonded fuel element by the Hot Die Sizing process.

Examinations of sections from a nickel-plated uranium core preheated in the resistance furnace to determine the extent of nickel-uranium diffusion prior to sizing revealed that diffusion took place during preheat. Diffusion layers were measured up to 0.000058 inches thick on a piece preheated for 20 minutes to 580°C (1076°F), 610°C (1130°F) and 640°C (1184°F) for 20, 30, and 40 minutes.

Experimental end caps for use with the hot die sizing process for the purpose of preventing cap mushrooming and promoting end bonding during sizing are being fabricated.

The necessary parts to complete the installation of the sizing press are now on site. The end bonding press fabrication is nearing completion. The completion date of this work is uncertain because of the present labor dispute involving the construction workers.

COEXTRUDED PRODUCT ENGINEERING

N-Reactor Fuel Development

KER Loop Testing

- Loops 1 & 2 - Loops 1 & 2 have been shut down for planned pump modifications. It is anticipated that these loops will be back on line sometime after August 1, 1962.
- Loop 3 -The exposure on the eleven NAE-1 prototype fuels in Loop 3 is about 525 MWD/T. Approximately 75% of the exposure has been in "cold" water. Because the "cold" water situation has made this irradiation non-prototypic, it is planned to discharge these elements at the next shutdown and recharge with a new test of NAE-1's.
- Loop 4 -The fourteen NAE-1 prototype fuels in Loop 4 are operating satisfactorily. Present exposure is approximately 220 MWD/T. About 20% of this exposure has been on "cold" water. Planned goal exposure has tentatively been changed to 1000 MWD/T because of the "loss" of the Loop 3 test.

Test Fuel Fabrication

Loops 1 & 2 -

- (1) To test Loops 1 & 2 pump modifications, twenty NIE-1 heater fuels with zircaloy-2 sleeves will be required by August 1, 1962. These fuels are being fabricated in the 306 Building Pilot Plant.
- (2) The "tapered end closure test" is available at the K-East Reactor for charging. The fuels for this test have "V" shaped end recesses with mating "V" shaped end caps. Half this material is unbonded.
- (3) KSE-5 fuel element (1.790 O.D., 0.975 I.D.) fabrication has started. The KSE-5 fuel element is a new fuel design and will be used to scope the swelling problem in the single tube design for "N" application. The enrichment is 1.6%.

Loops 3 & 4

- (1) A charge of fourteen NAE-1 fuels has been fabricated and is available at the K-East Reactor for Charging.
- (2) The inners for a backup charge of fourteen NAE-1 fuels have been fabricated. The outers for this backup charge are being autoclaved.

Other Items

The schedule on the next page shows the other fabrication activity in the pilot plant in 306 Building.

C.P.E. PILOT PLANT WORK SCHEDULE
DATE ISSUED: May 28, 1962

IN PROCESS DATE	PWR NO.	EXTRUSION DATE	TUBE NUMBER	WORK DESCRIPTION	TYPE AND QUANTITY REQUIRED	PROCESS LOCATION	EXPECTED COMPLETION DATE	COMMENTS
12/27/61	29			See Previous Schedules	See Previous Schedules	Complete		Pilot Plant fabrication work has been essentially completed on PWR's 29-37. Additional work on these may be rescheduled as necessary
2/8/62	31			"	"	"		
2/22/62	32			"	"	"		
3/5/62	33			"	"	"		
3/20/62	36			"	"	"		
3/29/62	37			"	"	"		
4/20/62	38			Provide braze closures for thermal cycling tests on bonds	(3) I&E (3) NIE (3) NOE	Complete On test sample delivery		
4/25/62	39			Development of "Controlled Pitting" chemical milling solutions for braze closure bonding	(15) NIE (15) NOE	Complete Test sample delivery		
4/25/62	40			Evaluate different copper stripping media	(16) NIE	Complete		
4/15/62	41			Determine autoclave influence of white weld oxide formation	(10) I&E	Complete		
4/25/62	42			Determine effect of etchant carry-over into stop bath on white weld oxide formation	(33) I&E	Complete		

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Uranium Billets

Feed Site Operations

The evaluation of the "Brandywine" material in the final finishing stages of the N process is not yet complete. However, there is not yet any indication that this material behaves significantly differently from regular enriched uranium.

About 126 NOE billets from the four-category feed site test have been received at HAPO for coextrusion evaluation. The various categories are being scheduled randomly through the coextrusion and final processing steps in the 333 Building. At least 100 of the billets are to be coextruded during the first two weeks of June.

NLO reports they have completed all necessary tooling modifications and planning in order to expedite the six-category, solid-cast and drilled ingot test as soon as HAPO issues the production request.

Quality Improvement

The final draft of the revised N-uranium Billet Specification has been prepared and reviewed with NLO and BBC. These have been formally approved and are now being printed.

The revised specification is designed to tighten up process parameters and quality control in order to reduce product variability. Specific modifications include the following requirements:

1. Suppliers supplying HAPO with copies of all their standard operating procedures.
2. Tightening up the chemical specifications.
3. Analyzing the primary extrusions for hydrogen.
4. Supplying a square-ended billet design.
5. Tighter control on melt charge makeup.
6. Direct temperature, pressure, and time control of the melting and casting cycle.
7. Tighter control on all the major primary extrusion parameters.
8. Tighter control of billet cutting.
9. Single-beta heat treating of the billet blanks.
10. Tighter metallographic sampling requirements.
11. General tightening of all quality control procedures.

Development

The first "British-type" alloy (nominally 400 Fe, 800 Al) ingot was extruded to N-outer billet size. This single-beta heat treated ingot was extruded with an alpha-annealed, single-beta treated Fe-Si ingot as a control. The Fe-Al alloy required about 50 to 60 per cent more force to upset than the Fe-Si unit. The ingot apparently extruded satisfactorily. Cutting and machining of the extrusion is not yet complete.

Coextrusion ProcessExtrusion

The following Coextruded Product Engineering extrusions were made during the month:

11.1 Inch ToolingTwo Primary Extrusions - PU 71 and 72

PU-71	-	NOE size for evaluation of single beta heat treated ingot vs triple beta heat treated ingot now used.
PU-72	-	NOE size with high Fe and Al. Content to evaluate coextrusion performance of this material.

7.5 Inch ToolingOne Uranium Billet - U-92

U-92	-	For evaluation of low billet temperature on as-extruded structure of the Mark V-B geometry.

Two Zircaloy Billets - Z-130 and 131

Z-130 & 131	-	2-3/8 x 1-3/4 inch tubing for HLO

One Composite - L-2

L-2	-	NOE size with strips of brass, steel, and copper at the zircaloy:uranium interface to evaluate the effect of material stiffness variation and clad: core interface roughness.

6.0 Inch Tooling

One Zircaloy Billet - Z-132

Z-132 - To NIE size for test of various copper stripping processes.

Six Copper Billets

These billets were clad with Everdur copper and extruded to NIE size for test work in eliminating die pickup.

Five Composites - UT-30, 31, 32, 33 and Grid #2

U-30 - 33 - NIE extrusions with single beta heat treated billet cores.

Grid #2 - NIE size to determine flow characteristics of the uranium billet during coextrusion.

Die Pickup

The extreme die pickup experienced during the past six weeks was primarily caused by the surface preparation of the copper billet can. The pickup was eliminated by abrading the entire O.D. surface of the assembled billet with emery paper prior to lubrication for preheat. It is not yet known whether this abrading removed a surface chemical effect produced during cleaning or produced a surface which retained more lubricant during the actual extrusion. In either case it is believed that this surface preparation of the copper can be refined by modifying the present copper cleaning process.

Some background on experiences with die pickup during the past two months is as follows:

1. Prior to the recent problem with extreme pickup on the NIE extrusions, the die life for the inner tube dies has been considerably less than the outer tube dies. The degree of actual pickup on the NIE size has definitely been on the increase for at least one month prior to the extreme experience encountered in late April.
2. Die pickup had never been a problem on the NOE size until late April and early May. The major difficulty with pickup on the NOE material extruded during May was eliminated by using a different (Fiskes 604) lubricant on the liner and die. It was proven during this month that the standard lubricant (oil-dag) would not perform satisfactorily with the outer tube.

3. Die pickup on the NIE size could not be eliminated by using different lubricants on the tooling. However, during test extrusions of copper billets it was observed that regardless of lubricant type the die had less pickup from billets clad in copper cleaned by the pilot plant process. Close examination of copper components cleaned in both the pilot plant and the 333 Building showed considerably more surface porosity on the pilot plant material. Based on this comparison, coextrusion billets assembled using the standard manufacturing process were sanded with emery paper prior to lubrication and preheat, and these billets when extruded did not produce die pickup. Manufacturing immediately adopted the practice of sanding the O.D. surface and since that time approximately fifteen billets have been extruded without die pickup.

Warp

Of further interest in connection with die pickup, it is believed that warp is increased when pickup occurs. To support this belief is the fact that warp of NIE material has been increasing for the past two months. Until recently the degree of warp increase has not been sufficient to increase the reject rate significantly, but the percentage of material requiring straightening after beta heat treatment had increased from approximately 20 per cent to 50 per cent. When extreme die pickup became a consistent and definite problem, the warp reject rate increased from approximately 6 per cent to 40 per cent. An additional variable had been introduced with most of this material (single beta heat treatment of billets) and the effect of this variable on warp cannot be determined due to the heavy die pickup which occurred on all of the extrusions. The most recent inner tube extrusions without die pickup have not been heat treated to date but some comparisons can be made with earlier material by using as-received warp following cut-to-length. The average as-received warp of inner tube extrusions during the past month has dropped from approximately 15 mils on the material with heavy die pickup to approximately 8 mils for material without die pickup. This 8 mils average as-received warp is equal to the material produced during February which had a warp yield of approximately 96 per cent. It is also of interest that the as-received warp data on extrusions without die pickup does not show any significant difference in material produced from beta heat treated billets vs standard billets.

Copper Component Cleaning

An exploratory investigation of the etching procedure for the copper-silicon sleeves (performed prior to assembly and extrusion) in the 333 Production facility and in the 306 Pilot Plant has been made. The surface obtained in the pilot plant is more pitted than that of production, even on samples cut from the same copper can. The studies to date of the copper component etch procedure have yielded the following:

1. The homogeneity of the copper-silicon alloy requires controlled conditions of etch rate, nitric acid concentration, temperature, and agitation to produce the maximum pitted surface during etching.
2. No noticeable improvement was observed by adding singularly or in combinations HF, HCl, H₂SO₄, H₃PO₄, and NaCl with the nitric acid.
3. One of the more pitted surfaces was obtained by using 39 w/o nitric acid at 45°C (113°F) for two minutes with good agitation. This solution removed approximately 0.003 inches of surface leaving a "satin" appearance.

Brazed Closure

Chemical Milling

The principal difficulty with horizontal milling has been in the depth variation in which the center mills deeper than the I.D. and O.D. edges. This appears as a dished recess. Experiments have been performed in which a rubber washer has been placed in the recess to protect the center areas. This allows the edges to be milled to sufficient depth without affecting the center. A fairly simple clip to hold the washer in place will serve equipment requirements. The approximate extra time required should not exceed 5 to 10 minutes. Additional tools are being made to develop this process for production application.

A flash etch solution containing the same chemical species as the current chemical milling solution, but in different proportions, has shown potential in producing a uniformly pitted uranium surface. The purpose is to produce a uniformly rough surface to explore better bonding in the braze closure. A nitrate to sulfate ratio of approximately 0.7 (normal for chemical milling approximately 0.25) has resulted in uniform pitting of several chemical milled samples with very little deterioration of original tolerances. Refinement of composition and determination of the sensitivity of the solution to different extrusion material is continuing.

Braze Temperature Measurement

Efforts are continuing to find a technique which is more reliable than thermocouple insertion for calibration of the brazing temperature recorder-controller. The use of gold, which has a sharp melting point of 1063°C, is being investigated. Also several eutectic alloys, such as iron-titanium, are being studied to find a system which will freeze at about the control temperature and which will give a sharp thermal arrest in their cooling curve at the freeze point which can be used as a calibration point.

Closure Contamination Study

It has been established that most brazed closures are contaminated on the surface with measurable amounts of uranium. The average inner closure has about 5 micrograms of uranium visible to an alpha counter. Some closures may have twice this much while others may not have any.

In general, the amount found is dependent to some extent on the temperature at which the braze was made. At 1000°C, which is too low for consistently sound brazes, there is virtually no contamination, while at 1100°C the levels are quite high, 25-30 micrograms per closure. There seems to be some correlation between the amount of contamination and the length of time the piece was held at temperature but this correlation is not very strong. Apparently the contamination is the result of both diffusion and braze flow, or stirring.

Fuel Element Supports

The fuel element supports have been the last major problem area in getting into production on the N-fuel element. For both inner and outer supports, there has been a definite problem in the fabrication: all strip does not respond the same in the forming operation and some strip cracks. The meeting of the close tolerance ($\pm .005$ inches) on the outer support circle diameter has not been possible to achieve, but drastically revised tooling has permitted coming very close to this tolerance range. The major alteration to previously planned methods has been to pre-select supports for a given fuel element diameter rather than attempting to size the supports while welding. Details are discussed below:

Support Procurement

Outer Supports

Tooling is in place at the vendor to manufacture supports 0.120 inch, 0.123 inch, and 0.126 inch high. Several thousand pieces from each size have been received and segregated into 0.001 inch increments from 0.115 inch to 0.128 inch for selective fitting to each location on each fuel. Current process requirements draw heavily upon the 0.116 inch to 0.120 inch sizes. Supplies are running short in this range; 4000 additional pieces have been fabricated and will be delivered by June 4.

Crushing tests have shown support strength to depend upon a variety of factors rather than any single one. The 0.120 inch parts crush to about 250 pounds, which is considered inadequate. The tools have been reworked to give a sharper radius to the camber--current parts run about 1/2 radius instead of the previous 3/4. Crushing strength increased to about 300 pounds, which is acceptable. The 0.123 inch parts are now strong enough, about 300 pounds, and the 0.126 inch parts are marginal at 275 pounds.

Some difficulty remains with strip failures principally occurring as cracked projections. Remedial tooling improvements will be made in a week.

Inner Supports

The buggy springs, when supplied in the "open" condition, appear to be sound and performing adequately. There is a sufficient supply on hand to last about one month. A new order for 55,000 parts is being set up for needs through August.

Locking Clips

Attention has just recently returned to the locking clips. One immediate change will be made to aid welding--the projections will be increased from 0.015 inch to 0.020 inch or 0.025 inch, if possible. Further changes will provide a "W" shape tab with one leg preformed closed to aid assembly. These latter changes will be incorporated by late June. Meanwhile, preforming is being done on-site.

Support Welding

The new welding fixture for outer supports has been installed and is now in use by Coextrusion Shop. Data compiled since changing to nine different support heights indicate that an overall variation of ± 0.008 " in the support diameter circle is being achieved. At this time a reduction in the variation is not possible, but alternate methods of the possibility of sizing during welding are being examined; the best answer could be spot welding.

Technical Shops has promised delivery of a new inner support welding fixture by May 31. Several improvements gained while shaking down the outer fixture have been incorporated and less trouble is foreseen in debugging.

A new fixture for handling locking clips during attachment to the inner surface of the outer elements is also expected to be installed on the "spike" welder on June 7.

Average shear strengths of current welds are about 940 pounds. This is considered excellent and substantially greater than was being obtained recently, when sizing was part of the welding process.

White Oxide - Autoclaves

Final Etching and Autoclave

It has been demonstrated in pilot plant tests that braze closed N-fuels develop white weld oxide during autoclaving when processed in an etchant-contaminated aluminum nitrate stop bath. Nitric acid and ammonium bifluoride components are carried over to the stop bath and build up on the stop bath as fuels are processed. The white oxide formation is also influenced by the type of autoclave procedure used.

With a complete water fill and hot blowdown autoclave procedure, the tolerance level of stop bath contamination is considerably greater than when an incomplete water fill and hot blowdown procedure is used. Stop bath contamination levels of less than 2 per cent by volume etchant-carryover produced white oxide on samples tested with the latter autoclave procedure which has been used in the 333 Production Facility. With the complete autoclave procedure, as used in the pilot plant, carryover volumes up to 10 per cent still gave gray but acceptable oxide films. Stop bath solutions are now changed once per month in the 333 Production Facility. This permits significant etchant buildup as this chemical line is also used for pre-weld etch.

Tests also have shown that immersion time in the stop bath is an important factor in white weld oxide contamination. Stop bath immersion periods reduced to 10 seconds gave black oxide while white oxide was formed when the period was the normal one minute, all other conditions being identical.

Present specifications have a one minute minimum with no maximum. These are being revised on the basis of information developed in these series of tests.

Scratches on Zircaloy-2

Metallographic examination of scratches and the white oxide produced thereby in the bore of the NPR outer fuel during assembly has been made on samples after a short exposure of 144 hours to 750°F (400°C) steam. There was a slight increase in corrosion product as evidenced by a thicker oxide film at the bottom and corners of the scratched area. However, oxide measurements are difficult for such thin films and possibly the longer exposure coupons (one, two, and three months) will enable better comparisons. A 20 mil interference fit per support produced a scratch approximately 1/3 mil deep in the bore of the outer tube. Micrographic examination revealed no noticeable disturbed metal grains or layers either under or adjacent to the scratched area.

White Welds

Microspark spectrographic analysis of several white reject welds compared to acceptable weld specimens indicated a qualitative trend for the white welds to have a higher beryllium to zircaloy-2 ratio, an average intensity ratio of 6.44 compared to 3.74. Also traces of nickel were found in the white welds and not in the black, acceptable welds. An explanation for these and some other anomalies associated with the formation of white oxide on the welds of autoclaved fuels has not been verified. Basically, there are at least three ways which a higher concentration of beryllium could be located on the surface: (1) more beryllium in the underlying cast weld, (2) preferential etching of the zircaloy during the final bright etch and (3) accelerated corrosion of the white welds during autoclaving.

Gas Pressure Bonded End ClosureLot No. VII

No corrosion data is yet available on the Ti-Zr-2 diffusion bonded coupons being autoclaved.

Lot No. VIIITitanium

Seven pieces of each NOT and NIT tubing, two inches long with 1/8 inch thick titanium closure rings have been prepared and were shipped to BMI on 5/23/62. They are to be used for bonding, steam and water autoclave corrosion and chemical separation studies.

Zirconium

Ten pieces each of NOT and NIT tubing, two inches long with a 90 degree "V" type zirconium closure ring equivalent to 1/8 inch flat closure rings have been prepared and were shipped on 5/23/62. They were prepared for bonding studies of zirconium to zircaloy-2, 90 degree included angle "V" type closure ring design and chemical separation.

Niobium

In order to produce the strongest diffusion bond for the end closure, it has been found that the most desirable type of bond is a solid solution type rather than a bond that is an inter-metallic compound. From a study of the phase diagrams for Nb-Zr-2 and Nb-U, it appeared that both of these formed solid solutions. Recent work, however, indicates that near room temperature the Nb-Zr-2 bond may form compounds. However, at the bonding temperature 650°C (1202°F) solid solutions only occur. By making a closure ring that would have titanium in contact with the zircaloy-2 and niobium in contact with the uranium, the closure bond would be of a solid solution type. Essentially this would mean that the closure ring would be trimetal. There is some doubt as to the type and strength of the Ti-Nb bond as it may be brittle.

Six pieces each NOT and NIT tubing, two inches long with 1/8 inch thick niobium closure rings are ready for assembly. One piece will be assembled with a Ti-Nb assembly. They are to be used for bonding, steam and water autoclave corrosion, and chemical separation studies.

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Electroplated Copper Development

Progress on the electrodeposition of copper on zircaloy-2 by Chemical Research, HLO, has developed to the point that it does not appear feasible and the work has been discontinued. The problem is caused by the formation of compounds between the copper plating and the zircaloy-2 substrate.

On the basis of this problem, some work is being done with zirconium metal but no results have been obtained.

Cathodic Etching

National Research Corporation believes that good etched surfaces can be obtained in the low pressure gas - 10,000 volt cathodic etching range using argon gas. Their contention is that even though the technique at atmospheric pressure has a high unit rate of etching, it takes considerable time to etch a complete area while in the low pressure gas range the whole area is being etched at one time and thus the total elapsed time per piece is equivalent. The surface finish is much smoother than that produced at atmospheric pressure.

A study has been started to investigate the merits of etching at low pressure and high voltage and to determine if the present high quality diffusion bonds can be produced. Manufacturing-wise, it means lower argon consumption and greater ease of etching multiple pieces at one time.

Vapor Deposition of Copper-DDR-139

Some progress is being made with vapor deposition and diffusion of copper into the zircaloy-2 closure rings. So far they have not been able to duplicate the cathodic etching at atmospheric pressure, the reason for which is unknown. It may be that the power source delivers narrow, high peaked pulses of current thus producing excessive pitting. Work is continuing to eliminate the problem. They are using 10,000 volts alternating-current and low gas pressure for etching. Specimens etched with this method and vapor coated at room temperature, followed by a diffusion treatment have shown diffusion of the copper into the zircaloy-2. However, a dark film forms on the copper during the heating operation which they believe can be eliminated.

TESTING METHODS ENGINEERING

N Fuel Testing

Braze Closure Temperature Control

Temperature control of the braze station is receiving intensive investigations, both from the point of view of evaluating the adequacy of the present optical radiometer system, and also investigating the possibility of developing other techniques which would provide better control of this operation. Investigations made to date suggest that the main sources of error are emissivity variations of the quartz viewing window, coupled with variations in the alignment of the optical system with respect to the fuel element. It appears that control of these variables will bring the accuracy of the system within the plus or minus twelve degrees desired. As measured against a standard black-body heat source the reproducibility of all three braze stations has been found to be within three degrees centigrade at temperatures ranging from 900 to 1100 degrees centigrade. However, measurements made on one station at successive intervals throughout a day's operation have revealed errors of as much as ten degrees due to emissivity variations of the quartz window. These windows become progressively "cloudy" during normal operation, suggesting a need for cleaning them on a regular mid-shift basis.

Experiments have been made with small pieces of gold wire inserted in the braze ring in an attempt to use its melting temperature as a reference point from which the system may be calibrated. These tests have not been entirely successful, as yet, and are currently being repeated with more refined techniques.

Considerable effort is being made to evaluate the possibility of measuring the changes in electrical impedance that is reflected into the induction heating coil by the heated fuel element, and correlating this impedance with the temperature of the fuel element closure zone.

Data obtained to date are encouraging in that this effect is clearly evident. However, a one-to-one correspondence between coil impedance and fuel element temperature is made difficult to establish by other variables which cannot be controlled. Techniques for circumventing this difficulty are presently under evaluation.

Attempts to correlate the temperature of the end closure with the resonant vibrational frequencies of the fuel element have also been made; however, these tests have revealed a decrease of only about three cycles per second at the brazing temperature. This small change is felt to be insufficient for useful measurement purposes.

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Fuel Testers

Operation of the N fuel tester continues on a routine basis. No attempts to further refine the equipment is presently being made. The accuracy of the cladding thickness tester (plus or minus .002 inches) is presently as good as the radiograph test and thought is being given the elimination of the latter test.

The bond test has revealed the first instance of uranium cracking in extruded N fuel. The defect, observed on only one outer tube, was a laminar crack positioned in the uranium about five mils from the internal zirconium-uranium interface.

AlSi Testing

Final UT-4 details are being cleaned up. Maintenance and instruction manuals have been written and are presently being issued. Several minor modifications made to the equipment to simplify maintenance procedures are now completed. Regular swing shift coverage has been discontinued, and operation has otherwise become routine.

Efforts to improve total count data provided by the external and internal bond testers are being reactivated. A single lithium sulphate transducer internal probe is presently being evaluated for this purpose. Consideration is being given the use of fifteen megacycle lithium sulphate transducers for both external and internal test.

Post-Irradiation Testing

Fabrication of the electronic equipment for inspection of irradiated N fuel in 105 KE basin is proceeding near schedule, being presently about seventy-five percent complete. A strike-caused work stoppage is delaying fabrication of the mechanical portions of this equipment and attempts are made to place some partially completed equipment in other shops in order to expedite its completion.

This system, designated UT-10, will inspect the bonding, closure, uranium core, and cladding thickness of irradiated fuel. The cladding thickness measurements will be performed by ultrasonic techniques, rather than eddy current as in pre-irradiation tests. The successful use of ultrasonics for this purpose represents a significant development accomplishment which may find application in other problems involving the measurement of cladding thickness.

JT Stringer:mbs

Acting Manager, Engineering

FINANCIAL OPERATIONMAY, 1962

A field inventory was taken of Zirconium stock in custody of the Engineering Section. Inventory follow-up has shown that there is planned ultimate use for all stocks on hand. Utilization will include transfer of some material to normal production inventories.

During the month, procedures were established for the annual steam coal inventory which was taken at the end of May. Results of the inventory are not yet available.

An estimate of the Engineering Section expenditures for the balance of the year was prepared and compared with Financial Plans and Budgets. No danger of overruns is apparent. R&D funds will be fully expended with a slight underrun of Process Technology funds.

The planned mechanization of Engineering Section cost distribution is to be implemented by July 1, 1962. Improvement in report timing and reduction in C&AO clerical effort is anticipated.

Cost accounting procedures covering FPD operation of the PRTR Water Plant were finalized in accordance with agreements between Plant Facilities Section and HLO.

A historical study of over-all Quality Control costs for 1959, 1960 and 1961 was prepared. Considering the expansion in work load created by the new reactor fuel, Quality Control costs show a favorable trend.

A review of the cost distribution procedures for the following HAPO Services and Assessments was completed during May.

1. Nuclear Materials Operation
2. Personal Meters and Bio-assay
3. Fire Protection
4. Patrol
5. Plant Telephones
6. Electrical Power
7. Vehicle Rental
8. Purchasing and Stores
9. Laundry
10. Area Bus and Road
11. HAPO Service Assessments Pool
12. Business and Occupation Tax

Manuals detailing current cost distribution procedures for these services are on file.

A review of the 300 Area steam generating capacities and peak requirements for the next several years has been completed. The addition of several facilities for which funds have been budgeted or have been approved will increase the requirements by as much as 35,000 lbs/hr. during the winter of 1963-64 and as much as 63,000 lbs/hr. during the 1964-65 winter. The Fuels Recycle Pilot Plant has an estimated usage of 28,000 lbs/hr. during the latter phases of construction and 45,000 lbs/hr. when completed. Other proposed facilities contributing to the increased steam load include the Consolidated Service Facility, Phase I and II and High Temperature Lattice Test Reactor.

In conjunction with the proposed gas-fired boiler addition, a request was received to analyze the financial stability of the Cascade Natural Gas Corporation. Cascade, the franchised distributor for this area, has agreed to install a line to the 300 Area provided supply contract terms can be reached. The problem was to appraise their resources for construction of the line as well as assuring a continuous supply of gas after the boiler is installed. Although not in a strong financial position, an adequate source of funds is available to Cascade for construction of additional facilities. Administration and regulation of their operations by the Washington State Utilities Commission assures continued service.

A study on the 300 Area sanitary and process water requirements and utilization was completed and a report prepared. Generally, the 300 Area system is adequate to supply the anticipated requirements for the next several years. No large water using expansions are currently planned or under construction. The PRTR filter beds will supply an additional source for HLO requirements.

The physical inventory of the Department's fixed property is nearing completion. Major production and engineering facilities have been inventoried and partially reconciled. The goal for completion of the inventory and machine-produced Plant and Equipment record is July 1.

FPD depreciation allocations are currently being reviewed. The review covers the appropriateness of allocations to HLO, Research and Development and Production, including the allocation between ALS1 and Coextruded products.

Travel for May, 1962, amounted to \$3,500 with 81 days in travel status. Of these amounts, \$133 and 6 days relate to attendance at Professional and Trade Society meetings, \$88 and 6 days to attendance at off-site courses and the balance to other regular business travel. No charges incident to the movement of personnel were incurred during the month.

Current month charges to Assistance to Hanford programs amounted to \$68. Cost to date on current-year programs is \$3,750.

Proposed FY 1962 closing schedules were reviewed and agreed upon.

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Organization and Policy Guides covering various aspects of nuclear safety are being further revised and will be ready for issuance shortly after the beginning of June.

No reports of unusual significance were issued during the month.

The Financial Section had no security violations during May.

Manager - Finance

WS Roe :mh

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PLANT FACILITIES OPERATIONMAY 1962I. RESPONSIBILITY CHANGES

None.

II. ACHIEVEMENTSA. Statistics

<u>Utilities</u>	<u>May</u>	<u>April</u>
Average steam generated (M lbs/hr)	54	59
Maximum steam generated (M lbs/hr)	84	92
Total steam generated (M lbs)	39,955	42,251
Coal consumed (tons)	1,922.09	1,963.25
Evaporation rate (steam/# coal)	10.39	10.76
Efficiency - Actual	69.7	71.3
Efficiency - Theoretical	73.3	75.0
No. of Boilers on: 1 2 3 2		
Date of Change : 18 21 22		
Sanitary water from 3000 Area (M Gals.)	158.8	155.4
Total water from 3000 Area (Avg. rate gpm)	3,557	3,597
Total water from #3 and #4 wells (M Gals.)	17.34	17.20
Total water from #2 well (M Gals.)	.30	.30
Peak water consumption for 24 hours (M Gals.)	5.9	5.6

Coal consumption during this month was the highest experienced in any May and can be attributed primarily to the colder than normal temperatures which have existed.

B. Operating Experience

Boilers Nos. 4 and 5 were checked out following their annual overhaul and placed in service May 21, 1962. No. 6 Boiler was removed from service and was opened up for inspection. It was found to be in fairly good condition with some of the tubes requiring weld repairs. Inspection of the air preheater tubes revealed approximately 10 percent to be completely plugged with another 10 percent partially plugged. These will be cleaned during the summer overhaul.

Heating and cooling equipment for the 3760 Building required more than normal manual control because of the greater than normal temperature range between night and day during the month of May.

The north process pond is operating satisfactorily although flow continues to be at a high rate.

The central critical incident alarm panel located in Patrol Headquarters and its connected circuits were tested and placed in service May 28, 1962. This panel will now indicate a critical incident alarm in buildings 305-B, 306, 308, 309, 325, 326 and 3731.

The "C" column was removed from the canyon of 321 Building, modified, and reinstalled in the "E" cell enclosure. The pulser used in conjunction with this column was also relocated. A mock-up column, pulser, and chemical pump were made for the nitro-benzene column installation.

A leak developed in the sewer line approximately eight feet north of the 307 basin and was repaired without interruption to operations. The leak was located at a point where the clay tile and stainless steel pipe joined. The tile was replaced with steel pipe and an additional flanged tee installed for future service to additional basins.

C. Equipment Experience

One of the four polyvinyl chloride exhaust fan impellers, located in the 333 Building, apparently disintegrated during swing shift, May 23, 1962. All four exhausters were running at the time. Pieces of the impeller, presumably of the Number 3 fan, shattered its fan housing causing parts to fly into and shatter the housing and impeller on the Number 2 fan, which in turn broke the Number 1 fan. Number 4 escaped without being damaged. Pieces of the flying impeller blades did extensive damage to duct work at fan outlets and duct turns at the top of the discharge duct where it enters the stack plenum. Heavy damage to scrolls occurred to all three fans. Repairs to the duct work were made by heating and forming new parts from PVC flat stock and welding into place. The large hole in the top of the exhaust stack plenum was repaired by making it an inspection plate. Six inspection ports were also cut into the side of the plenum. The cracked housing on one fan was repaired by welding both sides and reinforcing with a patch glued to the outside over the welded area. Wrap-around guards for future protection were installed. Difficulty was encountered while attempting to balance the one unit even though the manufacturer claimed that it was balanced before shipping. Unbolting the unit from the air washer seemed to relieve some of the vibration. The installation of a flex coupling and some PVC foam gasket material further reduced the vibration, and the Numbers 3 and 4 fans are now ready for use. Number 1 is currently being rebuilt and will be ready to install when a new impeller is received.

The excessive line voltage in the 700 Area, which was the cause of unscheduled down time in the Annalex Printer, has been temporarily corrected by wiring around the power supply. The permanent solution awaits procurement of a transformer by 700 Area electrical maintenance.

Some trouble has been experienced in attempting to replace a faulty heater in the non-isothermal equipment in the 314 Building. Attempts to reweld replacement heaters in the vessel were unsuccessful, finally requiring redesign and relocation of the heaters inside the vessel chamber.

Fabrication of two new furnaces for spectrographic work in the 325 Building was completed. Typesol insulation was used on these furnaces with the result that only 50 percent power was required to bring them to design temperature of 800 degrees centigrade. Heat loss through this insulation was so low that the outside of the furnace shell was barely warm to the touch.

Electrical wiring was completed on two UT-2 tester tanks in the 326 Building. This work was to have been done by the vendor, but due to their lack of understanding and the wiring complexity, was shipped to HAPO incomplete.

Vibration analyses have involved a considerable amount of engineering time during the month because of the repair and modification of the PRTR reflector and primary pumps.

D. Inventions and Improved Methods

All personnel in the Operation engaged in work which might lead to inventions and/or discoveries advised that, to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during May 1962.

E. Cost and Savings

One Cost Improvement item of \$300 was approved plus \$3,284 in suggestions bringing the total for May to \$3,584. The total savings approved for the calendar year to date are \$36,619 or 31.8 percent of goal. Two Cost Improvement items totaling \$14,837 are awaiting evaluation and approval.

F. Status of Projects and Major Jobs

Modification of No. 1 I.D. Fan -- The auxiliary oil pumping installation was completed and placed in service. All field work is complete with a few minor clean-up items remaining.

Monumenting Burial Grounds, 300 Area -- All field work is complete. Back filling and marking of the abandoned burning pit will be performed under this authorization of work but will not be added to the contract just completed. J. A. Jones will perform this work.

Air Dryer Installation, 384 Building -- All equipment has been installed with final electrical tie-ins and run-in of the dryer system remaining to be accomplished. It is anticipated that system will be in service by mid-June.

Modification of No. 6 Sanitary Water Pump -- Revision of the gasoline supply piping is partially completed.

Auxiliary Instrument Panel, 384 Building -- Installation of equipment started May 28, 1962 with completion scheduled for the end of June.

New Water Distillation Facility, 3706 Building -- All field work has been completed. BPF and operating procedures have been prepared and the as-built drawing for the system completed.

Refrigerated Air Conditioning, 3717-B Building -- The compressor cycle has been modified and the units are working satisfactorily. The heating coils control valve is on order and scheduled for delivery in June.

Modification of No. 5 Sanitary Water Pump -- All field work has been completed except for the electrical tie-in which is scheduled during the first week of June. Beneficial use is expected early in June.

Intercommunication System, 384 Building -- Authorization for this work was received, design has been completed, and the field work is 20 percent complete. Delivery of special equipment is scheduled for June 11, and the job is to be completed July 1, 1962.

Emergency Power System -- CE&UO's Electrical Design group is preparing the details of the procurement specifications and control circuitry. As soon as management approval of the Appropriation Request is received, the specifications will be issued.

Compressed Air Expansion -- The purchase order to procure the compressor from the low bidder has been placed with delivery promised in 8 to 10 weeks. Procurement of the electrical gear is underway and delivery is scheduled within 4 to 6 weeks. Field work is held up due to the current strike of construction crafts.

Sprinkler System, 3760 Building -- The design and construct specifications have been revised and returned to the AEC Contract Branch. Based on these revised specifications, the cost estimate is \$3,100. This information has been transmitted to the AEC and is awaiting their decision.

Perimeter Fence Relocation and Services, 3718 Building -- Field work reached 90 percent completion before construction activity was stopped by the strike of construction crafts.

Service Piping, 382-384 Buildings -- All materials are at the job site and construction is awaiting settlement of the strike.

New 300 Area Burning Grounds -- Field work is 90 percent complete. Completion is being delayed by the construction strike.

Pressure Regulator Valve, 382 Building -- The controller panel is now being fabricated.

Process Sewer Extension -- Construction of the 600 foot extension of the 15 inch process sewer line east of the 340 Building has been negotiated with J. A. Jones. All material is at the job site, however, the construction strike has held up the starting of field activity.

Laboratory Area Steam Line -- The project proposal has been submitted to the AEC for approval.

West High Tank Inspection -- A contract has been negotiated with Chicago Bridge and Iron to inspect and issue a structural condition report for the west high tank. This work to be scheduled in June.

Major Studies

4th Expansion, Steam Generation Plant -- A report was completed evaluating fuels, hazards and operational problems associated with this expansion. Financial is currently preparing a request to place this project in the PAC Budget Super General Plant as an emergency item. No major problems have been experienced in obtaining a satisfactory proposal for the furnishing of natural gas from Cascade Natural Gas Company.

300 Area Master Plan Project -- The Master Plan document HW-70619 was completed and distributed. Detailing of economic advantages for Phases I and II of the Consolidated Service Facilities is continuing. Potential uses for buildings to be made available by Phases I and II are being studied and evaluated. Occupational Health is investigating the possibility of a move into the 3706 or 3722 Building. Visual aids are being prepared for presentation to AEC representatives from Washington during their visit to HAPO in June.

313 Building Lighting Study -- Preliminary information furnished by manufacturers of the existing fixtures indicate that modernizing these fixtures would be more costly than replacement with new ones. It is not expected that this study will be complete before September.

Street Lighting -- Lighting surveys were completed and priorities established for upgrading the street and fence lighting for the area.

G. Special Reports Issued

HW-70619 - FPD 300 Area Facility Master Plan

III. PERSONNEL

A. Safety, Security and Radiation Experience

Medical Treatment Injuries	13
Frequency Rate	2.97
Disabling Injuries	0
Serious Accidents	0
Security Violations	0
Radiation Incidents	0

B. Meetings

Round Table-Staff	19
Safety and Security	20
Information	8

Manager

Plant Facilities Operation

E. Hilgeman:RTM:jse

END

**DATE
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