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DE93 000982

FUELS PREPARATION DEPARTMENT

MONTHLY REPORT

MARCH

1962

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HANFORD ATOMIC PRODUCTS OPERATION

RICHLAND, WASHINGTON

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FUELS PREPARATION DEPARTMENT

MONTHLY REPORT -- MARCH 1962

By Authority of: PR-24

Compiled by Fuels Preparation Department

RM Item 8-6-92

April 9, 1962 - Richland, Washington

By J. Tang 8-18-92
Dy Fred C 8/20/92

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

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PRODUCTION

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Production of fuel elements during March exceeded the forecast. For a period of four days, the plant operated nine canning lines per day rather than the scheduled eight line operation. A new record high operating efficiency of 97.6 per cent was attained during the month.

A significant improvement in yield of 8 inch I&E elements resulted from a reduction in rejects from AlSi slops.

The inventory of finished fuels at month end reflected a 2.5 month supply based upon projected reactor usage. Bare core inventory at the end of March reflected a 1.9 month supply.

No failure of AlSi fuels occurred in the autoclaves during March. None have in the autoclaves during this calendar year.

Uranium input of 7.2 tons was required to complete 35 extrusions for production. A total of 25 additional extrusions were completed for process and engineering development use.

At month end, the backlog of fuels awaiting installation of supports was 1,480 outer and 1,020 inner tubes.

ENGINEERING

Present Reactor Fuels

Six regular production I&E fuel elements failed in reactors during March. This was four more than in February and six less than experienced in the same period a year ago. Fuel performance continues to be affected by fuel fabrication oriented end and hole failures and the value of pressurized fuel assembly quench may not be as great as originally estimated. Additional irradiation experience, however, is necessary to effectively evaluate the effect of pressurized quench in the reduction of such failures.

Eighteen non-bumper and two bumper dingot fuel element failures have occurred during the dingot evaluation program as compared to ten non-bumper and three bumper failures in the ingot control fuel elements. Metallography evaluations of dingot uranium, before and after irradiation, indicate that dingot core ruptures are caused primarily by small radial cracks on the internal surfaces. Beta heat treatment of dingot core blanks in hollow form is expected to relieve this problem. Approximately 469 tons of alloyed dingot uranium are under irradiation and 1208 tons have been discharged to date.

As reported last month, effluent sampling from tubes containing nickel plated fuel elements has shown an undesirably high level of P32. A literature survey, contacts with persons in the field, and laboratory tests are continuing in an effort to find a chemical reducing agent which will function effectively in the plating process and provide reduced phosphorous in the nickel plate. Development of a satisfactory D.C. closure method for fuel elements canned in nickel-plated components is essentially complete.

During early March, 158 HAPO hot-press fuel elements were assembled. A yield of 87 percent was obtained through bond testing and welding, with an over-all yield of 74 percent after self-support attachment. Six columns each of HAPO hot press,

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Sylcor hot press and AlSi control fuel elements were premeasured and arranged for alternate charging under a preliminary production test to compare irradiation performance. This test will be charged in C Reactor during the next outage.

Destructive testing and metallography of Sylcor hot-press pieces has been completed. No discontinuities were observed in the nickel plate at 400 magnifications. Plating of irregularities on the core surface was very good. Some micro-cracking was observed in the intermetallic diffusion layer adjacent to the aluminum jacket; average residual can wall thickness was 33.5 mils with a guarantee of 17.4 mils.

Nickel-plated aluminum-clad fuel cores will be bonded in the Battelle Memorial Institute high pressure autoclave under Contract DDR-141. This program is designed to optimize parameters and to prepare material for preliminary irradiation tests.

Electrical services for the installation of hot die sizing equipment have been completed. The preheat furnace was installed and work authorization has been issued to J. A. Jones for the installation of the sizing press, end bonding press and demineralizer.

The program to obtain data on the mechanics of AlSi bonding layer formation continued. Primary conclusions based on preliminary evaluations of metallographic data follow. The thickness of the compound layer is proportional to lead preheat time, temperature and AlSi contact time. The percentage of the UAl_3 -type compound in the bond is inversely proportional to the percentage of silicon in the duplex bath. There is good correlation between UAl_3 -type compound layer and the percentage of fractured bonds.

Conversion of fuel and closure welders in the AlSi Shop from A.C. to D.C. was continued with a fourth semi-automatic welder converted during the month. Adjustments of power supplies and addition of argon to the helium shield were made to overcome arc starting problems.

A total of 7271 fuel elements were canned in the AlSi Pilot Plant. Of this number, 6340 were for reactor use and the remainder for special destructive tests.

Four UT-4 fuel end closure test stations have been placed in full operation in the AlSi Shop and have provided inspection for essentially the entire fuel production during the past month. Destructive examinations of rejects have established excellent correlation with UT-4 test results.

N Reactor Fuel Development

The "crud test" consisting of three 17 inch NIE fuels and one thermocouple fuel is operating satisfactorily in KER Loop #1. Five prototypic NIE, 23" fuels were discharged from KER Loop #2 after exposures in excess of 3000 MWD/T. Two prototypic N fuel assemblies used for Loop #3 shakedown tests were discharged after an exposure of about 400 MWD/T. Eleven prototypic N fuels were then charged and are destined for an exposure of 1000 MWD/T. Five 23" prototypic N fuel assemblies were charged for Loop #4 shakedown testing. Fourteen prototypic N fuel assemblies are

scheduled for charging into Loop #4 during the first outage in April; irradiation to 2000 MWD/T is planned.

The first coextruded I&E² fuel element failed in the KW Reactor during March. The failure occurred in a tube which had an average exposure of 1647 MWD/T. The ruptured fuel is now being examined at the C Reactor basin. The end cap, which was separated from the fuel during rupture has been transferred to the Radio-metallurgy Facility for study. Inspection of the pre-irradiation eddy current clad thickness test charts and the autoradiograph films has shown no processing irregularities. Evaluation of possible failure mechanisms is continuing.

NLO has shipped the first ten "Brandywine" billets for evaluation prior to the acceptance of this type of uranium for production use. Evaluation is under way.

NLO has started a test designed to reduce the inner clad variation which has occurred in the coextrusion of N outer tubes. This involves various special heat treatments of the uranium ingots and billets and increased I.D. upset during primary billet extrusions. NOE extrusions (about 10) tested to date, which had single beta heat treated uranium cores, showed excellent thickness control. Six extrusions made during March with single beta heat treated NIE uranium cores also showed excellent thickness uniformity. Consideration is being given to the beta heat treatment of all billets (both inner and outer) at the Feed Sites as a routine production step.

N uranium chemical specifications have been modified to tighten carbon limits, allow outgassing of hydrogen up to 3.0 ppm, and to require analysis of aluminum, oxygen and tin because of their possible effect on grain size.

Support and locking clip designs for N fuel elements have proved inadequate for effective production attachment and use. These difficulties involve problems with height, end tab contours, and weaknesses which have appeared in the bend areas of inner tube supports. Also, locking clips do not sufficiently limit the longitudinal slack between inner and outer tubes. A searching evaluation of the concepts, use and design for these parts is underway with the objective of producing better designs or incremental improvements which will provide better utility for this hardware.

Inspection of the billets produced from the 60 primary extrusions made at HAP0 is complete. The surface quality of billets from ingots cast by the "old", cold casting cycle at National Lead was compared with ingots cast by National Lead's hotter cycle. The hotter cycle produced markedly better surface quality. Fourteen out of 23 "old" campaign ingots produced billets with rejectable, pitted surfaces. Only one of the 37 "hot cycle" ingots produced billets with rejectable, pitted surfaces.

Modified coextrusion billet designs were issued during the month. These designs eliminate all preshaping of the uranium core and position the zircaloy cladding for maximum utilization with copper rings. These designs minimize zircaloy losses in the coextrusion end defects, and reduce copper component costs. Better bonding at the ends of the coextrusions is also promoted. Preliminary evaluations indicate that zircaloy losses in extrusion end defects will be reduced by about 4.5 percent

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or about 1.45 lbs. on the outer tube and 1.1 lbs. on the inner tube. Twenty-four composite extrusions involving 7.5" and 16" tooling and one zircaloy billet extrusion using 11" tooling were made during March.

NIE warp yield is up from 95 to 98 percent. (Results apply to material extruded during February. March Quality Control data not completed at time of writing.)

The first two "British-type" adjusted aluminum alloy 400 ppm Fe and 800 ppm Al have been cast at National Lead of Ohio on a development order. The aluminum concentration was low due to lack of experience with aluminum additions. An exploratory triple beta heat treatment on one of the 11" diameter ingots did not cause it to crack.

Electronic and mechanical design of the equipment under development for 105 KE fuel examination in basin is essentially complete. Fabrication of the mechanical apparatus is well under way. Construction work on the electropic phase of the project is now beginning. Goal date for equipment installation at the reactor site is June, 1962.

Lamb wave experimental investigations made on metal sections less than 0.1" thick have shown excellent agreement with theory. Attempts are being made to extend the technology to thicker sections which are of interest in many industrial applications. The objective being to determine if these techniques offer advantages over conventional ultrasonic test practices in such applications. Practical incentive (as well as excellent samples to work with) are being provided by the NPR primary piping system whose inspection by existing test methods has not proven entirely satisfactory.

A white oxide formation on the end welds of NPR inners resulted in a high autoclave rejection rate this month. A program has been adopted to evaluate the autoclave program in general and the effect of etchant variables as they influence the formation of white oxide on zircaloy clad fuels in the autoclave. Tests are also under way to determine the recoverability of fuel elements having white oxides in the weld beads.

Considerable emphasis is being given the detection of uranium surface contamination of N fuel in the 333 fuel production facility. Routine operation of the alpha counting equipment has shown that all of the 15 elements tested to date have evidenced a degree of contamination. Significantly, all elements have shown end cap contamination ranging from about four to 33 micrograms of uranium. Zirconium end rings examined prior to brazing, however, have shown no evidence of contamination. Samples of beryllium-zirconium braze alloy taken from near the ends of completed elements have shown uranium concentrations in the range of 1300 ppm by wet chemical analysis.

Contamination of the cladding has also revealed that five of eight elements tested have cladding surface contamination of approximately 60 micrograms. In each instance the contaminated elements had been autoclaved in equipment in which an autoclave failure had previously occurred.

Operation of the eddy current and ultrasonic test equipment is proceeding routinely in the N fuels manufacturing facility. A maintenance and reliability survey of recent operating experience has shown good performance for this equipment.

PERSONNEL STATISTICS

Number of employees as of February 28, 1962 823
 Number of employees as of March 31, 1962 824

	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
General	1	1	2
Manufacturing	90	354	444
Engineering	46	27	73
Financial	14	8	22
Plant Facilities	37	245	282
Employee Relations	1	0	1
TOTAL	189	635	824

<u>Employment</u>	<u>March</u>	<u>February</u>
Additions: Exempt	1	3
Nonexempt	12	3
	<u>13</u>	<u>6</u>
Reductions: Exempt	0	5
Nonexempt	12	30
	<u>12</u>	<u>35</u>

The addition to the exempt roll was the promotion of a nonexempt technologist to a supervisory position. Nonexempt additions included a replacement secretary; rotation of 7 craft trainees from other HAPO components; a reactivate from plant injury; temporary transfer of an employee from CE&UO to provide coverage during illness absence of a Stock & Tool Attendant; Instrument Trainee, new hire, to fill existing vacancy; and an excess Reproduction B from CE&UO on a verbal request basis to fill additional requirements.

Reductions of personnel included a transfer of a Janitor on a Request for Transfer procedure; rotation of 7 Craft Trainees to other HAPO components; transfer of a Design Draftsman to the Computer Department, Phoenix, Arizona; deactivation of a Stock & Tool Attendant due to personal illness; and the resignation of a Welder.

STAFF

R. L. Dickeman
 Manager, Manufacturing Operation
 Acting Manager, Engineering Operation
 Manager, Financial Operation
 Manager, Plant Facilities Operation
 Manager, Employee Relations

R. L. Dickeman
 W. N. Mobley
 J. T. Stringer
 W. S. Roe
 E. Hilgeman
 C. O. Steinnagel

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PATENT SUMMARY - MARCH 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 March 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.

"The Ultrasonic Vibration of Molten Metals Using the Linear Induction Pump Principle to Induce the Vibrational Energy."

..... By R. E. Rowley

RL Dickman

General Manager
Fuels Preparation Department

RL Dickman:mkm

MANUFACTURING OPERATION

MARCH, 1962

CURRENT OPERATIONS

Production

Statistics

	NORMAL					ENRICHED				
	8"	O				O				Total
	Solid	C	K	Reg.	Bumper	C	K	Reg.	Bumper	
<u>Current Month's Production</u>										
Acceptable Fuel Elements Produced (Tons)	-	56.3	241.3	77.5	138.0	21.3	55.7	-	10.5	600.6
% of Forecast	-	161	99	1292	84	112	105	-	32	108
Production m. % of Forecast	-	48	126	120	81	102	106	84	73	102
or Current Quarter	-	201	78	138	112	142	127	-	39	98
% of Past 3 Month's	-	106	86	53	203	142	124	-	35	92
Average Production	-	107	113	97	82	56	105	109	141	103
% of Past 12 Month's	-	113	106	103	100	80	100	101	96	104
Average Production										
of Forecast Achieved										
Last Fiscal Quarter										
of Forecast Achieved										
Last 4 Fiscal Quarters										

Operating Efficiency

Current Month (%)	97.6
Recast (%)	95.0
Previous Month (%)	95.5

Manufacturing Yield

Current Month (%)	-	92	93	89	84	92	92	-	76
Recast (%)	-	90	90	90	85	90	90	90	85
Previous Month (%)	-	-	87	93	84	90	94	94	84

Uranium Available for Processing (Tons)	1060
Finished Products in Storage (Tons)	1404
Special Products Finished (Pieces) Boll	161
Uranium Utilization	97.9

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Production

Plant Operation - ALSi

Production of ALSi fuels during March exceeded the forecast as a result of high operating efficiency and improvements in yields. In addition, operation of the plant on a nine canning line per day basis for four days during the month increased output over the forecasted eight line schedule.

A production yield of 92.1 percent for eight-inch I&E normal fuels reflected a significant improvement over the February yield. This was primarily due to an over-all reduction in ALSi sloop rejects. During the month, recent shipments of aluminum cans were used wherein the vendor was conforming to revised specifications concerning ALSi ring upset metal height. It appears that the revised upset metal specifications will improve the control of ALSi sloop rejects.

Bumper welding produced 153 acceptable tons welded. Production and reactor charging for March and to-date is as follows:

	March 1962		To-Date	
	Natural	Enriched	Natural	Enriched
FPD Produced	143	10	1050	530
IPD charged	59	32	638	506
Finished Inventory	412	24	412	24
Average Welding Yield	92%	87%		

There were no autoclave failures of ALSi Process fuels during March and none to date during the calendar year.

The inventory of finished fuels at month end reflected a 2.5 month supply based upon projected reactor usage.

The month end inventory of bare cores reflected a 1.9 month supply based upon projected fuels process needs.

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

8" Normal I&E	24,782
Water Mix	144
Total	<u>24,926</u>

Two shipments totaling eight tons of natural and enriched uranium scrap, including NPR defective billets and tube scrap were made. These shipments also contained 765 boxes with lids. An additional shipment was made containing 390 boxes with lids.

Plant Operation - Extrusion

A total of 60 extrusions were made during the month of March, of which 35 were outer extrusions for production and 25 were special extrusions for engineering development work. The 35 production extrusions represents a total input of 7.2 tons. Nine of the production extrusions were made on a PWR using square ended billets.

Work is continuing on resolution of the problems associated with the installation of supports and locking clips on the otherwise completed fuels. Total backlog of components awaiting installation of supports consists of 1,480 outer and 1,020 inner tubes.

The following is the total throughput by stations for March:

<u>Operation</u>	<u>Inners</u>	<u>Outers</u>	<u>Total</u>
Extrusion	0	35	35
Cutup - 1st	185	276	461
Cutup Rework	40	2	42
Chemical Milling	846	114	960
Braze	2022(Ends)	1032(Ends)	3054(Ends)
Heat Treat	945	410	1355
Machining	718	407	1125
Vacu-Blast	961	338	1299
Welding	401	521	922
End Test (2 tests)	878	820	1698
Clad & Bond Test	364	437	801
Support Weld	163	21	184
Autoclaves	173	0	173

Responsibility for the oxide burner was transferred from HLO to FPD late in the month. Although minor modifications are scheduled for April to improve efficiency, it was operated on a trial basis the last two days of the month.

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

CGF-934 UT-4 Testers

Design	100	100
Construction	93	91

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The fifth tester has been installed in the 313 Building. This tester was installed outside of the production line at the request of operating personnel. The conveyor system is set up so it can be moved into the production line when required.

CAF-954 High Pressure Autoclaves Development Facility

The project proposal document is being revised to provide further clarification.

Drafting and Duplicating

Drawings Produced

New	93
Revisions	65
Small Charts	33
Large Charts	9
Miscellaneous	41

Duplicating Production

Xerox Masters Prepared	838
Multilith Impressions	482,683
Ozalid Copies	10,728
914 Copier Copies	18,989

PLANT CONDITIONS, INCIDENTS, AND IMPROVEMENTS

ALSI

A new record high operating efficiency was attained in March. The previous high was established in December, 1961. Approximately 30 percent of the downtime was attributed to operational problems and the remaining 70 percent was attributed to equipment outages, the major contributor being the quench machines.

The overhaul of the Acme-Gridley lathe removed from the No. 1 position has been completed and run-in has been started. The present schedule calls for a two week break-in period. All spare parts ordered for the remaining lathe overhauls have been received.

On March 18, the blower fan of Ajax furnace No. 2, which keeps the furnace coils from overheating, shorted and blew out a fuse. All blowers stopped and the alarm horn failed to operate. The problem was discovered when the furnace coils started to smoke. Electricians were called out immediately and the trouble was corrected before the furnaces were damaged. After the furnace blower failure, it was evident that there were some defects in the control circuit design. It was also evident that the alarms were not audible in all areas where coverage personnel have to perform routine duties during off-production periods. Design and modifications of the circuitry have been completed to assure positive alarm in case of blower failure.

The trichlorethylene reclamation unit was installed on the degreaser and tested late in the month. Operation of the unit was satisfactory. Tie-in of the degreasers to both cap and can and pickle machines has not as yet been completed.

The prototype magazine rail feeder for the AlSi Process ultrasonic welders was completed and is ready for testing. A new type slide is being fabricated to reduce rail alignment problems. An experimental welding tip is also being fabricated which may permit improvements in the rail feed system. The double shear tester was also completed, but will not be installed until acceptance by Quality Control.

During the month, operation was started using the recently issued specifications for pressurized quench. Under the new specifications, all fuel elements quenched with a pressure less than 35 psi are identified by a seventh character in the lot number; and the total of such pieces is limited to 0.5 percent of the month's production.

Necessary shielding to permit operation at full line pressure has been installed on all pressure quench machines. A production test was started on March 27 to determine the optimum operating pressure for fuel element quality and production yield.

The AlSi Shop UT-4 tester debugging which began in the last week in February, 1962, proceeded far enough on four units to permit a trial run to begin on March 26, 1962. The sensitivity is set so that the tester will just detect a 0.016-inch diameter hole drilled along a radius of a dummy fuel element. The tester must also get a 25 plus or minus disc count on both total bad disc and maximum successive disc counters on a hole drilled parallel to the axis of a fuel element along the braze layer from the end of the lathe facing to the core. Both total bad disc and maximum successive bad disc rejection modes were being used during the trial run. In order to segregate some of the worst material from the material to be irradiated, rejection settings of 22 total bad discs and 15 maximum successive bad discs were used. As more experience is gained with the testers, it may be desirable to use more stringent reject settings. On a two-week's limited throughput, the 22 TBD and 15 MSBD settings have given less than a one percent reject rate.

The control chart technique used in the rail weld sampling plan indicates that a nominal 55 pound average tensile peel strength can, and is, being maintained by both ultrasonic welders now in the production line. Since the sampling plan was put into effect over a month ago, the lower product acceptance level was violated only four times. By observance of the higher process control limit, the product has, in general, been maintained above the lower acceptance limit, and significant shifts in product quality have been readily identified and corrected when necessary. Statistical analysis has shown that a minimum weld strength of 20 pounds can be maintained with an acceptance level of 99 percent or greater.

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An analysis of the control chart data shows no significant difference between the ultrasonic welders in either the average strength or standard deviation of the rail welds that are being produced; however, there are significant differences in average weld strength between individual welding heads. A revised sampling plan based on product requirements will be adopted to provide measurements of product quality more consistent with customer requirements.

A test designed to determine the percentage of fuel elements produced in the ALSi Shop that still contain braze voids, and the effect of braze voids on weld quality has been partially completed. The first portion of the test involving braze void inspection demonstrated that at 95 percent confidence limits, an over-all average of 2.96 plus or minus 0.02 percent of the fuel elements produced contained braze voids. The second portion of the test, the effect of braze voids on weld quality, is pending on the installation of a second DC transformer on the semiautomatic weld line.

A new accountability system was successfully demonstrated on a trial basis in March. The new system appeared successful enough to place all enriched material on the system the third week in the month for a thorough evaluation. Inventories and other checks revealed no apparent difficulty with the simplified procedures.

Coextrusion

Constant mechanical difficulties plagued vacu-blast throughout the month thereby reducing the throughput of the two machines. Principal difficulties were eroding probes, failure of pinch tubes, and plugging exhaust filters. A design change was made on each of the machines to eliminate the use of pinch tubes. This is expected to result in improved utilization of the equipment.

The capacity of final etch was increased 33 1/3% with the use of an additional basket. A newly designed processing basket which allows the processing of three tiers of elements simultaneously will be tested in April.

White oxide on the welds after autoclaving continues to be a major problem area. A high reject rate was experienced on all material autoclaved in March. Work on the problem is continuing but no immediate solution is in sight.

Production through the support welder was limited due to the lack of acceptable supports. An improvement was shown in the yield at this station, but the welders are still not reliable. Study of the equipment and problem is continuing.

The status of the spare parts, lubrication instructions, and maintenance procedures program is as follows:

Spare Parts	75% complete
Lubrication Instructions	20% complete
Maintenance Procedures	20% complete

Alpha counts which were above background level have been detected in the braze layer of coextruded fuel. Studies are in progress to determine the extent of this low-level contamination and to establish whether the detected amounts are significant in terms of reactor performance.

New fuel hangers were fabricated and installed on the beta heat treat conveyor. The new hangers provide loading and unloading by one man instead of two. A secondary water supply loop was installed to provide flexibility in the event of partial water loop outage. The temperature controller and monitor were connected to the emergency power supply to increase the reliability of temperature control.

Design of modifications to the NFR shipping pallet has been completed to provide further protection during shipment. A prototype is being modified for use on a trial basis.

FPD HEALTH AND SAFETY

	<u>March</u>	<u>February</u>
Disabling Injuries	0	0
Serious Accidents	0	0
Medical Treatment Injuries	51	41

The annual spring clean-up campaign sponsored by the Health and Safety Program Council was conducted in March with good results. A steering group representing all sections of FPD programmed the event to include publicity, safety topic, inspection, evaluation, and an historical record. Program theme was titled, "As Clean As Outer Space", and was aimed at external storage and housekeeping practices.

The March safety audit conducted by the Central Safety Council covered all of Mechanical Crafts Subsection. Conditions in need of corrective action were given prompt attention, and unsafe practices were discussed with employees involved. Overall climate was considered to be good.

Revisions in progress to Hanford Standard HWS 8210-S Audible Alarm Signals will delay the preparation of emergency signal cards for 300 Area buildings. Format is established and printing will be made as soon as possible after the revised standard is issued.

The employee education program on emergency signals will also be started upon acceptance of the standard signals for HAPC. Tapes have been prepared for use in safety meetings. The tape provides a reproduction of each of the standard emergency signals, and includes a narrative describing corresponding action for each.

FPD SUGGESTION PLAN

A total of 61 new suggestions were received; 43 were adopted; 39 were rejected; 4 reopened; and 9 other department suggestions were evaluated. The backlog of open suggestions was officially reduced by 21 in March.

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Participation:

	<u>March</u>	<u>February</u>
Number of eligible employees	635	635
FPD suggestions received	61	40
Annualized rate per 1000 eligible employees	1,153	756
Number of suggestions adopted	43	33
Net annual savings	\$6,961.00	\$5,199.00
Amount of awards	\$1,220.00	\$ 680.00
Average amount of awards	\$ 27.73	\$ 23.60
Percent of total awards to savings	17.5%	13.0%

SIGNIFICANT REPORTS ISSUED

HW 72847	Isotopic Analyses of Uranium	2/28/62	G. B. Hansen
HW 72937	Uranium Quality Control Analytical Results	3/8/62	G. B. Hansen
HW 73065	Uranium Quality Control Analytical Results	3/19/62	G. B. Hansen
HW 73172	FPD Alternate Budget Assumptions FY 1964	3/29/62	J. W. Talbott R. E. Middaugh
HW 73143	Plant Improvement Program-FPD 1963-1972	3/23/62	R. L. Dickeman
	Budget Study-Primary Extrusion Facility	3/16/62	S. L. Hooper
	Budget Study - Consolidated 303 Area Service Facility, Phase II	3/23/62	K. Drumheller
	Project Proposal - Consolidated 303 Area Service Facility - Phase I	3/30/62	K. Drumheller
HW 72991	Consolidated Service Facility - 303 Area	3/16/62	J. W. Talbott
HW 72829	Alternate Methods of Four Inch Element Production	2/28/62	D. E. Blahnik

EMPLOYEE RELATIONS

Safety

Members of the Manufacturing Operation sustained 27 medical treatment injuries during March.

Security

One security violation incurred during March involving an unsecure repository.

Radiation and Beryllium Control

The total of the exposures in excess of 100 mrad for Manufacturing personnel for the four-week badge period ending February 23, is 5,161 mrad compared with an average of 7,400 mrad per four-week badge period for the previous year. There were no individual exposures in excess of 300 mrad during this badge period.

A total of 17 air samples and 57 smear samples were taken and submitted for beryllium analysis during the period from February 19 through March 22, 1962. The beryllium concentration in each of the 13 air samples inside 333 Building was less than 10 percent of the maximum acceptable concentration. Beryllium was not detected in any of the four samples taken in the beryllium exhaust system outlet, and the volume of these samples was sufficient to establish that the beryllium concentration was less than 50 percent of the limit for outdoor air.

Smear samples taken on the receiving inspection work table during inspection of beryllium braze rings exceeded the HAPO control limit for surface contamination. The surface contamination control limit is based on the air contamination that would result if the contamination on relatively large surfaces was dislodged and became airborne. Other samples taken on the floor and on other work tables in the area were below the limit. This contamination came from smearable beryllium on the as-received beryllium rings. The inspection area was set up as a temporary beryllium control zone and three air samples taken during the inspection; each contained less than 10 percent of the AEC limit for an eight-hour exposure per day. These beryllium rings will be inspected in a beryllium zone with adequate personnel protection until the vendor is able to supply contamination-free rings.

All other beryllium smear samples were below the control limit or were taken in areas where contamination is known to be present and adequate safeguards are maintained.

Training

Ten electricians were given a total of twenty instruction hours on the UT-4 tester tank and control systems.

Ten instrument technicians and specialists were given a total of twenty instruction hours on the data logging system. Sixteen instrument technicians and trainees were given a total of thirty-two instruction hours on set up procedures.

Visitors - Visits

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
Gene W. Becker	Vickers, Inc.	L. F. Reilly	3/19 through 3/23/62	Technical assistance with DC power supply

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<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
M. M. McCartney	Tumpane Co. USAF Dier Storage Site Terre Haute, Ind.	Ben Copenhagen	3/26-27/62	To select engine lathe and accessories
G. W. Johnson	Pittsburg Analytical Conference Pittsburg, Pa.		3/4/62	Professional meeting
G. W. Johnson	National Lead Of Ohio Cincinnati, Ohio	R.H.Sisson	through 3/11/62	Discussion of uranium analysis
H. P. Kraemer	Stoker Engineering Co. Tacoma, Washington	Ed Gress	3/27/62	Discuss quality and
H. P. Kraemer	Rottler Boring Bar Seattle, Washington	Don Rottler	3/27/62	delivery problems

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 March.

HCB for WN Mobley

Manager - Manufacturing

WN Mobley:HFT:mrh

Unclassified

FUEL ATTRIBUTE DATA
1962

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ENGINEERING OPERATION

March, 1962

VISITORS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
RF Hartmann NF Neumann	Mallinckrodt Chemical Works, St. Charles, Mo.	JT Stringer	3-21/22/ 23	Discuss dingot prob- lems.
HC Kloepper, Jr.	Mallinckrodt Chemical Works, St. Charles, Mo.	EA Weakley	3-27 thru 30	Discuss dingot prob- lems.
H Watts E Myers	Sylcor, Hicksville, New York	JT Stringer	3-30	Discuss hot press program.
RA Graham EF Baroch	Wah Chang Corp., Albany, Oregon	GW Riedeman	3-27/28	Discuss N fuel reactor fuel supports.

TRIPS

	<u>Company Visited</u>			
DC Worlton	Seattle, Washington	H Hovland	3-16	Attend meeting of Society for Non- Destructive Testing
JT Stringer	National Lead Co. of Ohio, Cincinnati, Ohio	FL Cuthbert	3-10 thru 14	Technical discussions with feed sites
	Mallinckrodt Chemical Works, St. Charles, Mo.	JA Fellows		
RL Straley	Brush Electronics, Seattle, Washington	JE Sperry	3-14	Witness demonstration of a surface profile recording setup.
GW Riedeman	Airline Welding, Hawthorne, Calif.	H Meredith	3-19	Consultations on N reactor fuel components.
	Custom Tube Products Paramount, Calif.	M Wheeler		
	American Brass Co., Paramount, Calif.	RH Hill	3-20	
	NIW Products, Vernon California	A Ernestus		

TRIPS (cont'd.)

<u>Name</u>	<u>Company Visited</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
GW Riedeman	Torrance Brass Co., Torrance, Calif.	C Spurrier	3-21	Consult on N reactor fuel components.
	Harvey Aluminum Torrance, Calif.	G Moudry		
	Westmetals Products, Los Angeles, Calif.	A Neubauer	3-22	
	Bridgeport Brass Co., Riverside, Calif.	C Hoshne		

PERSONNEL

<u>Name</u>	<u>Title</u>	<u>Reason</u>	<u>Date</u>
JR Kosorok	Rotational Tech. Grad.	Transferred out - assignment completed	3-1
GE Miller	Rotational Tech. Grad.	Transferred out - assignment completed	3-1
KK Grittner	Technician	Transferred to Mfg.	3-1
RD Dudley	Technician	Transferred in from Manufacturing	3-26

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 March, 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.

"The Ultrasonic Vibration of Molten Metals Using the Linear
Induction Pump Principle to Induce the Vibrational Energy"
by R. E. Rowley

SIGNIFICANT REPORTS ISSUED

HW-72820 - Proposal for Feed Site Uranium Data System - LT Hagie, 2-27-62.

HW-72867 - Fuel Element Fabrication Costs for a Proposed Superheat Power Reactor -
DR Stenquist, 3-1-62

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- HW-73148 - Coextruded K Reactor Enriched I&E Fuel Element Program - KW Norwood, 3-26-62
- HW-73155 - Fuel Elements Surface Contamination Uranium Tester - CN Jackson
- HW-72664 - Design, Development, and Production Evaluation of I&E Contour-Base Components - EV Padgett, 2-13-62
- HW-72541A- Design of Production Test IP-468-A-FP, Program for Evaluation of Alpha Extruded Fuel Cores - MA Clinton and WH Hodgson, 1-28-62
- HW-70223A- Design of Production Test IP-423-A-FP, Evaluation of Uranium Fuel Cores Having Various Heat Treatments - WH Hodgson and MA Clinton, 1-5-62.
- HW-72415 - Nickel Plating Fuel Elements by a Chemical Deposition Process-Pilot Scale Studies - DC Brandt, 1-24-62.

SECURITY

There was one security violation in the Engineering Operation during March. Total CYTD - 1.

ALSI PRODUCT ENGINEERING

Fuel Performance and Requirements

Six (6) regular production I&E fuel element ruptures (4 natural and 2 enriched) occurred in the reactors during March. A summary of these ruptures is as follows:

Fuel Element Type	Tube and Reactor	Exposure MWD/T	Rupture Classification	Failure Date	Canning Date
Natural Non-Bumper	*2378B	289	Cap End	3/9/62	10/20/61
Non-Bumper	**1078DR	469	Side Hot Spot	3/11/62	10/17/61
Non-Bumper	.1584DR	486	Side Hot Spot	3/15/62	10/17/61
Bumper	**1372H	263	Base End	3/12/62	10/23/61
Enriched Bumper	4169H	157	Mechanical Damage	3/29/62	11/15/61
Non-Bumper	2091KE	695	Hole	3/28/62	11/15/61

* Alloyed dingot

** Ingot control for alloyed dingot test

Fuel performance continues to be adversely affected by fuel oriented "end" and "hole" failures. Total production ruptures incurred this month was four (4) more than experienced in February and six (6) less than sustained in the same period a year ago. Severity of service is about 1.5 times that of a year ago. Although irradiation experience is inadequate to fully evaluate the effect of a pressurized fuel assembly quench on resistance to "end" and "hole" failures, ruptures of these types have occurred in five lots of material canned after complete conversion, which is approximately fifty (50) percent of the rate expected if fuel quality remained unchanged.

An alloyed dingot rupture and two ingot control ruptures sustained this period increases the total failures sustained under the dingot evaluation program to 18 non-bumper and 2 bumper dingot, and 10 non-bumper and 3 bumper ingot controls. Under the sequential test design if two more non-bumpered dingot ruptures occur without incurring additional ingot control ruptures, the performance of non-bumper dingot fuel will be two-fold worse than the ingot control material at a 95 percent confidence level. Radiometallurgy examination of an unclassified dingot rupture, which occurred in B reactor at an exposure of 746 MWD/T in January, 1962, shows no evidence of end closure defects. The core was partially cracked in the transverse direction. Based on the metallography of dingot uranium both before and after irradiation, it has been concluded that dingot core ruptures are largely attributed to small radial cracks observed on the internal surface. Beta heat treatment of dingot core blanks in hollow form is expected to relieve this problem.

Radiometallurgy examination of two bumper enriched I&E ruptures, incurred in the H Reactor E-N loading during December, 1960, has been completed. Although these ruptures were classified as a side other and core failure, the actual cause was found to be mechanical damage on the base end. A previously examined side other rupture from this loading was also re-classified as mechanical damage after photographs of the piece were

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re-examined. All of these ruptures have a diagonal shear plane on the base end, extending 90 to 120 degrees around the circumference. Thus, at least four of the fifteen ruptures sustained in the E-N loading were caused by mechanical damage during charging. As previously reported, excluding second failures (4) in lots, the number of "hole" and "end" failures experienced in this loading is not significantly different from that expected if adjusted for increases in severity of service. Examination of two "hole" failures experienced in January is in progress. Groove corrosion of the spires has been observed both upstream and downstream from the point of failure.

Uranium Technology

Approximately 274 tons of alloyed dingot are being irradiated in the old reactors and 1128 tons have been discharged at goal. In addition, 195 tons of alloyed dingot are being irradiated in the K Reactors and 80 tons have been discharged. An "end" failure occurred this month in an alloyed dingot fuel element at 289 MWD/T and two failures (a side hot spot and an end) occurred in non-bumpered and bumpered ingot control elements at 469 and 263 MWD/T, respectively. Eleven (11) tons of vacuum outgassed and 63 tons of regular OIIN alloyed dingot cores were canned this month.

Through the routine chemical analysis audit of one uranium core per incoming lot, the following cores did not meet specifications:

<u>Number Of Cores</u>	<u>Type Metal</u>	<u>Out Of Specification Analysis</u>	<u>Maximum Allowable</u>
1	Normal Ingot	775 ppm C	750 ppm C
4	Enriched Ingot	813 to 1027 ppm C	750 ppm C
3	Enriched Ingot	3.3 and 3.9 ppm H ₂	3.0 ppm H ₂
2	Alloyed Dingot	3.3 and 3.9 ppm H ₂	3.0 ppm H ₂

The above dingot cores are the first found to exceed the specified hydrogen content since late 1960. Twelve ingot cores have exceeded the specified carbon content since September, 1961. A review of the present specified producer-site composite sampling plan for analyzing carbon content has shown that the acceptance of high carbon cores is quite likely unless the individual samples fall below the specified minimum density of 18.82. Statistical studies are being made to establish an improved sampling plan for carbon and to change the composite limit value for zirconium. HAPD analysis of samples from the beginning of each rod and the end of the last rod (6th) in an enriched ingot has shown that the carbon and nitrogen are highly segregated as to the position within the ingot (as was shown previously for normal ingots). The carbon analysis ranged from a low of 568 ppm near the top of the ingot to a high of 744 ppm near the bottom of the ingot, and the nitrogen analysis ranged from a low of 7 ppm near the top to 51 ppm near the bottom of the ingot. A bottom ingot analysis, although not at the highest carbon or nitrogen level, would more closely approach the maximum carbon and nitrogen values than the present top ingot analysis.

The remaining half of the ingot charge make-up test cores was lot canned this month. Two additional Quality Certification columns were prepared to measure any gross dimensional differences after irradiation between the six types of ingot casting charges involved. Each of the six charges has a different combination of virgin metal (derbies and dingot uranium), briquettes, and massive remelt metal.

Process Development

Development of fuel elements canned in nickel-plated aluminum components included a final quality evaluation of the 400 pieces canned last month, further development of end closure welding, and the initiation of an additional canning test. Considering the material canned last month, rejections ($\sim 1/3$) for can wall penetration were excessive. By successive caustic etches, the residual can wall of the rejects was found to be between 11 and 13 mils. In further non-destructive testing, the accepted material was separated into two categories; and the best group was found to have sustained up to 6 mils can wall penetration, with a minimum residual can wall of 18 mils. There was some evidence that the penetration might have been caused by a steel plunger used to purge frozen AlSi and dross from the cans prior to core insertion. No penetration was found on any of the spire walls, plated with 0.6 to 0.8 mils of nickel as compared to 0.2 - 0.3 thick nickel on the can walls. Accordingly, an additional test is being made using 0.6 to 0.8 mils thick nickel on the can wall as well as the spire. Initial results are encouraging, with no penetration of the can or spire on a sample of 10 out of the first 40 pieces canned. Presumably, the nickel thickness can eventually be reduced with process refinement.

Development of a satisfactory D.C. closure welding method for fuel elements canned in nickel-plated components is essentially complete. Coverage over the braze layer is ≥ 50 mils, employing a V-groove machined into the cylindrical surface of the fuel element to promote weld mixing. Metallographic examination and chemical etching indicates the weld bead is quite homogeneous. Inadequate control of the weld bead dimensions has resulted in excessive overhang; however, it appears this deficiency can be remedied by minor changes in design of the V-groove and the welding cycle.

Exploratory lab-bench tests carried out to produce a low phosphorous nickel plate by chemical deposition have been somewhat encouraging, with a few samples in the range of 1 to 4 wt.% P, using sodium hypophosphite reductant at $\text{pH} \geq 10$. Reproducibility has not been determined. A survey of the literature and contacts with persons in the field has not disclosed other reductants (non-phosphorous) which have been successfully used, even on an experimental basis.

Laboratory development of a corrosion resistant autoclave film on X-8001 aluminum alloy included accelerated corrosion testing of coupons autoclaved over a time range of three to twenty-seven hours and temperatures from 170 to 290°C using 10 wt.% potassium dichromate at pH 6.7. This treatment was

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preceded by water autoclaving for the same time and temperature ranges. Statistical analysis of the data is not yet complete; however, it appears that the corrosion resistance of the film deposited at 290°C is superior with little dependence on time or the conditions of the preceding water autoclaving. Studies of the effect of dichromate concentration and pH are planned.

Fifty (50) tubes of externally nickel-plated fuel elements being irradiated in 105-DR were discharged at estimated exposures of 1150 - 1250 MWD/T. This exposure level was 150 - 200 MWD/T short of the planned goal; however, approximately 1/2 of the process tubes were scheduled for replacement and the objectives of the test were essentially satisfied. Visual examination of fuel elements from a rupture suspect tube revealed no evidence of a rupture, but four pieces exhibited positive evidence of nickel detachment. The nickel appeared to have separated from 25 - 50% of the surface of one piece. Whether or not the separation occurred at the Al-Ni interface or within the nickel laminations has not yet been determined. The P³² activity in the effluent from the two monitoring tubes continued to be five to twenty-fold above bulk reactor effluent on samples through February and early March. Visual examination of the fuel elements from these and other monitor tubes prior to cleaning revealed the following:

1. Characteristic circumferential hairline surface cracks on 8 - 12 pieces in each tube. These cracks were similar to those observed on earlier tests; however, they appeared to be more closely spaced and often completely circumscribed the fuel element.
2. Blistering on 2 - 3 fuel elements per tube. The blisters were approximately 1/32 to 1/8" in diameter, and ranged from 2 up to about 25 per fuel element. In some cases, the nickel had become detached, exposing the aluminum.
3. One to three fuel elements per tube exhibited groove pitting, which generally appeared to have resulted from mechanical damage to the plate.
4. No heavily-scaled hot spots were observed. Some pieces showed evidence of nickel overheating, with no visible corrosion or detachment of the plate in these areas.
5. No gross detachment of the nickel plate was observed.

Cleaning, weighing, and further examinations are scheduled.

Alternate Process

HAP0 Hot Press

An additional 158 HAP0 hot-press fuel elements were assembled during early March. These fuel elements were necessary to make up for the low yield

experienced in the January pressing run. A yield of 87% was obtained through bond testing and welding, with an overall yield of 74% after self-support rail attachment. The largest yield losses experienced after bonding were in the self-support attachment and marred surface categories.

An equivalent of six columns each of HAP0 hot-press, Sylcor hot-press, and AlSi control fuel elements were pre-measured and arranged for alternate charging under a preliminary production test to compare irradiation performance. The test is scheduled to be charged in C Reactor during the next outage.

Sylcor Hot Press

Destructive testing and metallography of Sylcor hot-press pieces has been completed. The results are summarized as follows:

1. No discontinuities were observed in the nickel plate under a metallograph at 400 magnifications.
2. The throwing power or ability of Sylcor's nickel plating operation to plate irregularities in the core surface was very good.
3. Some micro cracking in the bond was observed in the intermetallic diffusion layer adjacent to the aluminum jacket. This cracking manifested itself as 2 to 3 mil long cracks parallel to the residual nickel plate and adjacent to the aluminum jacket.
4. The average residual can wall was 33.5 mils with a guarantee of 17.4 mils.

Fluid Pressure Bonding

Contract negotiations were continued with Battelle Memorial Institute to bond HAP0 assembled fuel elements in their high pressure autoclave facility. Fuel elements will be bonded to optimize process parameters and for a preliminary irradiation test under contract DDR 141.

Hot Die Sizing

Electrical services for the installation of hot die sizing equipment in 3716 Building has been completed. The preheat furnace was installed; however, minor damage to the refractory during shipment to HAP0 will require repair before the furnace can be operated. Temperature recorder and control instruments for the end bonding press were received. Work authorization has been issued to J. A. Jones for the installation of the sizing press, end bonding press, and de-mineralizer. Remaining work on the hot die sizing press is being expedited to facilitate installation and operation.

Process Technology

Seven (7) process work requests have been performed in the 306 AlSi Pilot Plant, all aimed at obtaining data on the mechanics of bonding layer formation

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and to obtain useful information on the apparent differences between ingot and dingot uranium. Although metallographic examination of test samples is incomplete, the following conclusions are based on preliminary data:

1. The thickness of the AlSi compound layers is proportional to lead preheat time, temperature, and AlSi contact time, but not necessarily proportional to silicon concentration in the range 7.5 to 12.5 percent.
2. The percentage of UAl_3 -type compound in the bond is inversely proportional to the percentage silicon in the duplex bath.
3. There is a good correlation between percentage UAl_3 -type compound layer and the percentage of fractured bonds.
4. No correlation was found between percentage of fractured bonds and total bond count.
5. A large cocoon of AlSi is carried into the lead as cores enter the duplex bath. This AlSi begins to diffuse into the uranium surface forming the initial compound layer.
6. The heating rate of the I&E core is not uniform with the horizontal agitation in the duplex bath. The center of the core (internal and external surfaces) has a lower rate than the ends. This causes a variation in bonding layer characteristics.
7. The average weight loss of ingot uranium cores through one canning and recovery cycle is 21 percent greater than for dingot metal.
8. The average warp of ingot cores through one canning and recovery cycle is 8.30 mils with a standard deviation of 3.76 mils. This compares to 5.18 mils and 2.98 mils respectively for dingot cores.
9. The nitric acid etch rate for ingot cores is 1.75 grams per minute on OIIIIN cores (in range from 2 to 4 minutes etch time) compared to 1.05 grams/minute for dingot. The ingot rate is 67 percent greater than for dingot.

Conversion of the AC welding machines to DC was continued in the AlSi Shop with one additional semi-automatic welder converted during the month. All of the DC power supplies received were checked out in the welding laboratory, and 7 of the 13 units would not operate properly. Minor adjustments and repairs as required were made by a vendor representative. Inconsistencies in arc starting with the new low ripple power supplies led to the investigation of argon additions to the helium shielding gas. Test work involving 700 fuel elements revealed no adverse weld quality effects from using up to 30 percent of argon in the shielding gas. It was further found that arc starting continuously improved with increasing percentages of argon in the shielding gas. Several other tests were also conducted to further optimize DC welding

techniques. Single-pass 12-1/2 rpm welding was compared to double-pass 20 rpm welding. The latter resulted in far fewer weld laps, but weld cracking was more severe. In another test involving 700 fuel elements it was found that, as welding speed was decreased from 20 to 10 rpm using a double-pass weld, weld cracking was reduced by a factor of 9.4 and weld voids by a factor of 1.5.

One bid was received for a projection fuel full length slotted tube gage at a quoted cost of \$650. An order was placed for a CIV self-support gage with delivery the first week in April. Additional gages will be procured for other projection fuel models if this gage is satisfactory.

Two ultrasonic welding heads from the 306 Building prototype ultrasonic welder have been returned to the vendor for testing and rebuilding. These heads were returned because of an observed decrease in efficiency with use. Testing by the vendor revealed an increase in impedance of the transducers on both heads, which is believed to have resulted from deformation of the laminated nickel transducer stacks. In an attempt to alleviate this problem, the vendor is modifying the design and rebuilding the transducers.

Production of CIV self-support fuel elements was temporarily delayed due to marred surface rejects caused by the vibration of the projection rail dimples when the rails were ultrasonically welded to the fuel elements. Surface mars ranged up to 9 mils in depth. Rail design was altered to provide a 0.010 ± 0.002 inch clearance between the rail dimples and the fuel element surface to relieve this problem.

A new welding head with a "screw-on" type welding tip for the 306 manual ultrasonic welder was received and installed. Thus far, performance has not been satisfactory, and the old head may have to be re-installed to insure welding continuity on special materials.

AlSi Pilot Plant

During the past month, a total of 7,271 pieces were canned in the 306 AlSi Pilot Plant. Of this number, 6,340 were for reactor use and the remainder were for destructive or other tests. An additional 900 pieces were partially processed for special tests.

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COEXTRUDED PRODUCT ENGINEERING**DECLASSIFIED****N-Reactor Fuel Development****KER Loop Testing**

- Loop 1 - The "crud test" in Loop 1 is operating satisfactorily. The "crud test" consists of three 17-inch NIE fuels and one thermocoupled fuel. The thermocoupled fuel was provided by HLO.
- Loop 2 - Five prototypic NIE, 23-inch fuels, comprising the "high exposure" test, were discharged from Loop 2 on 3/29/62. The exposure on these fuels was slightly in excess of 3000 MWD/T.
- Loop 3 - On 3/29/62, two prototypic N-fuel assemblies were discharged from Loop 3 at an exposure of approximately 400 MWD/T. These were irradiated for loop testing. Eleven prototypic N-fuel assemblies were charged in Loop 3 on 3/31/62 and are destined for 1000 MWD/T.
- Loop 4 - Five 23-inch prototypic N-fuel assemblies were charged in Loop 4 during the month for Loop 4 testing. It is planned to charge fourteen prototypic N-fuel assemblies in Loop 4 during the first reactor outage in April. This is the largest charge which can be put in the loop and this charge will be irradiated to 2000 MWD/T.

K-I&E² Failures

During the month, a coextruded I&E² fuel element failed in the KW Reactor. The failure occurred in a tube which had an average exposure of 1647 MWD/T. The ruptured fuel is now being examined at the C-reactor basin. The end cap, which was separated from the fuel during rupture is at Radiometallurgy.

Inspection of the pre-irradiation eddy current clad thickness test charts and the autoradiograph films has shown no processing irregularities.

Production Test and Development Fabrication - Pilot Plant

The schedule on page 12 represents the status of work in the Coextrusion Pilot Plant. In excess of 300 fuel elements are in various stages of processing.

Materials Development and Procurement**Uranium Billets****Feed Site Operations**

National Lead Company of Ohio completed shipment of five NOE and five NIE "Brandywine" billets to HAP0 by mid-month. One NIE billet was rejected at HAP0 after pickling for surface pits. These were coextruded

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IN PROCESS DATE	PWR NO.	EXTRUSION DATE	TUBE NUMBER	WORK DESCRIPTION	TYPE AND QUANTITY REQUIRED	PROCESS LOCATION	EXPECTED COMPLETION DATE	COMMENTS
12/27/61	12			Fabricate NPR prototype fuels for high temperature flow tests.	(20) 24-inch assemblies	Complete	3/28/62	---
	29			Prepare fuel elements for brazing to evaluate application of ultrasonic vibration.	---	Not in process		Delayed due to equipment fabrication
2/8/62	31		UT-6 UT-7 UT-8 UT-9 UT-10 UT-11 UT-12	Process six outer tubes to determine effect of beta heat treatment prior to coextrusion	(60) NOE	In process; chemical milling and brazing	Indefinite	---
2/22/62	32			Prepare NIE specimens for projection welded end closures (copper removal & chemical mill)	(288) 2-inch specimens	168 complete		---
						120 to be processed.	4/6/62	---
3/5/62	33			Prepare fuel element clad specimens by chemical removal of uranium core clad to be used for burst tests.	(12) NOE - 10" length - (first group)	Complete - First Group	--	---
3/13/62	34			Determine effect of etchant variables (temperature & processing time) & autoclave procedures as they influence white oxide formation (weld beads).	(12) I&E	Complete	--	---
3/13/62	35			Recover white oxide rejects by mechanical removal (wire brushing, emery paper) of white oxide and re-autoclave.	(8) NIE	Complete	--	---
I&E Program				Fabricate coextruded I&E fuel elements with supports for production reactor testing	(100)	(54) Chem. mill (66) Heat treat (64) Machining	4/20/62	

by Coextruded Product Engineering for evaluation prior to ordering "Brandywine" material for use by Production. The evaluation is under way.

National Lead has initiated work on the four-category feed site test (i.e. the test involving increased I. D. upset during primary extrusion and beta heat treatment of billets) described in the last monthly report.

Some problems have arisen with the primary extrusion operation at Bridgeport Brass Company, Ashtabula, Ohio. Low yields have been experienced because of bends and radial cracks in the primary extrusions. The bending is believed due to runout tube and runout table inadequacies which have since been recognized and corrected. The radial cracking was so severe in some cases that wafers cut from primary extrusions parted into two pieces. The cracking may be due to plugged extrusion I. D.'s during post-extrusion quenching. The quench water cannot enter the I.D., and all cooling is from the O.D. surface. This plugging is due to fractured graphite from the cutoff block which was not removed after extrusion. Some striated extrusion surfaces have been noted on primary extrusions because of the use of broken dies.

Quality Improvement

Inspection of the billets produced from the sixty primary extrusions made at HAPO is complete. The surface quality of billets from ingots cast by the "old", cold casting cycle at National Lead was compared with ingots cast by National Lead's hotter cycle. The hotter cycle produced markedly better surface quality.

Fourteen out of twenty-three "old" campaign ingots produced billets with rejectable, pitted surfaces. Only one out of thirty-seven "hot-cycle" ingots produced billets with rejectable, pitted surfaces.

The N-uranium chemical specifications have been modified by letter until the new specification is issued in April. The carbon specification was changed from 650 ppm, maximum to 300 ppm, minimum and 650 ppm, maximum in an effort to minimize variation in billet properties caused by large variations in carbon content.

The hydrogen specification has been modified to permit outgassing of material up to 3.0 ppm, maximum. Also, because of possible variation of the hydrogen content of material from step-to-step throughout the process, an additional analysis is now required on the primary extrusion as well as on the ingot.

Aluminum, oxygen, and tin analyses are also requested because of the possible effect of these elements on grain size.

Inner clad thickness data from test outer tube coextrusions made from single beta heat treated billets continue to indicate a marked reduction in the thickness variability. Consideration is being given to heat treating all billets (i.e. both inner and outer) at the feed sites in routine production.

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The first two "British-type", adjusted uranium alloy (nominally 400 ppm Fe and 800 ppm Al) ingots have been cast at National Lead on a development order. The Al concentration was low on both ingots due to the lack of experience with Al additions. However, extensive sampling data indicate that segregation of the additive elements does not promise to be a problem in this alloy. Also, an exploratory triple-beta heat treatment on one 11-inch diameter ingot did not cause it to crack.

Zircaloy Cladding

Two qualified vendors are experimenting with forging, rolling, and drilling techniques for making #4 cladding shells (inner tube, inner clad). So far, no samples have been received for evaluation; however, they should be delivered by April 2. All our experience to date has shown that this fabrication method produces cladding shells that do not reduce uniformly when coextruded and give rough fuel clads. The vendor work so far indicates these experiments will probably fail to make acceptable components.

Wah Chang, whose qualification test pieces of #3 and #4 cladding shells (inner clads, outer and inner tubes, respectively) failed to produce uniform wall fuel cladding, has redesigned their process and will submit new samples when available.

Zircaloy Supports

In starting production attachment of supports and locking clips to fuel tubes, many design and fabrication problems were uncovered. All support pieces must be modified to some extent. A brief summary of their status shows the magnitude of the problems.

Outer Tube Supports

1. The supports are too high. The original plan was to size down during welding to provide the proper height. The present support was dimensioned after the prototype design that worked well during pilot operations. The production equipment is enough different in design and operation that the support height must be reduced to work.
2. The end tabs must be reshaped. Originally, it was thought desirable to contour the end tabs to conform to the fuel surface. Now, this contour interferes with proper welding by shorting part of the welding current at points where the contour touches the fuel cladding. The tabs must be shaped in such a way as to allow only the weld projections to touch the fuel surface.

Inner Tube Supports

1. The support design has proven extremely difficult to fabricate. The parts require four bends of about 3T diameter through roughly 200°. A $1\frac{1}{2}T$ radius (3T diameter) is difficult to bend reproducibly in most metals. Currently, one bend shows weakness by either cracking

or surface yielding. The vendor has spent considerable effort in perfecting his strip quality, and it is now about as good as it is possible to make. There remain a few minor process modifications that can slightly alter the strip's metallurgical structure and may prove helpful, but the improvement would be purely incremental.

A tooling change to reduce tensile strains in the bend area is now in progress. The help here will also be but incremental.

As the piece design requires dwelling on the very edge of fabricability, all incremental improvements will be beneficial, but no reasonable fabrication piece yield can be predicted.

2. The concept and use of these supports is being reevaluated. Currently, all the incremental improvements possible are being incorporated into making satisfactory pieces of the present design, but they may not produce a part of sufficient reliability. Consequently, several new concepts for applying and using the present general design may relax the bending demands on the metal and increase their fabricability.

Also, a new design may evolve from new analyses of the part's function. Any such change would, of course, require new tooling.

Locking Clips

1. The present design locking clips do not sufficiently limit the longitudinal slack between the inner and outer fuel tubes. Assuming the inner tube support design does not change, a relatively simple change in the locking clip appears to be able to sufficiently limit the longitudinal slack. The parts "as are" are not usable.

A new inner tube support may require a new locking clip.

Copper Sleeves

Torrance Brass Foundry has shipped the bulk of their 1.2% silicon-copper 6" x .065" wall extrusion sleeves. After considerable development, their process appears adequate to produce both 6" and 6½" sleeves and in the 3% silicon alloy. In many respects, from casting through extrusion, the 3% alloy is easier to handle and control. Torrance feels they will have no trouble meeting competitive pressures in these products. A new order for both 6" and 7½" sleeves of 3% silicon alloy will be placed with them soon for their full qualification.

Extrusion Process

Extrusions

The following extrusions were made during the month:

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11.1 Inch Tooling

One Zircaloy Billet - Zr #128 to 5½" rod for further fabrication to NOE inner clad components by Bridgeport Brass Company.

7.5 Inch Tooling

Eleven Composites

- ZT #15 & 16, X-21, and UT #22 through 29.
- ZT-15 - NOE size with copper core to evaluate inner zircaloy clad components.
- ZT-16 - Same as #15 except uranium core.
- X-21 - NOE test billet for preshape evaluation.
- UT-22 thru UT-26 - NOE billets for evaluation of "Brandywine" uranium coextrusion characteristics.
- UT-27 and UT-28 - NOE billets for evaluation of cast-alpha extruded-single beta heat treatment uranium billet fabrication route.
- UT-29 - NOE billet for evaluation of single vs triple beta heat treatment of the cast ingot prior to primary extrusion.

6.0 Inch Tooling

Thirteen Composites - T #318 through 326 and UT #18 through 21

- T-318, 319, and 320 - Standard I&E
- T-321, 322, 323 & 324 - Standard NIE
- T-325 - NIE extruded with 1180°F billet temperature
- T-326 - NIE extruded with 1065°F billet temperature
- UT-18 thru 21 - NIE billets for evaluation of "Brandywine" uranium coextrusion characteristics.

NOE Inner Clad Thickness Variation

There have been three basic developments in this area during the past month. They are as follows:

1. The reject rate on standard material suddenly dropped to less than 10% (approximately 4%) for no apparent reason.

2. Eight NOE extrusions using uranium billets fabricated on-site with a variety of primary extrusion conditions did not have any rejects due to clad thickness variation.
3. NOE extrusions tested to date (approximately ten) which had single beta heat treated uranium cores showed excellent clad thickness control. Evaluation of this material is not complete but all indications are that the additional heat treatment operation on the uranium core produces the most uniform clad thickness ever received on N-size coextrusions.

Billet Design Modification

The modified coextrusion billet designs were issued during the month. These designs eliminate all preshaping of the uranium core and positions the zircaloy cladding for maximum utilization with copper rings.

These designs minimize zircaloy losses in the coextrusion end defects, reduce copper component costs, and could promote better bonding at the ends of the coextrusion due to the "getter disc" effect of the uranium core ends.

The effect on bonding could be quite significant since Manufacturing has already changed tube cutting schedules to allow for an additional six inches on the front end defect since a very high bonding reject rate occurred on this first six inches.

NIE Clad Thickness Variation

Six development extrusions were made with single beta heat treated uranium cores to evaluate effect on NIE outer clad thickness and warp. These tubes have been evaluated for clad thickness variation and show excellent uniformity. Warp data is not available to date.

A Process Work Request was issued to single beta heat treat NIE uranium cores for Manufacturing usage during April for more thorough evaluation of clad thickness control and warp.

NIE Beta Heat Treated Warp

Quality Control data show NIE warp yield is up to 95 to 98%, for material extruded during February. This was all extruded using 1140°F billet temperature and 10 inches per minute ram speed.

The amount of straightening required, however, has been quite high (approximately 30 to 40%) during the past week. There is no apparent explanation for this increase in straightening requirements since extrusion conditions were not varied.

Additional information of interest is that the as-received warp prior to beta heat treatment is averaging in the 10 mil range. It is believed that this received warp cannot be improved considerably from this point.

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Billet Preheating

On March 26, 1962, a twelve hour test run was made with the large continuous production preheat furnace. An instrumented NOT and NIT billet was used in this test with an uninstrumented NOT billet added for greater furnace load. This test indicated that the furnace is capable of heating billets to a pre-determined temperature as required.

Chemical Processing

Autoclave Reject Problem - White Oxide

A white oxide formation on the end welds of 333 Building autoclaved NPR inners resulted in a high autoclave reject rate this month. Approximately 60% of the inners on Process Work Request CX-2 (material for KE Reactor, Modified Loops 3 and 4) was rejected because of the white welds. A smaller percentage of production material also developed white welds. The zircaloy cladding in almost all cases exhibited a black, lustrous film characteristic of good corrosion resistance. The cause for the white welds is evidently process oriented and may be partly due to the autoclave procedure itself.

The rejected white welds are:

1. being analyzed chemically, spectrographically and by x-ray diffraction.
2. being subjected to long term corrosion tests in high temperature water and steam, and
3. being recovered by several different techniques and evaluated.

A program has been adopted to evaluate the autoclave problem in general. Included in this are evaluations of (1) white stained and powdery autoclave films, (2) the effect of scratches due to autoclaving assembled elements, (3) the recovery of rejected fuels, and (4) the different processing steps, i.e. welding and brazing, on how they effect the corrosion resistant properties of the final element.

Tests were performed in the pilot plant to evaluate etchant variables as they influence the formation of white oxide on zircaloy clad fuels in the autoclave. The variables investigated were:

1. Temperature of fuel elements when immersed in etchant.
2. Time lapse from immersion to start of agitation-5 sec. minimum; 15 sec., maximum.
3. Transfer time from etch to stop bath- 5 sec., minimum; 15 sec., maximum.
4. Temperature of the stop bath - 17°C minimum; 40°C maximum.
5. Temperature of water rinse - 13°C minimum; 60°C maximum.
6. Use of solution agitation and wetting agents in the stop bath.

Briefly summarized, the results indicated the following:

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1. Variables 1 and 2 appeared not to influence autoclave oxide film.
2. The shorter transfer time favored the formation of darker oxide on the weld bead.
3. A cold stop bath and cold tap water without stop bath solution agitation produced a slight amount of white oxide around the supports indicating insufficient stop bath activity.

Conclusions made on the basis of these tests are:

1. Transfer time from etch to stop bath should be kept to a minimum, preferably under 10 seconds.
2. A warm stop bath and water rinse improves the "stopping" activity of the solution.

A test was performed to determine the recoverability of fuel elements having white oxide on the weld beads. Several methods were used to remove the white oxide, i.e. wire brushing and emery cloth. In these methods, the white oxide was removed leaving a black oxide underneath. In all the fuels treated, black oxide was penetrated in spots while removing the white oxide. The fuel elements were divided into two groups, with one group being etched prior to autoclave and the other degreased and rinsed in deionized water. When removed from the autoclave, the fuels given the prior etch treatment exhibited excessive white corrosion product; those not etched had white oxide only on the areas where metal had been exposed during the initial white oxide cleanup.

Results indicated generally that if white oxide on weld beads is of the type that is superimposed on black oxide and can be removed without exposing a metal surface, recovery of the fuel element is possible without reducing clad thickness by abrasive blasting and re-etching techniques.

Test results have shown that inserting the inner tube into the outer tube after autoclaving causes white scratches on the I.D. surface of the outer tube, if the fuel elements are autoclaved again. It has also been shown that inserting the inner tube into the outer tube before autoclaving results in white scratches. When inner tubes are autoclaved separately, the height of the inner support increases. The average increase in height is about 0.010 inch.

Equipment Development

Cathodic Etching

Considerable experimental work was done on etching zircaloy-2 twelve inch strips; after learning some of the characteristics of etching with the 6 phase D.C. power supply, samples of uranium, zircaloy, copper and aluminum were prepared.

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The settings and conditions were duplicated on each run of the four different samples. The first six inches of each strip was run at 26" Hg at a speed of 4"/min.; the last six inches was run at atmospheric pressure. There was a very definite difference in the two etched paths, the path etched at atmospheric pressure was much finer than the one etched at 26" Hg.

The 6 phase D.C. power supply etches a very fine path and covers a large area at a fast rate.

The etching characteristics of the four samples all differed, however uranium and aluminum are fairly close.

Rotary Attachment for Micro-Spark Unit

The rotary attachment for the micro-spark unit for analyzing the white oxide on N-material is being fabricated in the Tech Shops.

The unit is made to rotate at approximately 12 mm/hr. The rotary table is designed to tilt at any angle from 0° to 45°.

The fabrication will be complete by April 2, 1962.

Tool for Crimping Locking Device on Supports

A twelve inch outer and inner tube was equipped with buggy spring supports and locking devices on each end. One end of the tubes were sectioned away exposing the support and locking devices. By doing this, it made it possible for the machine shop to shape the crimping tool to fit the locking device.

A tool has been designed and fabricated for this crimping. However, additional modifications were necessary after crimping several locking devices. The angle at which the tabs of the locking device face makes it necessary to do a lot of hand work on the shoes of the tool.

The tool should be complete by April 2, 1962.

"W" Forming Tool for Locking Devices

The tool for forming a "W" in the locking devices has been in use for two weeks. Additional plungers were ordered which will be used for experimental purposes.

Several ideas exist where the "W" in the locking device can be modified further. The extra plungers will be used for this.

TESTING METHODS ENGINEERINGN Fuel Testing

Considerable emphasis is being given the problem of uranium surface contamination of N fuel in the 333 fuel production facility. Routine operation of the alpha counting equipment, now transferred to the 303 Area has shown that all of the fifteen elements tested to date have evidenced a degree of contamination. Significantly, all elements have shown end cap contamination ranging from about four to thirty-three micrograms of uranium. Zirconium end rings examined prior to brazing, however, have shown no evidence of contamination. Samples of beryllium-zirconium braze alloy taken from near the ends of completed elements have shown uranium concentrations in the range of 1300 ppm by wet chemical analysis.

Contamination of the cladding has also revealed that five of eight elements tested have cladding surface contamination of approximately sixty micrograms. In each instance the contaminated elements had been autoclaved in equipment in which an autoclave failure had previously occurred.

Present alpha counting equipment is limited to the inspection of inner geometries only. Authorization to provide additional equipment capable of inspecting outer fuel tubes has been requested through issuance of an Appropriation Request.

Operation of the eddy current and ultrasonic test equipment is proceeding in the N fuels facility routinely. A maintenance and reliability survey of recent operating experience has shown good performance for equipment of this type. Minor improvements are being routinely incorporated in the equipment as they are proven desirable. The cap to core bond has been changed to a fifteen megacycle system, using lithium sulphate focused transducers.

Ultrasonic inspection of the zirconium components for outer fuel tubes (inner and outer surface) is continuing. Inspection of the other geometries has been discontinued for the reason that the excessive cold work contained in these pieces preclude the performance of meaningful ultrasonic grain size determinations. The importance of these ultrasonic tests appears to be diminishing since the ultrasonic data do not appear to correlate with measurable extrusion parameters.

Recent extrusions of especially pre-heat treated billets appear to produce claddings of more uniform thickness and surface smoothness. A grain growth occurs with the heat treating process that is measurable by ultrasonic techniques. An ultrasonic test has been placed in routine operation which assures that the heat treating step has been performed properly.

AlSi Fuels Testing

Four UT-4 stations have been placed in full operation in the 313 fuel facility and have provided inspection of essentially the entire fuel production the past

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few weeks. Each station is equipped to scan approximately 0.2 inch along the closure braze of each end. For readout purposes the inspection zones are divided into twenty-five "lock washer" shaped discs which are determined by the instrument to be either good or bad on the basis of a single defect indication comparable in size to the bottom surface of a 0.016 inch flat bottom hole. Defective discs which occur consecutively, indicating a straight-through water leakage path, are summed on one reject channel, while the total defective discs are totaled on the other reject channel. Over many tens of thousands of pieces the reject rate has averaged between one and three percent on the basis of either fifteen consecutive defective discs or twenty-two total defective discs.

Destructive examination of rejects have in most cases established excellent correlation with ultrasonic results. In some cases the defects were so small as to be visible only at about 500X magnification. In a few instances no correlation was obtained.

During the trial run-in period the operability of the equipment has proven good. Minor trouble spots have occurred, such as excessive mechanical wear at certain points and improperly lubricated bearings; however, these have been readily corrected as they developed.

Two stations are adequate to handle the entire fuel production with some reserve capacity. Four stations thus provides complete backup instrumentation. Plans are to formally incorporate the testers into the production line near April 9, 1962.

Two UT-2 stations have been delivered from off-site fabricators and are now undergoing laboratory checkout. This equipment is the first major electronic nondestructive test equipment to be built by other than plant forces. Although completion of the project required a much greater period of time than originally estimated, the quality of workmanship appears good. One of the units is scheduled for pilot plant operation, the other will be used by maintenance forces within the 313 Building.

Post Irradiation Testing

Electronic and mechanical design of the equipment under development for 105 KE is essentially complete. Fabrication of the mechanical apparatus is well under way, while construction work on the electronic phase of the project is now beginning. Laboratory efforts have been devoted to the development of new circuitry required by the special needs of this application. Good progress is being made in the forming of short (in time) radio frequency pulses by Shockley diodes and delay line networks. Exceptionally high input impedance amplifiers have been obtained by special circuit arrangements. Goal date for equipment installation at the reactor site is June, 1962.

Lamb Wave Testing

Lamb wave experimental investigations made on metal sections less than 0.1 inch thick have shown excellent agreement with theory. Attempts are now being

made to extend the technology to thicker sections which are of interest in many industrial applications. The objective being to determine if these techniques offer advantages over conventional ultrasonic test practices in such applications. Practical incentives (as well as excellent samples to work with) are being provided by the NPR primary piping system whose inspection by existing test methods has not proven entirely satisfactory.

The theory suggests that these inch thick sections might be made to exhibit a "thin plate" behavior by a suitable reduction in test frequency. The initial experimental work indicates, however, that such is not the case, i.e., pronounced Lamb wave modes are not experimentally observed at the same frequency time plate thickness products as they are on thinner plates of the same material (carbon steel). Several possible factors which might account for these unexpected results are now being explored; they must be understood before further advances for this particular application can be made.

Experimental work on the application of Lamb waves to inspection of metal-to-metal bonds has not shown positive results. Attempts to differentiate Savannah River hot press bonded fuel elements of varying degrees of bond strength have been unsuccessful.

ADVANCE FUEL ENGINEERING

The Hanford Test Reactor Hazards Summary Review will be issued the week of April 16.

The Advance Fuel Engineering contribution to the status review of the ingot-dingot testing program will be published during the week of April 9.

Acting Manager
Engineering Operation

JT Stringer:msw

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Generating Facility. Phase II of the Consolidated Service Facility is included in the FY 1964 submittal at a cost of \$1,680,000. Miscellaneous capital work order requirements are estimated at \$180,000 for each of the two years.

Two project proposals were reviewed during the month. The first was for the Controlled Process Plating Facility estimated to cost \$187,000. This project consists entirely of equipment to be used in the development of alternate methods of cladding fuel elements. The second proposal requests \$66,000 advance engineering funds for the Consolidated Service Facility - Phase I. The balance of the funds for the project will be requested early in FY 1963.

A review of work performed in sensitive areas as established by the Commission has been completed. To the best of our knowledge, exception has been taken to only one of the 38 jobs approved in the Department since 7/1/59. Several others were questioned but readily approved when the Commission was apprised of the needs and circumstances of the work.

The Department's fixed property inventory has been started. An inventory team of two C&AO men has started counting the process equipment. A temporary office has been set up for use by these and other counters as they are assigned this inventory. The counting and reconciliation are expected to take the better part of two months. Counting will be facilitated considerably by the Department's policy of tagging fixed equipment. The inventory will serve a two-fold purpose: (1) compliance with AEC requirements and (2) serve as the basis for record mechanization.

Travel expenses in March amounted to \$9,000, reflecting 20 trips with 116 days in travel status and \$2,350 for the movement of household goods. Business travel included trips to essential material vendors, consultation at feed-sites, recruiting of BTR candidates and management consultation with corporate officers. One professional and trade society meeting was attended in conjunction with a feed-site visit.

Fiscal year to date travel costs are \$55,600 with 947 days in travel status. This represents a 37% increase in cost and a 24% increase in days over FY 1961. Both increases are attributable to the movement of personnel.

Savings resulting from the cost improvement program reached \$109,429 at the close of March with five additional proposals having estimated savings of \$119,038 under evaluation. This results from a substantial increase in activity during the month which saw 11 new proposals received. Savings estimated for these proposals totaled \$153,219. March business included cost improvements with the largest estimated saving submitted and largest estimated saving accepted during CY 1962. The former covers unit price reduction in aluminum components while the latter refers to 313 vacation relief. Estimated savings are \$64,600 and \$22,142 respectively.

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Assuming a 25% attrition rate in estimated savings for proposals currently under evaluation, cost improvements for this calendar year would total \$198,000, 88% of the \$225,000 first quarter goal.

A procedure for evaluation of clerical and secretarial work load has been developed and published.

No reports of unusual significance were issued during the month.

The Financial Section had no security violations during March.

Manager - Finance

WS Roe:mh

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PLANT FACILITIES OPERATIONMARCH 1962I. RESPONSIBILITY CHANGES

None.

II. ACHIEVEMENTSA. Statistics1. Utilities

	<u>March</u>	<u>Feb.</u>
Average steam generated (M lbs/hr)	79	94
Maximum steam generated (M lbs/hr)	125	144
Total steam generated (M lbs)	59,129	63,085
Coal consumed (tons)	2,912.17	3,105.08
Evaporation rate (steam/#coal)	10.15	10.16
Efficiency - Actual	73.0	72.3
Efficiency - Theoretical	75.0	75.0
No. of Boilers on: 3 2 1 2 1		
Date of change : 6 25 27 30		
Sanitary water from 3000 Area (M Gals.)	158.09	154.05
Total water from 3000 Area (Avg. Rate GPM)	3,541	3,829
Total water from #3 and #4 wells (M Gals.)	12.95	11.69
Total water from #2 well (M Gals.)	.30	.30
Peak water consumption for 24 hours (M Gals.)	5.9	5.9

B. Operating Experience

Intermittent failure of the ash sluice pump was again experienced this month. Inspection revealed that the upper layer of rubber on the wear plate in the sump, which had been replaced last month, had worn through and pieces of loose rubber were entering the pump suction line. Removal of this rubber layer eliminated the trouble. At the same time it was also discovered that the upper layer of the 1/2 inch steel plate was worn through, exposing the second sandwich layer of rubber, which is backed up by the second 1/2 inch steel plate. A new wear plate of special abrasion-resistant material has been ordered from the manufacturer of the ash handling equipment.

Water eroded away the footings supporting the flume between the three small ponds, which make up part of the north process pond. During the time required to repair these footings, the water was diverted temporarily to the south pond. As of the end of the month, the north pond was back in service and appears satisfactory.

A new type of hose connection was installed on the tube used to inject chlorine solution into the sanitary water at the 382 Building. This change incorporates a check valve to prevent the reverse flow of water out of the solution tube in the event that the hose blows off. This has occurred several times in the past few years.

The dump valve on No. 2 sand separator began leaking through badly and it was found that a rubber layer of the diaphragm had worn off; also, a groove was worn in the dam section of the valve body. Temporary repairs were made to restore the unit to service until a new diaphragm and new rubber-lined valve bodies have been received for replacement.

All portions of the 300 Area Critical Incident Alarm System for which this operation is responsible have been installed and tested. Primary detectors and alarms previously installed in 305-B, 325, 326, 329 and 308 are ready for tie-in with the master panel at Patrol Headquarters.

Extensive sign painting, identification lettering, floor lines, and the installation of prefabricated signs has been done in the 333 Building. Most of this work was classified as safety items.

Removal of existing materials and equipment from a cell in the 325-A Building is being performed under Special Radiation Procedure. The time limits for this job have required a rotation of all craftsmen involved.

C. Equipment Experience

Faulty wiring in the switchgear assembly in the 308 Building would simulate a power outage in the building if the emergency generator in 384 Building were operated. The necessary materials to correct the situation have been ordered.

A defective shut-off solenoid valve on the water still in the 325 Building will be replaced. Until the replacement is received it will be necessary to manually stop the water flow to the still during idle periods.

During the course of an autoclave run in the 308 Building, it was discovered that three of the seven chromel-alumel thermocouples were not chromel-alumel but iron-constantan. As this kind of an error could have serious consequences, a new procedure has been established for double checking all thermocouples used on the autoclaves before installation. All thermocouples will be certified in the Standards Shop at three temperature points.

The recent failure of an over-temperature instrument for the billet furnace in the 308 Building was caused by internal failure of a vacuum tube. This failure has caused some concern as to the reliability of this particular safety circuit inasmuch as its failure could potentially result in a plutonium contamination spread. Investigation is being made to determine if increased reliability can be practically built into the system.

A problem hood in the 3706 Building was corrected through the use of Polyvinyl Chloride sheet material, which was used for the hood lining, draft box, filter box, and connecting duct work.

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, none were made in the course of their work during the month of March 1962.

E. Cost and Savings

Two Cost Improvement items totalling \$7,634, and suggestions of \$3,286, were approved bringing the Operation's total of 24.5 per cent of the CY-1962 goal. Cost Improvement items in excess of \$38,000 are still pending approval with one of these referred to HLO for review and further verification.

F. Status of Projects and Major Jobs

Modification of No. 1 I.D. Fan - Installation of the electrically driven auxiliary oil pump and motor is approximately 80 per cent complete. Completion of this work will finish the modification to the fan.

Monumenting Burial Grounds, 300 Area - The contractor's shop drawings were approved and fabrication of the concrete marker posts is under way.

Air Dryer Installation, 384 Building - Field fabrication work and piping is under way. A 21-day delay in the shipment of equipment is holding up installation. The equipment is now scheduled for delivery on site early in April.

Modification of No. 6 Sanitary Water Pump - Revision of the gasoline supply piping is under way; however, both motor and engine driver are available for use.

Auxiliary Instrument Panel, 384 Building - All instruments procured off-site have been received. The water treatment panel

is 70 per cent fabricated and is scheduled for installation on April 2, 1962. Fabrication of the second panel is scheduled in mid-April, with installation in May 1962.

New Water Distillation Facility, 3706 Building - Design is complete and installation is to be performed by Plant Forces. Equipment is scheduled for delivery during the first week of April 1962.

Refrigerated Air Conditioning, 3717-B Building - Work has been started by J. A. Jones on the installation of the 10-ton refrigerated air conditioning unit for control of temperature and humidity in the Standards Shop.

Modification of No. 5 Sanitary Water Pump - Field work is scheduled to start April 9, 1962.

Sanitary Water Grid System Extension - Installation of the line is 80 per cent complete and is undergoing hydrostatic test and chlorination.

Intercommunication System, 384 Building - A revaluation of engineered solution for this problem is under way.

Emergency Power System - Inquiry bids received during the month have permitted a decrease in the estimate from \$280,000 to \$200,000. Additional general data were compiled into report form and transmitted as further justification for the Appropriation Request. Work is continuing on diesel generator specifications for final invitation of bids.

Compressed Air Expansion - Based on an additional compressed air load for the 325 Building, procurement of an additional 815 scfm Compressor to replace the No. 3 and No. 4 Compressors is being requested.

Sprinkler System, 3760 Building - The bid package for the originally proposed work has been recalled from the AEC and a reduced package of work is being prepared for submission as a design and construct contract.

South Steam Export Header Loop - Comments on the project proposal have been received from Facilities Engineering and the final draft is being prepared.

Perimeter Fence Relocation and Services, 3718 Building - Design is complete for modifying the perimeter fence to include the 3718 Building within the 300 Area. Final scope and analysis of the cost estimate is being prepared.

Service Piping, 382-384 Buildings - Authorization to proceed with this work has been issued to J. A. Jones. Field work is scheduled to start April 9, 1962.

MAJOR STUDIES

Work Sampling, CY-1962 - Observations made during January and February were compiled into report form and issued March 20, 1962.

4th Expansion, Steam Generation Plant - The budget study was completed during the month and distribution was made. Contacts are being made through the Specialist, Contracts to obtain a general proposal from Cascade Natural Gas Corporation on supplying gas to the new generator.

Modification of Water Softening System, 384 Building - Data are being compiled to replace the dilute acid storage tank and installation of exhaust fan system and other miscellaneous improvements pending other major work to be covered by the 4th Expansion.

300 Area Master Plan Project - Preparation and integrating of the master plan with PAC Budget submittals and the FPD Plant Improvement Program continues with the final draft scheduled for issuance early in April.

G. Special Reports Issued

"FY-1963 Budget Study, Additional Steam Generating Facility, 300 Area," by R. G. James.

"1962 Work Sampling Survey, Plant Facilities Operation," dated March 20, 1962, by T. H. Whatley.

Rough draft of "300 Area Facilities Master Plan" issued March 23, 1962 by C. K. Michaelis.

III. PERSONNEL

A. Safety, Security and Radiation Experience

Medical Treatment Injuries	23
Frequency Rate	4.24
Disabling Injuries	0
Serious Accidents	0
Security Violations	0
Radiation Incidents	0

B. Meetings

Round Table-Staff
Safety and Security
Information

20
17
4

Manager
Plant Facilities Operation

E. Hilgeman:RTM:mkm

END

**DATE
FILMED**

12 / 2 / 92