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HW--72556

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FUELS PREPARATION DEPARTMENT

MONTHLY REPORT

JANUARY

1962

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HANFORD ATOMIC PRODUCTS OPERATION

RICHLAND, WASHINGTON

GENERAL ELECTRIC

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TABLE OF CONTENTS

General Summary	A-1 through A-9
Manufacturing Operation	B-1 through B-13
Engineering Operation	C-1 through C-30
Financial Operation	D-1 through D-2
Plant Facilities Operation	E-1 through E-6

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GENERAL SUMMARY

HW-72556

PRODUCTION

An increase of the in-process inventory resulted in the output of AlSi fuels being slightly below forecast. Operation of the plant continued at a level of ten canning lines per day throughout January.

Manufacturing yields exceeded the forecast but dropped slightly from the record high attained in December due to an increase in rejects attributed to the AlSi slopover problem.

The inventory of finished fuels increased to an equivalent 2.9 month supply based upon projected reactor usage.

At month end the inventory of bare cores reflected a 1.7 month supply.

An input of 16.4 tons in the Coextrusion Process resulted in 135 extrusions, of which 18 were primary billets.

ENGINEERING

Present Reactor Fuels

A total of twelve regular production I&E fuel elements failed in reactors during January (four natural and eight enriched). This less favorable trend is serious, particularly because of the increased incidence of enriched "hole" failures. Earlier examinations of failures of this type indicated that these ruptures are caused by coolant entry through small defects in fuel element end closures. Additional "hole" type ruptures are scheduled for Radiometallurgy examination to assure the rupture mechanism is unchanged. Improvements underway which are expected to reverse this trend are: increases in the quench pressure from 40 psig to 80-90 psig to further suppress cap braze closure voids; further optimization of the canning cycle; conversion to DC end closure welding; and the installation of UT-4 braze closure integrity testers. Other studies will also be made to more precisely determine the sources of braze porosity and appropriate corrective measures will be taken.

The second production Model UT-4 tester has been delivered to the 313 production facility. The UT-4 prototype which was installed in the AlSi Pilot Plant has been operational for about two weeks and no significant operating difficulties have been encountered.

Low ripple DC power supplies for conversion of existing production welders from AC to DC current are under test and two units have been installed in the 313 production facility.

Approximately 310 tons of alloyed dingot uranium are being irradiated in the old reactors and 1088 tons have been discharged at goal. In addition, 104 tons are being irradiated in the K Reactors. Including the three natural alloyed dingot

ruptures (one core split and two unclassified) this month, a total of 19 dingot ruptures have occurred to date under the program to evaluate dingot uranium for unrestricted use. Both of the unclassified ruptures show evidence of transverse and longitudinal splitting of the cores. The dingot rupture sustained in B Reactor and an incipient rupture from the same charge are scheduled for Radio-metallurgy examination. It is felt that examination of the incipient rupture may reveal the failure mechanism inherent in these ruptures. Examination of two dingot transverse core failures, which occurred in F Reactor during October, 1961, show no evidence of end closure defects which might have permitted coolant entry. Since no unusual fuel cladding corrosion is evident, core quality is suspected as the major contributing cause of failure. Sectioning of these cores has shown evidence of both crazing and cracking on the internal surface. These cracks are currently being examined at high magnification to determine the mechanism of their formation. The chemical composition of these cores is also being analyzed.

The first overbore fuel rupture was experienced at an exposure of 631 MWD/T. Damage to the support rails during charging apparently resulted in inadequate support during irradiation and failure from accelerated corrosion resulted. Because of this rupture, and evidence of charging damage and/or possible deficiencies in rail strength indicated in other pieces discharged, 325 overbore fuels with rails 72 mils high and 40 mils thick have been sized down to a 65 mil rail height. Three hundred fifteen overbore fuel elements have also been fabricated with redesigned rails 65 mils high and 45 mils thick. The later rail design will be used on an interim basis until reactor charging problems are alleviated or until justification develops for further increases in rail strength.

The status of the alternate aluminum cladding component evaluation program remains essentially unchanged. A total of ten non-bumper ruptures have occurred in vendor "H" clad fuel elements and two in vendor "B" clad fuel elements as compared to six non-bumper ruptures in the control material for each vendor.

Irradiation of 62 tubes of nickel-plated fuel elements in the 105 DR Reactor have reached an exposure of 950 to 1050 MWD/T. Goal exposure is 1400 MWD/T. Eighteen tubes were discharged during January and one tube each of fuel elements with 0.5 mil thick nickel plate and 0.2 mil plate were visually examined immediately after discharge. "Hot spot" patterns were observed on one of the fuel elements from each of the tubes examined. The nickel plate was shiny and integral in the bare areas where the scale had sloughed off on both the "hot spot" fuels and the others examined. Small blisters were observed on one fuel element from each tube but no appreciable amount of nickel was detached. Characteristic circumferential hair line cracks were observed on fuel elements from both tubes except in the two "hot spot" areas. No nickel sloughing or aluminum corrosion appeared to result from these cracks. Rib scratches were more prominent on the 0.2 mil than on the 0.5 mil plate. Readily visible aluminum corrosion in these scratches indicated that nickel had been abraded during charging. Following preliminary examination in the 105 DR basin, the fuel elements were exposed to a heavy concentration of decontamination compound in the C basin and gross sloughing of nickel plate occurred. Further examination of the fuels with the "hot spots" indicated that the nickel remained intact in the two "hot spot" areas. This behavior confirms earlier evidence that increasing the time and/or temperature of the post-plating heat treating may further

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HW-72556

improve plate adherence. Although a rupture had been suspected in one of these fuel elements, no confirmatory evidence was found.

Nickel plating of about 700 K-size enriched nickel-plated fuel elements was completed. Approximately 700 O-size fuel elements were canned in aluminum components plated externally and internally with nickel.

A production run to produce 300 hot press fuel elements for irradiation was completed. Testing and evaluation will be completed in February.

Evaluation of 661 Sylcor hot press fuel elements is complete except for destructive examination of the samples for diffusion thickness and continuity of the nickel bond layer.

The hydraulic power unit for the hot die sizing press was received. Assembly of the end bonding press is in progress. Delivery of the pre-heat furnace is expected in February. Design and procurement of auxiliary tools and equipment is being expedited. Fabrication of die and die cases is about 75 percent complete.

Small scale tests in the Battelle Memorial Institute pressure bonding facility demonstrate that acceptable bonding of HAPO fuel elements can be achieved at a pressure of 10,000 psi at 500°C on a 30-minute cycle. A proposal has been prepared for further development work at BMI.

As part of the Quality Certification program the dimensional instability and warp characteristics of regular production fuel have been studied. Pertinent items of interest follow: Fuel quality as measured by statistics is highly variable with time; a rank coefficient of 0.80 has been determined between warp and percent "hot spots" on normal production fuel; since May 1960 a dramatic but unexplained reduction in warp has occurred; fuel elements tend to swell in the middle during irradiation causing a barrel-shaped profile; a decrease in total bond count has been observed over the test period.

N Reactor Fuels

The high exposure test consisting of five 23-inch enriched inner tube elements in KER Loop #2 is operating satisfactorily. Present exposure is about 1980 MWD/T with a goal exposure of 3000 MWD/T.

Five 23-inch enriched inner tube elements comprising the warp test have reached an exposure of 650 MWD/T toward a goal exposure of 1000 MWD/T. Loop difficulties have partly negated the value of this test and a repeat test is planned.

Fuel elements for the "crud" test and the tapered end closure test are ready for charging.

KER Loops #3 and #4 are now being converted to N fuel size and are expected to be on the line about March 1, 1962. Fabrication of 54 NPR prototypic assemblies for Loops #3 and #4 are nearly complete. Initially it is planned to charge two prototypic fuels in each loop to test loop modifications. It is then planned to charge ten prototypic NPR fuel assemblies in each loop for full-scale testing.

These will represent the first full size prototypic N fuel assemblies irradiated under test conditions similar to those proposed for the N Reactor.

Three tubes of K-size coextruded I&E² elements are now under irradiation. Each tube contains 45 fuel elements. One tube of K-size I&E² fuels was discharged in December at an exposure of 1057 MWD/T.

As discussed in previous monthly reports, the N-outer and the N-inner billet supplies are short because of uranium quality problems at National Lead of Ohio. The National Lead-Bridgeport Brass combine is scheduled to begin deliveries of N-outer billets in March and N-inner billets in April. In the interim period, N-inner billets from the HAPO inventory and from National Lead's machining of the primary extrusion stock originating from the CY 1961 casting campaign should meet the coextrusion schedule.

Bridgeport Brass Co. tested their re-installed ingot pre-heat furnace and extrusion press during January. Both are operating satisfactorily and a total of 16 natural uranium ingots were extruded. Machining and inspection of these extrusions have not yet been completed by NLO.

Shakedown tests of the National Lead of Ohio new casting facility in Plant 9 were underway at the end of the month. The new facility will cast larger ingots than have been produced previously (28" vs. 22").

The temporary waiver on the maximum carbon limit for uranium billets was extended from the original termination date of January 31 to March 15, 1962 in order to gain more information prior to establishing a permanent specification.

National Lead of Ohio employed hotter melting cycles in December for producing ingots for primary extrusion at HAPO. Insufficient data has been gained from the extrusion and machining of this material to determine whether the hotter melting cycles have reduced the pitting problem.

The uranium billet specification is being rewritten in an effort to establish closer controls on both the fabrication process and the final product. A sounder, more reproducible billet should result.

The structure and properties of uranium billets are considered to be the major variables affecting the quality of coextrusions. Extensive tests and development are underway or planned and involve heat treatment, alloying and hot working of the uranium.

Currently there are no apparent technical problems concerning the cladding shells. A fourth vendor, Wah Chang, is in the process of qualifying as a cladding shell fabricator.

Fuel element supports continue to be a problem but of decreasing magnitude. About 3000 outer tube supports have been fabricated and appear sound. Locking clips are in production. The first production lots of 1000 inner tube supports should be shipped early in February.

Copper can welding modifications for billet assembly have been made and this part of the process has been significantly improved.

DECLASSIFIED

HW-72556

Forty-two primary extrusions have been made to date at HAPO and 18 additional ingots are on site. These 18 will be extruded early in February. Machining of these extrusions has progressed very well, and of the 42 ingots extruded, 26 have been fully machined to produce 28-inch full-size billets.

The reject rate for outer tube-inner clad variation is approximately 40 percent of the production material tested. The cause for this variation is believed to be the low work history of the inner bore of the outer tube billet. Additional work can be introduced in the ID billets by many methods, however, the evaluation of these methods can only be made by performing tests. Evaluations of some of these tests are being made in the HAPO primary extrusions. Tests to date include: up-setting oversize I.D.'s and chilling of the I.D. prior to extrusion with copper drill blocks or cold mandrels. The results of these tests are not complete, but most of the data should be available the last week in February.

N outer tube wall thickness control has been improved substantially by reduction in ram speed to 14 inches per minute and raising the graphite cut-off temperature to 1170°F (631°C).

Reactor analysis studies on the warp of N fuel pieces has culminated in an effective method for predicting the magnitude of the change in warp during beta heat treating.

Negotiation of DDR-137 with the General Atomics Corporation has been completed. This contract covers the development of powder metallurgy fabrication techniques for NPR braze closure rings. Braze rings made by the NMI pressed chip method have also been ordered and will be evaluated.

Occasionally a cap-core bond is broken by the T.I.G. finish welding operation. An intensive investigation is underway to further evaluate the parameters which prevent or enhance the formation of an integral intermetallic compound layer which is necessary to guarantee maximum bond strength.

The fifth test lot of gas pressure bonded end closures, the first to which copper had been added to reduce a bond between the Zircaloy-2 cladding and Zircaloy-2 cladding ring, have been examined. The bond quality was poor because of deficiencies in the copper plate. Improved methods of copper plating are under study. These include: vapor deposition of copper and surface deposition by gaseous decomposition of copper acetyl acetonate.

Performance of the external bond testers for N fuels has been improved through the use of 15 megacycle lithium sulphate transducers.

Recent difficulties with the cladding thickness test were corrected with the installation of new eddy current coils in the test probes.

Ultrasonic inspection of outer zirconium components have shown a technique capable of detecting grain size variations. Adoption of this test as a regular inspection test is being pursued.

Beneficial use of the 105 KE basin nondestructive testing equipment is placed at June, 1962.

Investigations are underway to determine whether ultrasonic velocity measurements in uranium can be used as a nondestructive method of assuring beta transformation of N fuel.

Internal friction measurements utilizing ultrasonic methods have proven successful in detecting hydrided zirconium and development of a standard testing technique is underway.

An integrated data collection system for NPR fuels is believed necessary as a part of systematic NPR fuel element control and development. A punched card system, with sufficient capacity to expand or contract with the business, appears to be an effective solution. The details of the proposed system are reported in HW-72431, "A Data System for NPR Fuels," by I. T. Hagie.

GENERAL

No failures of AlSi fuels in the autoclaves occurred during January.

Installation of the four new autoclaves in the Coextrusion Shop was completed.

PERSONNEL STATISTICS

Number of employees as of December 31, 1961 855

Number of employees as of January 31, 1962 855

	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
General	1	1	2
Manufacturing	92	384	476
Engineering	45	28	73
Financial	14	8	22
Plant Facilities	39	242	281
Employee Relations	1	0	1
TOTAL	192	663	855

<u>Employment</u>		<u>January</u>	<u>December</u>
Additions:	Exempt	5	1
	Nonexempt	1	5
		<u>6</u>	<u>6</u>
Reductions:	Exempt	4	5
	Nonexempt	2	6
		<u>6</u>	<u>11</u>

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FW-72556

The additions to the roll were two engineers, a Manager-Employee Relations, an MTP rotational engineer, a Tech Grad rotational engineer, and a transfer from IPD to fill a new nonexempt job.

The reductions included an engineer (resignation), an MTP engineer (rotated), a Manager, Engineering (transferred to APED), an engineer (transferred to CPD), a transfer to CE&UO (on request for transfer), and a military leave.

STAFF

General Manager, Fuels Preparation Department
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

Effective January 15, 1962, Mr. J. T. Stringer was appointed Acting Manager, Engineering. Mr. L. H. McEwen transferred to APED, San Jose, California.

PATENT SUMMARY - JANUARY 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 January 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.

"Ultrasonic Vibration of Liquid Metals."

..... By R. E. Rowley

"A Method for Holding a Cylindrical Object
While Turning or Positioning."

..... By C. E. Allen

RL Dickeman

General Manager
Fuels Preparation Department

RL Dickeman:mkm

MANUFACTURING OPERATION

JANUARY, 1962

CURRENT OPERATIONS

Production

Statistics

	NORMAL					ENRICHED				
	8"	0				0				
	Solid	C	K	Reg.	Bumper	C	K	Reg.	Bumper	Total
<u>Current Month's Production</u>										
Acceptable Fuel Elements Produced (Tons)	-	0.1	397.3	35.8	150.9	0	39.3	7.1	27.1	657.6
as % of Forecast Production	-	-	170	26	110	-	85	51	123	98.0
sum. % of Forecast for Current Quarter	-	-	170	26	110	-	85	51	123	98.0
as % of Past 3 Month's Average Production	-	-	141	25	210	-	89	51	104	101.0
as % of Past 12 Month's Average Production	-	-	157	21	302	-	89	30	80	100.0
% of Forecast Achieved Last Fiscal Quarter	-	107	113	97	82	56	105	109	141	103.0
% of Forecast Achieved Last 4 Fiscal Quarters	-	113	106	103	100	80	100	101	96	104.0
<u>Operating Efficiency</u>										
Current Month (%)										95.6
Forecast (%)										93.0
Previous Month (%)										97.1
<u>Manufacturing Yield</u>										
Current Month (%)	-	-	91	90	87	-	94	85	90	
Forecast (%)	-	88	88	88	82	88	88	88	82	
Previous Month (%)	-	95	93	90	91	92	95	-	89	
<u>Rare Uranium Available for Processing (Tons)</u>										
Finished Products in Storage (Tons)										891
Special Products Finished (Pieces) Boll										1565
Uranium Utilization										199
										98.5

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HW-72556

Production

Plant Operation - AlSi

Both the manufacturing yields and efficiency remained at relatively high levels during January; however, output was slightly less than forecast due to a higher in-process inventory at month end. Ten canning lines were in operation throughout the month.

The production yield for eight-inch I&E normal material during January was less than for December. This was primarily due to an increase in the AlSi slopover reject rate. The various causes of the AlSi slop has not been determined. It is known that in most cases an AlSi slop prone condition is set by a combination of factors and not by any single factor. These factors are (1) sleeve-can mating, (2) sleeve preparation, and (3) canning conditions. Extensive studies are presently being done to learn more concerning these factors and means by which they can be controlled.

Output from the bumper welders increased over the December experience and were as follows:

	January, 1961		To-Date	
	Natural	Enriched	Natural	Enriched
FPD Produced	151	27	817	497
IPD Charged	82	21	496	450
Finished Inventory	321	47	321	47
Average Welding Yield	94%	92%		

Machining and canning of solid lithium-aluminum pieces was completed on the available rod stock. At month end, leak and radiograph testing remained on a portion of the canned material as well as recovery and re-canning of a small number of canned rejects.

There were no autoclave failures of AlSi Process fuels during January.

The inventory of finished fuel elements at month end reflected an equivalent 2.9 month supply based upon projected reactor usage.

The month end inventory of bare cores reflected a 1.7 month supply based upon projected fuels process needs.

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

8" Normal I&E	15,951
6" Enriched I&E	3,264
Water Mix	1,864
Total	21,079

Two shipments containing a total of 56 tons of natural and enriched scrap, including NPR defective billets and tube scrap, were shipped. In addition, one car of empty boxes was shipped.

Plant Operation - Coextrusion

A total input of 16.4 tons to the process resulted in 54 NOT and 38 NIT extrusions being produced during January. Forty-three additional extrusions were produced for engineering process development work, of which eighteen were primary billets.

Following is a total throughput for the major operations in the Shop:

	<u>Inners</u>	<u>Outers</u>
Extrusion	38	54
Cutup	471	664
Chemical Milling	705	588
Braze	701	242
Heat Treat	514	184
Machining	484	162
Vacu-Blast	365	401
Welding	348	398
Bond & Clad Test	173	414
Support Weld	17	22
Autoclave	17	22

Surface roughness rejects at chemical milling increased during the month. Etching differences in uranium and "leakers" have been the contributing factors.

Manufacturing Engineering

Design and Projects

CAF-847 New Fuel Cladding Facility

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

Installation of the sprinkler system was completed and accepted. Installation of the autoclaves has been completed with minor exceptions.

Repairs to the chem bay mezzanine floor were completed by the contractor.

Autoradiograph film developing equipment has been installed and is operating satisfactorily.

CGF-903 Projection Fuel Element Modifications, 313 Building

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

The purchase order has been placed on the mechanical portion of the third ultrasonic welder. The purchase order for the electronic portion of this unit is in process.

The manual welder for rejects has been installed.

DECLASSIFIED

HW-72556

CGF-934 UT-4 Testers, 313 Building

	<u>Scheduled</u>	<u>Actual</u>
Design	100	100
Construction	52	52

One UT-4 tester has been installed and is being debugged.

Miscellaneous Equipment

The new Acme Gridley lathe has been received and is being installed in a semi-temporary location in the AISI Shop.

Requisitions have been issued for major components of the criticality alarm system.

Design of the power supply for the 3716 Building has been completed.

Drafting and Duplicating

Drafting work which was completed follows:

New Drawings	81
Revised Drawings	91
Small Charts	33
Large Charts	1
Miscellaneous	58

Completed duplicating work:

Xeros Masters Prepared	626
Multilith Impressions	355,968
Ozalid Copies	11,284
914 Copier Copies	11,133

PLANT CONDITIONS, INCIDENTS, AND IMPROVEMENTS

AISI

Operating efficiency for January dropped slightly below the record high attained in December but was significantly higher than forecast. About 75 percent of the downtime was attributed to equipment outages. The major contributors to the canning line downtime were the quench machines.

Difficulties with the rail alignment mechanisms on the bumper welders have reduced efficiency as well as being the main contributors to the reduction in yield.

On January 31, 1962, an Ajax furnace, located in the metal recovery area, failed due to metal penetration through the cross channel into the induction coil in the lower hearth. This lower hearth has been in service slightly less than three months and is the third premature lower hearth failure on furnaces located in the recovery area during the last six months.

Recently the manufacturer of the vibrators used on the canning jacks changed the material specifications for the body of the vibrator from cast iron to aluminum. As a result of this change, we have been experiencing a great many premature vibrator failures. The temperature coefficient of expansion on the aluminum body is much greater than the steel ball race, and as a result, the race turns during operation causing small particles of aluminum to break loose and fall into the race. This in turn reduces the vibrational output of the vibrator. The manufacturer has been contacted and has agreed to supply vibrators with the cast iron body for our operation.

Pressure bell and basket alignment problems continued to represent the major portion of the quench machine downtime and is due to the lack of stability in the basket bushings. The problem of AlSi plugging the pressure bells has continued to be a problem; however, a method of cleaning the bells without disassembly has reduced the maintenance time required for removal of the AlSi.

A device to replace the soap tank for the ultrasonic welders is now in the process of being evaluated and modified. This piece of equipment will make available the present space now occupied by the soap tank.

An accountability procedure for SF material in the AlSi process was prepared early in the month. The procedure would reduce accountability paper work by processing all transactions and reports through the IBM-7090 computer. More definitive procedures and specific methods were proposed to improve over-all physical control of SF material. Discussions on the details of the proposal appear to be possible during the first week in February.

Linear programming was successfully used to produce the January forecast. The basic assumptions utilized by the production planner and five additional variations were processed. The output showed considerably less overtime than was required by the manual method. Programming difficulties caused a seven day delay in obtaining results. It appears that no future delays of this nature will occur. In addition, review of results indicate a change in "penalty assignments" is necessary to place excess inventories in normal products rather than in enriched products.

Canning control charts were put into use on January 11, 1962. The control charts will provide two-hour feedback data on AR-NS, AR-Other, and CPR rejects by canning line. By the use of the control charts, an out-of-process condition can be located quickly and attempts made to determine and correct the cause of the problem. It is also expected that the control charts will result in all personnel associated with the canning operation having the opportunity to follow the results of their work more closely, correct their problems, and keep the process under better control.

Use of dye penetrant techniques to detect and measure braze line voids before welding was evaluated. Results showed that dye penetrants can readily detect braze voids too small to be seen by visual examination. Further, this technique was able to determine if the voids were less than .015" deep or greater than .050" deep. Correlation between dye stain areas and intermediate void depths was not possible. Use of dye penetrants does not affect subsequent

welding quality for shallow voids. Since void depths in the range of .015" to .050" are of particular interest in weld quality studies, dye penetrants are of limited value. They can, however, be used to detect shallow voids and voids extending to the base of the weld melt area.

A test was run to determine if B and C Process aluminum components (except Li-Al I&E components) could be cleaned in the automatic cap and can machine under F Process Specifications. Such components are presently being cleaned in the manual cleaning line in Special Products. The test showed that cleanliness and welding characteristics of components cleaned under A Process Specifications to compare equally or favorably to those cleaned under existing B and C Process Specifications. A temporary standard will be issued to permit the cleaning of all B and C Process Components (except Li-Al I&E components) in the cap and can machine under F Process Specifications.

Coextrusion

A sample of an as-extruded inner tube examined in the laboratory was found to have unusual uranium structure for as-extruded material. X-Ray diffraction study shows that except for some (110) plane texture, this uranium had considerable beta characteristics. Metallographic examination revealed that the specimen shows small sub-grains in the grain structure, which is characteristic of beta transformed material. This demonstrates that it appears to be possible that a combination of ram speed and temperature during extrusion can affect grain structure. As a result of the findings concerning this specimen as well as to learn more of the effect of coextrusion variables, Fuels Engineering is scoping a study of historical coextrusion samples having a variety of extrusion variables.

A truck card that will provide information to relate reject information with processing date, operator, and machine for most of the processing steps, was put into use on January 23. The cards will also reduce the possibility of fuel elements by-passing an inspection station. New forms for recording assembly and inspection data for machine processing are being used at:

1. Billet assembly
2. Pre-milling inspection
3. Length inspection
4. Chem milling
5. End closure machining
6. Non-destructive testing

On January 24 the end cap braze operation was shut down until better temperature controlling and recording stability could be obtained. Several tests were made using thermocoupled fuel tubes and several changes were made, but the problem still existed to some degree. Since an automatic temperature cycle could not be satisfactorily obtained, Station A was set up for manual control. A factory representative is here assisting with correction of the problem. Indications are that modification made thus far to the existing controllers will solve the problem. A coil alignment device was installed and will alleviate a coil alignment problem. Also, two of the manufacturing maintenance personnel have suggested a new coil holding device which will speed coil changing time, provide better adjustment and improve electrical and water connections.

Heat treating was down two days for installation of a hot water rinse tank. This has improved operating conditions in this area and has permitted the major portion of the area to be released as a beryllium zone. No indications of moisture carry-over to chloride bath has been noted. Heat treat was out of service two additional days for the installation of a 10,000 cfm roof exhaust fan. The fan is not scheduled to be put into service until thermocouple tests are run to determine the fan's effect on element cooling rates.

Installations were completed on four new autoclaves which were accepted after undergoing the normal tests. A representative from the vendor investigated the "cold bottom" problem of the autoclaves. Recommendations were made to invert and lower the bottom zone heaters, reposition #3 thermocouple, add two heaters to the bottom zone, and make minor changes to the controls. These changes have been completed, but the effectiveness of the changes has not as yet been evaluated.

A fire occurred at 1:55 PM on January 15 when a gas engine portable welder belonging to J. A. Jones burned. The welder was being used for changing guy cables on the chemical exhaust stack on the building roof. The welder was located 10 to 15 feet from the building outdoor substation. The paint on the transformer was burned, but after shutting down the substation and inspection no other damage was found. The transformer and wires were cleaned and the substation put back into service. In order to shut the transformer down, an electrical outage of the building and equipment with exception of the press room was made. Service was restored and all equipment was in operation by 4:15 PM.

A proposed method for storage of coextruded tube laboratory samples has been accepted by laboratory management and approved by personnel with the responsibility for security, nuclear safety, accountability and radiation control.

FPD HEALTH AND SAFETY

	<u>January</u>	<u>December</u>
Disabling Injuries	0	0
Serious Accidents	0	0
Medical Treatment Injuries	60	43

The Department passed the 1,000,000 hour mark in January since the last Disabling Injury on June 15, 1961. Days worked without disability totaled 230 as of January 31, 1962.

Medical Treatment Frequency rate goal figure for 1962 has been established at 3.76. Achievement would reflect a 5% improvement over the average for the last four years.

Central Safety Council audits for 1962 have been scheduled to cover all Department facilities during the year. Audit teams will be composed of a council member (Department General Manager or Section Manager) and the subsection manager responsible for the facilities being audited.

Each council member will conduct two audits outside of his area of responsibility, making observations of employee work practices, housekeeping conditions and evaluating safety climate.

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HW 72556

FPD SUGGESTION PLAN

	<u>January</u>	<u>December</u>
Number of eligible employees	663	664
FPD suggestions received	67	74
Annualized rate per 1000 eligible employees	1,213	1,333
Number of suggestions adopted	14	42
Net annual savings	\$1,093.00	\$4,527.00
Amount of awards	210.00	930.00
Percent of total awards to savings	19.2%	20.5%
Average amount of awards	\$ 15.00	\$ 22.14

A total of 67 new suggestions were received and 49 closed out in January. In addition 18 adopted suggestions were evaluated too late for payment in January. Hence, the FPD backlog was reduced by 2.

SIGNIFICANT REPORTS ISSUED

HW 72200-A	Serious Irradiation Event, Current Capabilities and Action Plan - Fuels Preparation Department	1/26/62	J.W.Talbott
HW 72517RD	Production Assumptions and Schedules, January 1962 through June 1967	1/26/62	H.E.Berg
HW 72110	Diversey Variables Investigation and Chromate Coating Formations	1/10/62	R.W.Cremin
HW 72190	Monthly Report, Quality Control Operation, Fuels Preparation Department - December, 1961	1/2/62	A.G.Blasewitz
HW 72093	Stuck Sleeve Recovery Program	1/23/62	R.W.Cremin
HW 72413	Uranium Quality Control Analytical Results	12/29/61	G.B.Hansen
HW 72314	Uranium Quality Control Analytical Results	1/15/62	G.B.Hansen
HW 72356	Uranium Quality Control Analytical Results	1/18/62	G.B.Hansen
HW 72529	Report of Uranium Accountability in Manufacturing Operation Process for Quarter Ending 12/31/61	1/30/62	W.G.Jolley

EMPLOYEE RELATIONS

Safety

Members of the Manufacturing Operation sustained thirty medical treatment injuries during January.

Security

On January 27, 1962, an improperly stored classified document resulted in a security violation.

Radiation and Beryllium Control

The totals of the exposures in excess of 100 mrad for Manufacturing personnel for the four week badge periods ending December 1 and December 29 were 6,337 mrad and 9,127 mrad compared with an average of 7,500 mrad per four week period for Calendar Year 1961. There were no individual exposures in excess of 300 mrad in either of these badge periods. The high exposure for December resulted from loss of identity of 36 badges, including 12 for Manufacturing personnel during processing of the film. The highest reading on these 36 badges was 251 mrad and this exposure was assigned to all 36 of the people involved since their actual exposure was known to be no greater than this amount. Most of the 12 Manufacturing personnel involved normally receive very little exposure, and assigning these people 251 mrad for December probably increased the total exposure by at least 2,000 mrad. Therefore, the total exposure for December is estimated to be approximately 7,000 mrad which is less than the 1961 average.

There was a moderate amount of contamination spread in the Coextrusion press room during the extrusion of 18 primary uranium billets early in January. The maximum smearable contamination level detected was 300 c/m per ft² inside the temporary radiation zone around the press. Smearable contamination up to 50 c/m per ft² was detected outside the radiation zone in the press room. This is less than the HAPD radiation zone limit for smearable contamination, but any amount of smearable contamination in clean areas of 333 Building is undesirable because of the possibility of contaminating finished fuel elements. The area was decontaminated and tighter controls imposed on the handling of primary extrusions.

A total of nine air samples and 36 smear samples, taken within the beryllium control zone, were analyzed for beryllium during the period from December 21, 1961 through January 18, 1962. Of these 45 samples, beryllium was detected in seven of the smear samples, and three exceeded the control limit for surface contamination. The three samples which exceeded the control limit were from an end closure sample and from parts of the end closure welder. Controls have been imposed in the handling of these materials to protect personnel from the beryllium present.

The size of the heat treat area in the beryllium control zone has been reduced so that the load-unload station is out of the zone. This has allowed the operators to work in this area without protective clothing. Beryllium was not detected in any of the seven air samples or ten smear samples taken during the past several months in the area which was released.

Training

A series of operator training meetings were started in the Coextrusion Shop late in January. The purpose is to acquaint the operating personnel with the finer details of the process. Meetings were conducted on the final bright etch and braze operations. Engineers from Coextruded Product Engineering are assisting with the program.

Five classes, for a total of 78 instruction hours, were presented on the UT-4 electronic console, power supplies, and preset counters during this month. Two classes, for a total of 36 instruction hours, were also presented on the tank control panel. Shop copies of all UT-4 circuitry have been prepared and issued to the instrument men for study purposes.

DECLASSIFIEDVisits - VisitorsVisits

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
D. D. Stone	Defense Systems Dept. Syracuse, New York	W. Bourne	1/3/62	Job interview
H. C. Money	Crotonville, New York		1/16,17/62	Shop Management Conference
R. L. Roske	National Acme Co. Cleveland, Ohio	R. Mandell	1/8,9, 10/62	Discuss lathe problems and observe test runs
F. W. Grubb	Mfg. Systems Computer Workshop, Lenox, Mass.		1/22-24/62	Attend workshop
F. W. Grubb	Ordnance Department Springfield, Mass.	F. B. Sturgeon	1/25/62	Evaluated data, requisition equipment
J. A. Cowan	E. I. DuPont Co. Aiken, South Carolina	Mr. Schwertfeger	1/18, 19/62	Discuss main- tenance
J. A. Cowan	Ajax Magnathermic Corp.	Mario Tuma	1/23/62	Discuss Ajax induction furn- ace performance
J. A. Cowan	Plant Maintenance & Engineering Conference & Executive Study Groups, Philadelphia		1/22-26/62	Participation in conference and study groups

Visitors

Doolie Pierce	Pickar X-Ray Co.	T. W. Gore	1/24-26/62	Check installa- tion of X-Ray film developer
R. E. Brechtel	Gisholt Machine Co. Madison, Wisc.	D. G. Lehfeldt	1/11,12/62	To work on the end cap facing lathe
Paul Berner	Star Machinery Co. Madison, Wisc.	D. G. Lehfeldt	1/11,12/62	To work on the end cap facing lathe
W. S. Randall	Leeds & Northrop Seattle, Wash.		1/29,30, 31/62	Evaluate re- corders on braze equipment

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
Claren Hoeline Lester Menns Jack Foss	Bridgeport Brass	H. E. Berg	1/18,19/62	Procurement of aluminum and zirconium components
D. M. Guy Amos VanVorst	Alcoa	H. E. Berg	1/30,31/62	Delivery and quality problems on aluminum caps and cans
F. J. Boucher	Mfg. Services New York, New York	W. N. Mobley	1/18,19/62	Visit trainees on the MTP Program

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 January.

WNM:HFT:mrh

W N Mobley
Manager - Manufacturing

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FUELS ATTRIBUTE DATA

8" NORMAL

8" BUMPERS

	DEC	JAN	FEB	MAR	APR	MAY
CUR. MO.	92.7	90.6				
3 MO.	90.5	91.6				
CY	88.3	90.6				
FY	90.0	90.1				

	DEC	JAN	FEB	MAR	APR	MAY
CUR. MO.	91.1	87.0				
3 MO.	87.6	87.7				
CY		87.0				
FY	85.3	85.8				

6" ENRICHED

6" BUMPER

	DEC	JAN	FEB	MAR	APR	MAY
CUR. MO.	92.2	92.2				
3 MO.	92.6	92.9				
CY	88.1	92.2				
FY	91.7	91.7				

	DEC	JAN	FEB	MAR	APR	MAY
CUR. MO.	88.6	89.8				
3 MO.	87.2	88.2				
CY		89.8				
FY	84.6	85.5				

FUELS ATTRIBUTE DATA

8"

6"

ENGINEERING OPERATION

January, 1962

VISITORS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
JA Parsons	Union Carbide Oak Ridge, Tennessee	GF Jacky	1-18	Discuss nickel plating.
WF Martin	Tube Reducing Corp. Wallington, N.J.	GW Riedeman	1-10	Coextrusion cladding shell fabrication.
RA Graham	Wah Chang Corp., Albany, Oregon	GW Riedeman	1-12	Fabrication of coextru- sion components.
M Wheeler	Custom Tube Products Los Angeles, Calif.	GW Riedeman	1-12	Fabrication of coextru- sion components.
J Evans	E.I. duPont Savannah River, S.C.	GW Riedeman	1-16	Zr product fabrications.
R Krom	Nuclear Metals Inc. Concord, Mass.	WK Alexander CH Shaw	1-16	Assemble foil wrapped billets.
JE Sperry	Brush Electronics Co. Seattle, Wash.	RL Straley	1-17	Demonstrate an indicator.
J Foss	Bridgeport Brass Co. Seattle, Wash.	GW Riedeman	1-19	Zr-2 N-reactor cladding components.
L Menns C Hoehne	Bridgeport Brass Co. Riverside, Calif.	GW Riedeman	1-19	Zr-2 N-reactor cladding components.
J Dickenson	Linde Company Seattle, Wash.	TR Groupman	1-31	Demonstrate and discuss feasibility of using sigma welding unit.

TRIPS

EJ Corrado	G.E. APED San Jose, Calif.	P Herbert	1-5	Discuss bonding program.
WA Blanton	Savannah River Plant Aiken, S.C.	TC Evans VI Montenyohl	1-15/19	Attend Working Committee of the FEDC meeting.

TRIPS (cont'd.)

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
EA Weakley	E.I. duPont Savannah River Aiken, S.C.	Chittenden	1-8	Uranium technology.
	National Lead of Ohio Cincinnati, Ohio	P McCreery	1-9/10	Uranium technology.
	Mallinckrodt Chem. Works St. Charles, Missouri	NF Neumann	1-11/12	Uranium technology.
GL Waldkoetter	Montek, Inc. Salt Lake City, Utah	KD Bingham	1-15/16	Discuss equipment being fabricated by Montek.
GL Hammons	National Lead of Ohio Cincinnati, Ohio	PN McCreery	1-10	Feed site orientation.
	Mallinckrodt Chem. Works, St. Charles, Missouri	DE Stephens	1-15/16	Feed site orientation.
KW Norwood HF Zuhr	E.I. duPont Aiken, S. C.	JW Croach WP Overback	1-8/9	Consult on fuel and reactor programs.
	National Lead of Ohio Cincinnati, Ohio	JH Noyes	1-10	Consult on fuel and reactor programs.
	G.E., GEL & GERL Schenectady, N.Y.	JL Michaelson WE Tragert	1-11/12	Consult on fuel and reactor programs.

PERSONNEL

<u>Name</u>	<u>Title</u>	<u>Reason</u>	<u>Date</u>
EN Wells	Engineer	Terminated	1-5-62
WL Hampson, Jr.	Engineer	Transferred to Mfg.-FPD	1-1-62
LH McEwen	Manager	Transferred to APED-GE	1-12-62
JD Schaffer	Engineer	Permanently assigned from Tech. Grad. Program	1-15-62
PV Apple	Clerk	Transferred from FEO-Irradiation Processing Dept.	1-15-62

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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 January, 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.

"Ultrasonic Vibration of Liquid Metals," R. E. Rowley
 "A Method for Holding a Cylindrical Object while Turning or Positioning," C. H. Allen

SIGNIFICANT REPORTS ISSUED

HW-72203, "Evaluation of Ultrasonic Rewelding of Projection Fuels," EV Padgett, 1-4-62.
 HW-72239, "Effects of Bond Quality and Dimensional Stability on Side Rupture Resistance of Non-Bumper Fuel Elements," RR Bloomstrand, 1-5-62.
 HW-72322, "A Data System for NPR Fuels," LT Hagie, 1-25-62.
 HW-72431, "Fuel Element Statistics from the Quality Certification Program," LT Hagie & JL Jaech, 1-16-62.
 HW-72392, "ET-6 NPR Cap Thickness Tester Operating Manual," RL Brown, 1-22-62.
 HW-72523, "Welder Monitor Operating Manual," RL Brown, 1-30-62.
 HW-72376, "Alternate End Closure for New Production Reactor Fuel Elements," TB Correy, 1-19-62.

SECURITY

There were no security violations in Engineering during January, 1962.

ALSI PRODUCT ENGINEERINGFuel Performance and Requirements

A total of twelve (12) regular production I&E fuel elements (4 natural and 8 enriched) failed in the reactors during January. A summary of these ruptures is as follows:

<u>Fuel Element Type</u>	<u>Tube and Reactor</u>	<u>Exposure MWD/T</u>	<u>Rupture Classification</u>	<u>Failure Date</u>	<u>Canning Date</u>
Natural Non-Bumper	*2088B	208	Unclassified	1/7/62	9/5/61
Bumper	*2773D	253	Unclassified	1/9/62	8/15/61
Bumper	*2371D	976	Core Split	1/30/62	6/20/61
Non-Bumper	4667KE	254	Hole	1/23/62	12/13/61
Enriched Non-Bumper	3271C	511	Side Hot Spot	1/5/62	9/11/61
Bumper	2580H	746	Hole	1/7/62	8/11/61
Bumper	2576H	738	Hole	1/9/62	8/11/61
Bumper	1968H	890	Hole	1/16/62	5/11/61
Bumper	2669H	881	Hole	1/21/62	7/19/61
Bumper	3174H	829	Hole	1/25/62	7/19/61
Non-Bumper	2779KW	540	Side Hot Spot	1/21/62	11/14/61
Non-Bumper	2571KW	540	Unknown	1/24/62	11/14/61

* Alloyed dingot

The less favorable fuel performance trend this period is significantly influenced by the increased incidence of enriched fuel oriented "hole" failures. Earlier radiometallurgical examinations of ruptures of this type indicated failure was caused by reactor coolant entry through small defects in the fuel element end closures. Additional "hole" ruptures are scheduled to be examined in the Radiometallurgy Laboratory to assure that the rupture mechanism is unchanged.

All of the enriched "hole" failures sustained this period were in the H-Reactor E-N demonstration loading, increasing the total ruptures (1 core split, 1 side other, 11 hole and end, and 1 mechanical damage) in this loading to fourteen (14). In addition, a side other rupture was previously sustained in the enriched fringe of this loading. Based on a preliminary analysis, the number of enriched "hole" and "end" failures in the E-N loading does not vary significantly from the expected ruptures after adjustment for differences in severity of service; further emphasizing the importance of fuel quality improvements to insure fuel will not be limiting under more severe irradiation conditions.

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Although it is too early to predict the effectiveness of a pressurized fuel assembly quench toward minimizing fuel oriented ruptures, two of the "hole" failures in the E-N loading and one in KE Reactor this period were canned after complete conversion to pressurized quenching on August 3, 1961. Inadequate guards on the quenching units to protect operating personnel against the hazards of splashing molten metal and water has necessitated operating this equipment at a reduced pressure (40 psig). Guards being fabricated for installation early in February should permit increasing the applied air pressure to 80 - 90 psig, which should further suppress cap braze closure voids by approximately a factor of 2 based on early development tests. Other process improvements, such as canning cycle optimization, conversion to DC end closure welding, and installation of UT-4 braze closure integrity testers are being expedited to enhance fuel closure quality. Further studies will also be made to determine more precisely the sources of braze porosity in present fuel production and take appropriate corrective measures.

Including the three natural alloyed dingot ruptures (1 core split and 2 unclassified) this month, a total of 19 dingot ruptures have occurred to date under a program to evaluate dingot uranium for unrestricted use. Both of the unclassified ruptures show evidence of transverse and longitudinal splitting of the cores. The dingot rupture sustained in B-Reactor and an incipient rupture from the same charge, having "worm tracks" on the surface, are scheduled to be examined in the Radiometallurgy Laboratory. Examination of the incipient rupture may reveal the failure mechanism, even though rupture examinations have not thus far established the cause of dingot uranium core failures. Examination of the third and fourth dingot transverse core failures, which occurred in F-Reactor during October, 1961, shows no evidence of defects in the end closures that may have permitted coolant entry. Since no unusual fuel cladding corrosion is evident on either the external or internal surfaces, core quality is suspected to be the major contributing factor. Sectioning of the cores shows evidence of both crazing and cracks on the internal surface, which is being further investigated. Chemical composition of the cores is being analyzed.

Under the sequential test design for evaluating non-bumper dingot uranium, seventeen (17) dingot and nine (9) ingot control ruptures have occurred. If two more non-bumper dingot failures occur before incurring additional non-bumper ingot control failures, dingot fuel performance will be two-fold worse than ingot fuel at a 90% confidence level. The natural "hole" failure in KE-Reactor this period was in a mixed lot of dingot and ingot uranium. Identification of the core is pending examination in the Radiometallurgy Laboratory.

The first overbore fuel rupture was experienced on January 16 at an exposure of 631 MWD/T in the C-Reactor test facility. This rupture was an ingot piece, located in the #4 position of a ribless aluminum fringe tube, and was classified as a corrosion failure. Evidently, three of the bridge-sections of the support-rails were damaged during reactor charging, leaving only the 40 mil thick rail tabs to support the fuel element during irradiation. Severe groove corrosion and pitting of the cladding in a hot area on the base end of the fuel element adjacent to a rail with the bridge section missing caused the failure. Fifteen (15) central columns of overbore fuel were discharged this

period at exposures ranging from goal (800 MWD/T) to 950 MWD/T. In addition, three central columns and nine fringe columns were discharged at exposures from 230 - 650 MWD/T to monitor rail damage and fuel element cladding corrosion that may have resulted from inadequate rail strength and/or rail damage associated with reactor hardware and charging problems. A total of 325 overbore fuel elements with rails 72 mils high, 40 mils thick, were sized down to a 65 mil height, and 315 overbore fuel elements with redesigned rails, 65 mils high and 45 mils thick, were provided as replacement for the above charges to minimize charging damage. The later rail design will be used on an interim basis until reactor charging problems are alleviated or until justification develops for further increases in rail strength.

The status of the alternate aluminum cladding component evaluation program remains essentially unchanged. A total of ten non-bumper ruptures have occurred in vendor "H" clad fuel elements and two in vendor "B" clad fuel elements as compared to six non-bumper ruptures in the control material for each vendor.

Uranium Technology

Approximately 310 tons of alloyed dingot uranium are being irradiated in the old reactors and 1088 tons have been discharged at goal. In addition, 104 tons of alloyed dingot are being irradiated in the K Reactors and three tons have been discharged. Three (3) dingot failures, one core split and two unclassified, occurred this month at exposures of 976, 208, and 253 MWD/T, respectively. One unclassified failure was from a dingot lot vacuum outgassed before beta heat treatment. This makes a total of 17 dingot failures and nine control ingot failures to date in non-bumpered elements and one dingot failure and two control ingot failures to date in bumpered elements. About 97 tons of vacuum-outgassed and 37 tons of regular KIVN dingot cores and 14 tons of vacuum-outgassed and 79 tons of regular OIIIN dingot cores were canned this month.

No evidence of a weld closure defect could be found in either the third or fourth dingot transverse core failure by Radiometallurgy examination. A network of cracks was evident on the I.D. surface of the third split failure after the spire and uranium oxide was removed. A similar network of cracks was found on the second split failure examined earlier. In the fourth failure, several transverse cracks were found in the uranium that did not have evidence of water reaction in the cracks and did not appear to be connected with the I. D. or O. D. surfaces. These cracks are currently being examined at higher magnification to try to determine the mechanism of crack formation. A

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re-analysis of the first dingot core failure and an analysis of the second core failure showed an iron content of 150 and 195 ppm, respectively. The average iron content of alloyed dingot uranium is 150 ppm, but dingots containing up to 185 ppm iron are acceptable. The third and fourth core failures are awaiting analysis for iron content.

An upward trend in natural ingot core reactivity has been observed at both the Savannah River Plant and HAPO during the past five to seven months. This upward trend is believed due to a slight contamination of the natural uranium stream with 0.047% enriched uranium. A reactivity test in the 305 Reactor detected a core from a natural ingot that was slightly enriched. The National Lead Company had also detected this unusual ingot and was not planning to use it for production, but the ingot was inadvertently rolled and mixed in the production stream. NLO had measured the U-235 content as 0.723% as compared to a HAPO analysis of 0.82% U-235. Natural uranium contains 0.711% U-235. The wide discrepancy between NLO and HAPO analysis suggests two possibilities; (1) the U-235 isotope is heterogenous within the ingot or (2) there are differences in the measurement techniques used at HAPO and NLO. A re-analysis of the core analyzed at HAPO is being made, and the remaining portion of the core will be returned to NLO to compare analytical results.

Process Development

Irradiation of sixty-two (62) tubes of nickel-plated fuel elements in 105-DR is proceeding, with an estimated exposure of 950 - 1050 MWD/T toward a goal of about 1400 MWD/T. Eighteen (18) tubes were discharged during early January; two for post-irradiation examination, fifteen for tube replacement, and one as a rupture suspect. One tube each of fuel elements with 0.5 mils and 0.2 mils thick plate were visually examined in the 105-DR Basin immediately after discharge. Observations were as follows:

1. The surface crud film appeared to increase in density, going from upstream to downstream. Three or four upstream pieces were characteristically shiny. The more heavily filmed downstream pieces exhibited the same shiny nickel surface in regions where the crud film had sloughed.
2. One "hot spot" occurred in each tube. These were distinguished by the characteristic tear-drop flow pattern, but the normally heavily-scaled area was bare, revealing a shiny and apparently integral nickel coating.
3. Blisters in the nickel were observed on one fuel element from each tube. On a piece having 0.5 mil coating, the blisters were approximately 1/16 - 1/8 inch in diameter and were generally scattered. Blisters on the piece with a 0.2 mil plate were about the same size, but confined to an area about 2 inches long by 1/2 inch wide. No appreciable amount of nickel was detached.

4. Characteristic circumferential hairline cracks were observed on both the 0.2 and the .5 mils thick plate, except in the two "hot spot" areas. No nickel sloughing or aluminum corrosion appeared to result from these cracks.
5. Rib scratches were more prominent on the 0.2 than on the 0.5 mils thick plate. Readily visible aluminum corrosion had taken place in some of these scratches, indicating the nickel had been abraded during charging. The estimated depth of corrosion was < 10 mils.

Following the preliminary examination in the 105 DR-Basin, the fuel elements were exposed to a heavy concentration of decontamination compound in the basin water. Subsequent examination in the C-Basin facility revealed that the "polluted" storage basin water had essentially removed the crud film and caused gross sloughing of the nickel plate, thus precluding obtaining further information on plate integrity. Further examination did reveal that the nickel remained intact in the two "hot spot" areas, supporting the general observation from preceding tests that higher in-reactor surface temperatures are beneficial to the integrity of the plate. This behavior also suggests that increasing the time and/or temperatures of the post-plating heat treatment may further improve plate adherence.

The rupture suspect of nickel-plated pieces from the 105-DR test exhibited about the same features as the pieces described above. Two fuel elements in the upstream 1/3 of the tube appeared to have small (1/16" diameter or less) blisters with the nickel essentially intact. Evidence of a rupture has not yet been found.

Preparation of approximately 700 K-size enriched nickel-plated fuel elements was completed. The surface of these pieces was discolored by a yellow organic stain from the rubber liners used in the autoclave to minimize mechanical damage. This stain is a surface discoloration only, and should not impair the integrity of the fuel elements. Plating of the remaining fuel elements in the 304 facility for a 100-tube test will be resumed in late February or early in March, depending on availability of enriched fuel elements that can be temporarily diverted from production.

A document summarizing the results of fuel element plating experience in the 304 facility is being prepared. The plating of 2000 fuel elements has been generally satisfactory with 11% rejects for poor plate adhesion, and 2% rejects due to handling damage. Plate porosity, as determined by prolonged immersion in hot caustic ranges from 0 - 4 pores/fuel element (approximately 0.3 sq. ft.) for 0.1 - 0.2 mils thick plate. As expected, roughness of the weld beads and possibly lack of cleanliness contributed to a higher incidence of porosity, with one to three pores per weld bead. Nickel thickness control ranged from 0.12 - 0.25 mils. It is believed a 0.1 mil variance in thickness could be achieved with more careful process monitoring.

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HW-72556

Approximately 700 O-size fuel elements were canned in aluminum components plated externally and internally with nickel. Incomplete examination and testing of these pieces shows about 5% assembly rejects, 10% external bond rejects, no internal bond rejects, and satisfactory wetting of the cap and can base. Discontinuities in braze closures range from 15 - 25% based on an arbitrary UT-4 tester standard.

Laboratory development of a corrosion resistant autoclave film included further investigation of the electrochemical effects in 1 wt.% chromic acid solution, and preliminary corrosion testing of a film produced at a relatively high pH of 5 - 9, using a potassium dichromate - sodium hydroxide solution. This process appears to provide corrosion resistance equivalent to a pH/chromic acid solution, does not produce "worm-track" corrosion of the aluminum, and provides a light gray to brown colored film which is amenable to surface inspection.

Alternate Process

HAP0 Hot Press

A production run to produce 300 hot-press fuel elements for irradiation testing was completed January 12, yielding 315 assembled pieces. The fuel elements have been chemically cleaned and welded. Testing and evaluation will be completed in February.

Sylcor Hot Press

Evaluation of the 661 Sylcor hot-press fuel elements received is complete, except for the destructive examination of samples for diffusion, thickness, and continuity of the nickel bond layer. The samples have been prepared and about one week is required to complete the examination.

Hot Die-Sizing

The hydraulic power unit for the die sizing press was received. Assembly of the end bonding press is in progress. Delivery of the preheat furnace is expected about mid-February. Design and procurement of auxiliary tools and equipment are being expedited. Fabrication of dies and die cases for the initial die-sizing tests is about 75% complete.

Fluid Pressure Bonding

Small-scale tests in the Battelle Memorial Institute pressure bonding facility have indicated acceptable bonding of HAP0 fuel elements can be achieved at a pressure of 10,000 psi at 500°C on a 30 minute cycle. A proposal and program document (HW-72417) have been prepared and issued for further process development in the aforementioned facility. This work will include the bonding of approximately 125 HAP0 assembled fuel elements to fully optimize process parameters and prepare fuel elements for a preliminary irradiation test.

Process Technology

Statistically designed tests to optimize the canning cycles for natural and enriched fuel assembly, utilizing cores with and without the benefit of lead plugs during the duplex bath preheat cycle, have been completed and the data analyzed. Use of lead plugs accelerates core preheat and improves both the quality and strength of the internal and external braze layers. This results primarily from the formation of more of the diffused U-Al₃ type compound layer on the core surfaces. Optimum lead preheat time and AlSi braze time in the duplex bath were determined on the basis of bond tensile strength and metallographic examination of the compound layer properties. Increasing the can-sleeve preheat time in the canning bath reduces braze porosity and produces a slight improvement in bond strength. Optimum cycle times derived from the test data were as follows:

<u>Duplex Bath</u>	<u>Cycle Time (Seconds)</u>	
	<u>8-Inch Natural</u>	<u>6-Inch Enriched</u>
Core Preheat (without lead plugs)	30	28
Core Preheat (with lead plugs)	23	25
AlSi Braze	3	3
<u>Canning Bath</u>		
Can-Sleeve Preheat	75	75

The above cycle times were established without benefit of pressurized quench to insure the optimums were based on canning process capability. Since the relative improvement in braze porosity for can-sleeve preheat cycles above 60 seconds was small, the absolute optimum may not be feasible without incurring non-wetting problems similar to those experienced previously during the production evaluation of a 70-second preheat cycle. Further, it is planned to supplement existing test data with UT-4 tester measurements of braze closure porosity before revising process specifications.

The first of five UT-4 braze closure integrity testers has been installed in the AlSi Shop and is expected to be ready for beneficial use early in February. A similar unit has been installed in the Pilot Plant. Beneficial use of this equipment will provide a reliable non-destructive technique to facilitate control and improvement of fuel braze closures, which have contributed to numerous ruptures during irradiation.

Low-ripple direct-current power supplies for the conversion of existing production welders from AC to DC are being tested and two units have been installed in the AlSi Shop. Since the DC welds produced by the low-ripple power supplies have a lower width to penetration ratio, process specifications are being revised to limit minimum weld coverage and penetration. Weld width currently specified will no longer be necessary to insure adequate weld cover on either side of the closure braze. Fifteen (15) fuel assemblies were DC welded for the Atomic Energy of Canada, Ltd., Chalk River Plant, and returned for comparison of weld quality with their standard AC technique.

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HW-72556

Process Development

Newly designed rails for CVIN fuels were fabricated from 0.045 inch X-8001 aluminum stock. The 5 mil thicker rails were welded on CVI fuels and exhibited exceptionally strong weld strengths with an average tensile peel of 66 pounds on the samples pulled. The new rails were designed from thicker stock to alleviate a breakage problem encountered with the thinner rails.

During the month, a total of 3232 pieces were canned in the 306 AlSi Pilot Plant. Of these, 2102 were for reactor use. An additional 230 components were processed in tests evaluating wetting characteristics.

COEXTRUDED PRODUCT ENGINEERINGN-Reactor Fuel DevelopmentKER Loop Testing

The high exposure test consisting of five 23-inch enriched inner tube elements in Loop 2 is operating satisfactorily. Present exposure is approximately 1980 MWD/T with a goal exposure of 3000 MWD/T, estimated to be reached about April 1, 1962.

Five 23-inch enriched inner tube elements, comprising the warp test, are being irradiated in Loop 1. Goal exposure is 1000 MWD/T. Present exposure is approximately 650 MWD/T. Development of a leak in a loop valve during the month required putting this loop on single pass cold water. This change of conditions at least partly destroys the value of this test and the loop will be discharged at the next opportunity. The test will be repeated.

Fuel elements for the "crud" test and the tapered end closure test are ready for charging. It is planned to irradiate the "crud" test in Loop 1 after discharge of the present warp test.

Tentative plans are to shut down Loops 1 and 2 during the spring for minor modifications. About two months will be involved for each loop. The modification involves changes in water pumping. Loops 3 and 4, now being converted to N-fuel size, are expected to be on the line about March 1, 1962.

Fabrication of 54 NPR prototypic assemblies (in 333 Building) for modified loops 3 and 4 is nearly complete. Some delay has been encountered in autoradiographing and in assembling. Initially, it is planned to charge two prototypic fuels in each loop to test loop modifications. Following this initial charge, five prototypic fuels will be charged in each of Loops 3 and 4 to further test the modified loops. After completion of loop testing, it is planned to charge ten prototypic NPR fuel assemblies in each loop for full-scale testing. These will represent the first full size prototypic N-fuel assemblies irradiated to date under test conditions similar to those proposed for the N-reactor.

Coextruded I&E² Program

Three tubes of K-I&E² fuel elements are now being irradiated. Each tube contains 45 K-I&E² fuels. One tube of K-I&E² fuels was discharged in December at an approximate exposure of 1057 MWD/T.

Production Test and Development Fabrication - Pilot Plant

The following schedule indicates the type and amount of work in progress in the pilot plant. With the arrival of adequate supplies of buggy spring supports and locking devices, all material overdue for delivery will be completed and delivered.

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C.P.E. PILOT PLANT WORK SCHEDULE
DATE ISSUED: January 26, 1962

IN PROCESS DATE	PWR NO.	EXTRUSION DATE	TUBE NUMBER	WORK DESCRIPTION	TYPE AND QUANTITY REQUIRED	PROCESS LOCATION	EXPECTED COMPLETION DATE	COMMENTS
	11			Fabricate NPR prototype fuels for N-charging machine tests.	(72) 23-inch assemblies (36) 11-inch assemblies	All complete except for locking devices. Material has been delivered for trial runs and will be returned for attachment of locking devices.	Unknown	Insufficient locking devices available.
	12			Fabricate NPR prototype fuels for high temperature flow tests.	(20) 23-inch assemblies	Support and locking device welding	2/10/62	Support and locking devices not available.
	25			Evaluate cap clad end closure nondestructive tester by incremental machine of cap to locate non-fills.	(15) NIE	Not in process	--	--
	26			Determine presence and location of inclusions in copper billet components.	(50-100) copper billet components	Complete	--	--
	CX14-27			Compare quality of fuels brazed at pilot plant & 333 production plant.	(200) NIE	Complete	--	--
	28			Prepare fuel elements for pressure bond end closure tests.(Pressure bonded offsite).	(12) NOT	Copper Removal	1/30/62	--
	29			Prepare fuel elements for brazing for the evaluation of ultrasonic vibration.		Not in process	--	--

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HW-72556

C.P.E. PILOT PLANT WORK SCHEDULE

DATE ISSUED: January 26, 1962

IN PROCESS DATE	PWR NO.	EXTRUSION DATE	TUBE NUMBER	WORK DESCRIPTION	TYPE AND QUANTITY REQUIRED	PROCESS LOCATION	EXPECTED COMPLETION DATE	COMMENTS
	30			Determine amount of interference fit of NIT supports to meet specifications and eliminate excessive scratching of NOT (I.D.)	(10) NPR assemblies	Not in process	--	--
				Fabricate coextruded Category I (I&E) fuel elements for production reactor testing.	(100)	At autoclave	1/30/62	--
					(150)	At copper removal	1/15/62	--

I&E
Program

C-14

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Materials Development and Procurement

Uranium Billets

Inventory Picture

As outlined in the previous monthly report, the N-outer and the N-inner billet supplies are short because of uranium quality problems at National Lead of Ohio. The HAPO coextrusion schedule has been reduced for the first four months of CY-1962 due to N-reactor schedule delay. The National Lead-Bridgeport Brass combine is scheduled to begin deliveries of N-outer billets in March and N-inner billets in April. These billets will be the first material from the modified Plant 9 facility at National Lead and from Bridgeport Brass Company's re-installed primary extrusion press at Ashtabula, Ohio.

In the interim period, N-inner billets from HAPO inventory and from National Lead's machining of the primary extrusion stock originating from the CY-1961 casting campaign should meet the coextrusion schedule through March. Adequate billet supplies are contingent, however, upon the accuracy of predicted yields after machining.

The N-outer billet supply for February will come from the remainder of the billets from the "old" campaign plus billets produced from the primary extrusion and machining campaign performed at HAPO in December and January. There will be essentially no outer billet inventory at the end of February, and the coextrusion of N-outers during March will require delivery of billets from National Lead-Bridgeport Brass beginning March 1.

The primary extrusion campaign at HAPO was reduced from the 100 ingots reported last month to 60 ingots by intentional postponement of ingot deliveries from National Lead.

In the middle of January, Bridgeport Brass tested their re-installed ingot preheat furnace and extrusion press. Reportedly, both the furnace and the press are operating satisfactorily. A total of 16 uranium ingots were extruded. Machining and inspection of the extrusions have not yet been completed by National Lead.

At the end of January, National Lead began shakedown tests on their new casting facility in Plant 9. The new facility will cast larger ingots than have been produced previously (28 inches vs 22 inches). Each outer ingot will produce three billets vs the two produced previously, and each inner ingot will produce four billets vs the previously produced three billets.

Metal Quality

The temporary waiver on the maximum limit on carbon was extended from the original termination date of January 31 to March 15 in order to gain more information prior to establishing a permanent specification. Specifically, no data are yet available on the chemical analysis of the long ingots made in the new Plant 9 facility.

NLO employed hotter melting cycles in December for producing ingots for primary extrusion at HAPO. The hotter cycles were used in an effort to produce sounder ingots and to reduce the surface pitting problem on machined billets. Insufficient data are available from the extrusion and machining of this material at HAPO to determine if the hotter melting cycles have reduced the pitting problem.

The uranium billet specification is being rewritten in an effort to establish closer controls on both the fabrication process and the final product. A sounder, more reproducible billet should result. The specification will be issued in two parts - one, a requirement enumeration section and, two, a quality control procedure section. All available data developed at National Lead in their hotter melting cycle and Plant 9 startup and during the HAPO primary extrusion development work will be considered in revising the specification.

The structure and properties of the uranium billets are considered to be the major variables effecting the quality of coextrusions. Therefore, tests involving the alloying, heat treatment and hot working of the uranium are either under way or being considered. Presumably, coextrusion quality could be improved if the strength of the uranium could be increased at the temperature of coextrusion. (Currently, the zircaloy-2 cladding strength, or resistance to reduction, is much higher than that of the uranium.) Also, quality should be improved if a finer grained, more heavily worked structure can be produced in the immediate vicinity of the clad interface.

Special Engineering tests are under way in the areas of -

1. evaluating new alloying additions to refine and randomize the grain structure and increase the hot strength.
2. evaluating modified heat treating cycles to better refine the grain structure.
3. increasing the hot working of the metal surfaces in the primary extrusion operation by
 - a. upsetting scarfed ingots in an oversized liner and over an undersized mandrel and removing a minimum of metal from the surfaces during billet machining.
 - b. reducing the primary extrusion temperature.

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HW-72556

Zircaloy Cladding

Currently, there are no apparent technical problems concerning the cladding shells being received from qualified vendors. The fabricating process of one vendor which resulted in inordinately large grain size in some outer tube, outer clad shells has been corrected, and his processing is being watched closely to insure that the trouble does not recur.

A fourth vendor, Wah Chang, is in the process of qualifying as a cladding shell fabricator. Wah Chang has supplied satisfactory outer cladding shells and test samples of inner clads. These sample inner clads (for both outer and inner tube billets) are being evaluated by coextruding, using copper in lieu of the uranium core and zircaloy-2 outer clad. Should these experimental coextrusions prove acceptable, standard billet assemblies will be coextruded with both inner and outer clad fabricated by Wah Chang. Their qualification depends on evaluation of the resulting fuel tubes.

Zircaloy Supports

Fuel supports continue to be a problem but of decreasing magnitude.

Outer tube supports, as reported last month, were presumed to be in production. However, the first 6000 pieces proved defective, because of defective strip. Many of the supports were cracked in the bends and projections. A second quantity, about 3000, have been fabricated from satisfactory strip and appear sound. These have been shipped and are due immediately.

Locking clips have had a few minor last minute modifications and are in production. The vendor has 100% inspected about 4000 and these appear to be sound. A shipment of about 2000 parts will be received next week.

Inner tube supports are in production, but no reliable inspection data is available yet. The fabrication of these parts continues to be very difficult, and part quality so far has been variable. Because of the delays in delivering usable quantities of these supports, some elements of appearance have been sacrificed in order to get some mechanically acceptable parts shipped. The vendor is also inspecting these parts 100% for cracks and other metal failures. The first production lot of 1000 pieces should be shipped next week.

Copper Sleeves

Few concrete copper sleeve problems exist today. To evaluate several copper and copper alloys as billet cladding materials, test quantities have been ordered in all sleeve sizes. These are:

1. Type OF Copper - electrolytic copper, produced free of oxygen with no residual deoxidants.

2. Type DHP Copper - electrolytic copper, phosphorus deoxidized, high residual phosphorus (about 0.04%).
3. Type DLP Copper - electrolytic copper, phosphorus deoxidized, low residual phosphorus (about 0.01%).
4. Silicon Copper - standard 3% silicon alloy now in use.
Alloy A
5. Silicon Copper - 1.5% silicon alloy.
Alloy B

Three per cent silicon copper alloys were adopted as standard several months ago to facilitate billet assembly as pure coppers generally do not weld well, and weld failures were exacting a high toll in bond rejects. Subsequent experience has shown that the 3% silicon alloy, though welding well, may not hold extrusion lubricants as well as lower silicon alloys. One test extrusion using a 1.5% silicon alloy appeared to hold the lubricant much better.

Recent improvements in billet welding techniques have shown that pure coppers may indeed be satisfactorily welded. The three copper grades listed represent the three commercially available grades that are applicable to the process needs.

The five varieties of can material will provide a ready source of supply for development experiments leading to the optimum billet cladding process.

Billet Assembly - Copper Can Welding

Nine NIE's were welded as directed in Process Work Request CX-13. The billets contained OF copper jackets and 3% silicon copper end plates. The 1/2-inch thick front end plates were replaced by 1/4-inch thick plates. To gain additional data, the end plates were not machined except for a two degree taper on the I.D. and the O.D. The peel and bond tests were all good. Taking into consideration previous tests performed using 1/4-inch thick front and rear end plates that were not machined, i.e. heat sink grooves and chamfers, and the results of the aforementioned nine, it becomes very apparent that the ideal combination of materials for satisfactory weld integrity would be 1/4-inch 3% silicon copper end plates to either DHP, DLP or OF copper jackets.

The evacuation tube crimping machine is now in operation and the results are highly satisfactory. A close surveillance has been kept on evacuation tubes sealed by the old method, i.e. T.I.G. hand torch, and a large number of tubes showing possible flaws have shown poor bonds extending further into the extruded element. A reduction of front end defects is foreseen now that the hydraulic crimper is in use.

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The following Engineering extrusions were made during the month:

11-inch Tooling

18 NOE primary extrusions - PU-29 through 46
(This material is the start of new campaign castings).

7.5-inch Tooling

7 Coextrusion Billets - ZT 4, 5, 6, 9 & 10; UT 6 & 7

ZT 9 & 10 - NOE with zircaloy foil components
UT 6 & 7 - NOE with single beta heat treated U billets
ZT 4, 5 & 6 - NIE to test zircaloy components

6.0-inch Tooling

7 Coextrusion Billets - ZT 7 & 8; T-313 through T-317

ZT 7 & 8 - NIE with zircaloy foil components
T-313-316 - I&E (standard)
T-317 - NIE (standard)

1 copper billet for NIE copper ring preshapes

Primary Extrusions

The schedule for extruding primary ingots has been set back two weeks due to slight uranium oxide contamination spread in the 333 Building. This problem was created due to lack of storage space for primary extrusions prior to machining, thus the schedule was set back to allow the machine shops to reduce backlog.

To date, 42 extrusions have been made and 18 additional ingots are on-site. These 18 will be extruded during the week of 1/29/62. Machining of these extrusions has been progressing very well, and of the 42 ingots extruded, 26 have been fully machined with a resultant 28 full-size billets.

The first 24 ingots extruded were from old campaign castings that had been scalped to minimize pitting in the finished billets. The billets produced from those extrusions have shown only slight amounts of pitting and, to date, only two billets have been rejected for this cause. Two primaries from new campaign castings have been machined and no pitting was evident on the finished billets.

NOE Inner Clad Thickness Variation

The reject rate for outer tube-inner clad variation (exceeding ± 0.004 inches) is approximately 40% of the production material tested. The degree of variation from Specification is about .004 inches 75% of the time. In other words, the reject rate would be reduced to 10% of the material tested if the allowable variation was ± 0.006 inches. It is also of interest that most of this variation is toward thickness. The number of rejects for thin clad is quite low.

To date, it has not been possible to correlate clad variation with "A" or "B" billets, clad vendors, or extrusion conditions. The cause for this variation is believed to be the low work history of the inner bore of the outer tube billet.

The approach to this problem to date has been to (1) single beta heat treat two NOE billets which have been extruded and will be evaluated for clad thickness variation and (2) attempt to put more work in the billet I.D. during primary extrusion.

Additional work can be introduced in the billet I.D. by many methods, however, the evaluation of these methods or theories can only be made by performing tests. An attempt has been made to evaluate some of these methods on the primary extrusions made on site. The tests to date include: (1) upsetting oversize I.D.'s, and (2) chilling of the I.D. prior to extrusion with copper chill blocks or cold mandrels.

The results of these tests are not complete, but most of the data should be available by 2/26/62.

NOE Wall Thickness Variation

The reject rate on NOE wall thickness variation has varied from 11% to 4.5% during the past four months. The extrusion variables believed to be most important in minimizing wall thickness variance with existing tool designs and lubrication techniques are:

1. speed,
2. graphite cutoff temperature,
3. tooling temperatures, and
4. mandrel techniques (free or traveling).

Material was extruded with various changes in these variables and an optimum process has been specified for the outer tube. This process differs from the existing in that the ram speed was reduced to 14 inches per minute and the graphite cutoff temperature was raised to 1170°F (631°C).

The degree of variation from specification (20 mil range) is reasonably small. The actual variation of reject material has not exceeded 26 mils, except in isolated cases.

Warp Studies

Heat treated warp data are available for all coextrusions through NIE-1117. These coextrusions were made for the purpose of comparing coextrusion process variables vs the warp that occurs during heat treating. The coextrusion process variables of main concern are:

1. Copper Components: DHP copper vs Everdur A (Cu:3 W/o Si)
2. Billet Temperature: 1170, 1155, 1140 and 1100°F (632, 624, 616 & 593°C)
3. Liner Temperature: 800 and 600°F (427 and 316°C)
4. Ram Speed: 14 and 10 ipm
5. Graphite Cutoff Temperature: 800 and 1140°F (427 and 616°C)

To date, the warp data have been correlated with the process variables from the consideration of yield of good pieces. This correlation is shown in the following table.

TABLE 1

Group	Tube No.	Coextrusion Variables	% of Fuels With Heat Treated Warp		
			<30 Mils (Good)	>30 < 75 Mils (Recoverable)	>75 Mils (Reject)
1	1016-1025	CuSi-1170°F	20.6	19.6	59.8
2	1026-1027	" "	16.7	47.6	35.7
	1031-1033	" "	"	"	"
3	1028-1030	CuSi-1155°F	33.3	45.7	21.0
	1034-1043	" "	"	"	"
4	1044-1047	CuSi-1140°F	31.3	45.8	22.9
5	1048-1063	Cu -1140°F	72.3	21.4	6.3
6	1064-1069	CuSi-1140-600°F	71.4	26.4	2.2
7	1070-1075	CuSi-1140°F	62.3	28.6	9.1
8	1076-1084	CuSi-1140°F- 10 ipm	82.2	17.8	0
9	1085-1094	CuSi-1100°F	53.7	43.0	3.3
10	1095-1103	CuSi-1140°F 10 ipm	69.8	30.2	0
11	1104-1113	CuSi-1140°/Gr	42.6	48.8	8.5
12	1114-1117	CuSi-1140°F	50.0	37.5	12.5

One generally concludes from the data that the warp problem is much reduced by the use of the combination of CuSi cans: 1140°F billets: 10 ipm ram speed. However, there is wide variation (Group 8 vs 10) in yield with this combination.

An earlier conclusion, that DHP copper is better than Everdur A as a can material (Group 5 vs 4), is not as apparent with later data (Group 5 vs 4, 7, 12).

The yield data through Group 7 has been examined and shows that B and C billets were much more prone to large heat treated warp than are A billets. This correlation is no longer as sound when data from Group 8 through 12 are considered.

It would be surprising if the yield data were to correlate exactly with the coextrusion variables. The yield value of 30 mils and 75 mils are arbitrary values. Precise values that are currently being compared with the process variables are: (1) as-received warp, (2) the change in warp (i.e. V_1) that occurs when fuels are beta heat treated.

When V_1 data (as-received warp) are related to the coextrusion variables, two coextrusion methods are shown to be equal:

1. CuSi - 1140°F billet - 600°F - 14 ipm
2. CuSi - 1140°F billet - 800°F - 10 ipm.

The superiority of A billets vs B and C billets is not apparent using V_1 as criterion of a quality coextruded product. The interaction of billet type vs coextrusion variables remains to be determined. Also, the needs for wall thickness and clad thickness control have not been determined in these analyses. The dimensional data should be given more weighting than V_1 when final choices of process variables are made. The cross-section cannot be remedied if it is lacking; warp pieces, however, can be straightened and recovered.

The dependence and interaction of billet type and can material will be determined from the experiment described in the section of this report under coextrusion (tubes 1118-1147).

Heat Treating Development

Fundamental Studies

A significant advance can be reported on the vector analysis work on warp of N-fuel pieces. Earlier reports have speculated that:

1. warp occurs during the heating part of the thermal cycle of beta heat treating.
2. the driving force of warp is an unbalanced axial preferred orientation (fiber texture), $V_{p.O.}$
3. bimetallic warp (interaction of uranium:clad) is reversible during the thermal cycle of beta heat treating (i.e. the magnitude of warp during heating will be reversed during cooling; $V_{U:ZR}$ and $-V_{U:ZR}$).

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HW-72556

V_{DH} is defined as the sum of $V_{P.O.}$ plus $V_{U:ZR}$ and V_{IC} is defined as $-V_{U:ZR}$. Addition of V_{DH} and V_{IC} (measured quantities) gives $V_{P.O.}$ (calculated) over 280°C . If any significance is to be attached to the calculated value of $V_{P.O.}$, it follows that the magnitude of $V_{P.O.}$ should be proportional to the magnitude of V_1 which is determined over 640°C . This leads to a statement that -

1. $|V_1| = 2.3/V_{P.O.}$, Or,

2. $Z \equiv 2.3/V_{P.O.} - |V_1| \equiv 0$

The average value of Z for the individual tubes 1016 through 1025 is zero. The overall average value of Z for these tubes is zero. There is no difference in value of Z between these tubes.

Thus, the magnitude of the change in warp during beta heat treating can be predicted from changes in warp on heating an as-coextruded piece before heat treating and cooling that same piece after heat treating. Ultimately, the goal is to predict the change in warp from the heating data obtained prior to beta heat treating.

Chemical Processing

Chemical Milling of Reworked Fuel Elements

Recent experience in the reworking of reject fuel elements in the 333 facility presented a problem in chemical attack of the welded end in the chemical milling solution. Although chemical attack is not sufficient to remove any part of the weld bead, it does leave an adherent corrosion product which is not removed in subsequent etching. Since all fuels reworked through chemical milling and brazing must be heat treated again, the problem is not serious, as abrasive blasting removes this residue. Caps from these fuels have been sectioned and polished to be examined for any surface penetration which may have occurred but which may not be visible in subsequent finishing operations. Further test will be conducted if this proves to be the case.

Brazed End Closure

Braze Development and Procurement

Negotiation of DDR-137 with General Atomics Corporation of Yonkers, New York has been completed and work has been started. The object of this contract is to develop methods to fabricate the braze rings for use in NPR fuel closures by powder metallurgy techniques. They will continue the work they started earlier under their own sponsorship.

An order has been placed with Nuclear Metals Institute for 300 each, NOT and NIT, braze rings to be made by their proposed pressed chip method. These will be used in the coextrusion shop on a Process Work Request basis to evaluate the production capabilities of this material. The brazes produced from these rings should be no different than the ones machined from cast rings. However, they may act a little differently in production and could possibly have some effect on yield.

Investigation of Cap-Core Bond Cracking

It became apparent, as the result of testing before and after welding, that occasionally a cap-core bond would be broken by the welding operation. It is not obvious why welding should cause this cracking when beta heat treatment does not. There have been other indications that the cap-core bond on inner pieces in the production plant are not as strong as those produced in the 306 Building Pilot Plant. Examination of cracked pieces indicated that cracking was associated with a lack of intermetallic compound formation between the braze alloy and the uranium. A properly brazed piece should have essentially 100% intermetallic compound layer formation.

An intensive investigation is under way to further evaluate the parameters which prevent or enhance the formation of this layer. Tentative indications are that uranium surface roughness and temperature during the brazing cycle are very important.

It has also been demonstrated that the existence of an intermetallic compound layer is necessary to guarantee maximum strength bonds.

Gas Pressure Bonded End Closure

The fifth test lot of gas pressure bonded end closures, the first to which copper was added to induce a bond between the zircaloy-2 cladding and the zircaloy-2 closure ring, has been examined metallographically. Bonding parameters were 650°C (1202°F), 10,000 PSI for one hour at temperature. The bonds were not complete as the quality of the electroplated copper left a lot to be desired. Before sectioning, closure welds were made on both the outer and inner bonds. The following information was gained from the examination:

1. One section disclosed a complete bond between the closure ring, cladding and uranium that was free of voids indicating that it is physically possible to produce the required continuous bond below the alpha-beta transformation temperature of uranium. In addition, the primary T.I.G. fusion closure welds had adequate penetration.
2. The addition of clean pure copper in the zircaloy-2 to zircaloy-2 interface will induce diffusion, forming grains across the interface.
3. A film of copper thick enough to fill extrusion striations will diffuse in one hour until there is no copper visible and grains form across the interface.
4. Very thin films of copper will diffuse and form grains across the interface until the location of the interface can be found only with polarized light.
5. Both closure welded and as-bonded closure rings were removed, made free of uranium and autoclaved in 400°C steam for 72 hours. There was a very slight silver-gray formation at the weld closure ring interface in regions that were obviously high in copper. The bond joints showed a similar indication. Continued autoclaving is in progress.

DECLASSIFIED

HW-72556

Techniques or methods must be developed for applying a thin film of copper to the cylindrical surfaces of the end cap. Two possible methods now being studied are vapor deposition, and surface deposition by gaseous decomposition of copper acetyl acetate. Offsite development of these two processes is being pursued.

Autoclave

Contamination of Fuels In An Autoclave Failure

Three groups of coextruded I&E fuel elements were submitted to Testing Methods for measurement of surface uranium contamination by the alpha detector.

Group A consisted of 10 fuel elements which had been part of a loading in which a failure occurred. These were cleaned in water and nitric acid prior to testing. Group B consisted of 10 autoclaved fuels in which no failure occurred, and Group C consisted of 10 unautoclaved fuels. Surface contamination was indicated on one of Group A and one of Group C. The element from Group A was washed with water, dried and retested and no contamination was detected. The element from Group C was cleaned with nitric acid, retested and gave no indication of contamination.

Although this represents the first application of this tester to prototypic fuel elements, the fact that ordinary cleaning method was adequate for decontamination is encouraging. Additional tests are planned to evaluate decontamination requirements for autoclave rupture fuels having different degrees of oxide layer when exposed to the uranium contamination.

TESTING METHODS ENGINEERING

N Fuel Testing

Performance of the external bond testers has been improved through the use of fifteen megacycle Lithium Sulphate transducers rather than the twenty-five megacycle Quartz transducers previously used. The new transducers generate a wedge shaped beam, with a three-eighths inch focal length, oriented so as to intercept the fuel element surface along a line parallel with the longitudinal axis of the elements. The rectangular piezoelectric elements measure three-sixteenths by three thirty-seconds of an inch.

Evaluation studies have shown the new transducer capable of resolving known unbond defects, (made by leaving one millimeter square patches of oxide on a fuel core and then pressure bonding it in a zirconium sleeve) which have not been detectable with other equipment. Steps have been initiated to evaluate similar transducers for the internal bond test.

Recent difficulties with the cladding thickness test were corrected with the installation of new eddy current coils in the test probes. Other discrepancies, however, appear to be creeping into the internal cladding thickness test data. These are believed to be a result of misalignment due to wear of the internal probes and should be corrected with probe design modifications now being made.

The incidence of cap-clad closure defects continues to be unexpectedly low. As defects in the cap-core braze are very infrequent, special emphasis is being made to ensure that this test is operated with adequate sensitivity.

No solution has been found to the problem of nondestructively segregating weak cap-to-core bonds. Laboratory attempts are being made to differentiate weak bonds by super-imposing on the high frequency ultrasonic beam normally used, an intense, low frequency acoustic wave. It is hoped that the bond interface stresses created by the low frequency waves will cause weak bond distortions of sufficient amplitude to produce measurable effects on the high frequency wave.

Ultrasonic inspection of outer zirconium components have shown the technique capable of detecting large grain size variations. As special extrusions have demonstrated the adverse effects that large zirconium grains may produce, adaption of this test as a regular inspection step is being pursued. Data is now being obtained to demonstrate that the test is also valid for inner tube geometries.

Surface Contamination Inspection

For the first time actual uranium surface contamination has been detected on extruded fuel. Four elements in one group of thirty coextruded I&E fuel were found with uranium surface contamination. Roughly twenty micrograms of uranium were detected on two which had been in an autoclave test in which a fuel element had ruptured; approximately forty micrograms were found on the remaining two

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HW-72556

which had not been autoclaved. In each case the contamination was easily removed by cleaning.

Improved light pipes are presently being installed in the equipment. Upon completion of this work it will be installed in the 333 facility.

UT-4 Project

The second production model UT-4 station has been delivered to the 313 facility. This unit, along with the first unit delivered, will be put in service as soon as installation is complete. Two additional stations are scheduled for delivery during the first week in February. The prototype unit, which was delivered to the pilot plant facility early in the month, has been operational for about two weeks.

No significant operating difficulties have as yet been encountered. The internal probe continues to be a potential trouble spot, however, as several internal transducers have failed after limited use. Recent improvements in transducer fabricating techniques appear to have corrected the problem.

Preparation of preliminary UT-4 maintenance and operating instructions has been initiated and will be ready for use at the time the equipment is phased into production line use. Familiarization classes have been conducted for instrument men and engineers.

Remote Fuel Inspection Development

A series of bond mapping studies were made on twenty over-bore fuel elements (before attachment of self-support rails) which will be again bond tested after reactor irradiation. These tests showed that the length of the water path between transducer and fuel element surface influences the information plotted on the maps. Optimum results were obtained with a fifteen megacycle, three-fourths inch diameter Lithium Sulphate transducer with a two-inch water path. This experimental arrangement will be duplicated for the post-irradiation measurements.

Laboratory attempts to develop ultrasonic methods of measuring the zirconium clad thickness of N fuels have received encouraging results. Using exceptionally fast rise-time circuitry, echo pulses arising from the zirconium-uranium interface have been isolated on samples on which the 0.020 inch thick clad is known to be well-bonded to the uranium. After these weak signals are successfully amplified to usable amplitudes, further development work will be aimed at producing readout systems capable of measuring and reading out the extremely short time variations which the echo signal undergoes with small cladding thickness variations.

Beneficial use of the 105 KE nondestructive testing equipment is placed at June, 1962. Equipment orders have been issued; fabrication of the mechanical and electronic portions of the equipment will commence the latter part of February.

Preferred Orientation Studies

Ultrasonic velocity measurements in extruded uranium are continuing. Tests have confirmed that beta heat treatment increases the ultrasonic velocity of propagation

by about three percent. A recent test of five supposedly as-extruded samples revealed two which were characteristic of beta uranium. X-ray diffractions and metallographic studies suggest that these particular samples had, in fact, been beta heat treated.

Further investigations are being made to determine whether this principle can be reliably applied as a nondestructive method of assuring beta transformation of N fuel.

Hydride Detection in Zirconium

Continuing attempts to correlate the absorption of twenty to sixty megacycle ultrasonic waves with zirconium hydriding have been unsuccessful. More encouraging results are being obtained, however, with internal friction measurements at much lower frequencies. With this principle the mechanical "Q" of the metal is measured by forcing it into oscillation at frequencies near its natural modes. After removal of the driving force, (which is around one megacycle for N process tubes) the logarithmic decay of the oscillations is observed. A section of tube containing a patch of hydrided metal at 5000 ppm hydrogen is found to exhibit a logarithmic decay roughly twice that of normal zirconium. That is, energy decays in the hydrided metal at roughly twice the rate that it does in normal metal. The same effect is observed in coupon samples containing 50 and 500 ppm hydrogen.

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ADVANCE FUEL ENGINEERING**DECLASSIFIED**Quality Certification Program Report

As part of the Quality Certification Program, the dimensional instability and warp characteristics of regular production fuel has been studied. The items of interest contained in HW-72322, "Fuel Element Statistics from the Quality Certification Program," by L. T. Hagie, et al, dated January 16, 1962, are as follows:

1. Fuel quality, as measured by these statistics, is highly variable with time.
2. A rank correlation coefficient of .80 has been determined between warp and percent hot-spots on normal production fuel.
3. Since May 1960 a dramatic but unexplained reduction in warp has been observed.
4. Post-irradiation ΔOD_2 is about four mils larger on the average than ΔOD_1 and ΔOD_3 . Thus, fuel elements tend to swell in the middle causing a barrel shaped profile.
5. A decrease in total porosity as measured by total bond count has been observed over the period.

NPR Data Collection System

Believing an integrated data collection for NPR fuels is one of the most urgently needed programs before FPD at the present time, a special study was undertaken to define the type and scope of such a system. A punched card system with sufficient capacity to expand or contract with the needs of the business appeared to be the solution. The details are reported in HW-72431, "A Data System for NPR Fuels," by L. T. Hagie, January 25, 1962.

In using IBM forms in the 333 and 313 Buildings, operator cooperation is required to achieve the best accuracy. General educational meetings utilizing visual aids were held with operation and inspection personnel for this purpose.

Billet Grain Size Characterization

At the request of Quality Control, an analytical method for characterizing traces from the billet ultrasonic grain size tester was developed. This system permits the numerical comparison of various billets with respect to average, variability, and degree of grain size coarseness occurring on one end. This system is described in a letter to A. C. Barkoff from L. T. Hagie, dated January 11, 1962.

Chemical Composition of N-Billets

Frequency distributions of 19 chemical elements in over 1500 NPR billets were prepared and reported in a letter dated January 22, 1962 from L. T. Hagie and G. L. Hammons to F. W. Knight. In addition, all inspection information received from NLO in card form is summarized.

Unfortunately, due to the process changes which occurred during the fabrication of these ingots, the distributions may not be indicative of current production.

Acting Manager, Engineering

JT Stringer:msw

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HW-72556

FINANCIAL OPERATION

JANUARY, 1962

Preparation of the FY 1964 and revision of the FY 1963 budget is in process. The budget is scheduled for completion by March 15, 1962.

Several additional case studies of NPR fuel cost were prepared, outlining cost estimates for different reactor startup dates. The results of the studies, together with personnel and production estimates provided by the Manufacturing Section, were reviewed in exploring possible Department operating plans.

Several significant modifications were effected in reporting techniques. Use of both equivalent production unit costs calculation and incremental projection costing is scheduled for January reporting. A revised format for the production cost report was developed and will be used in reporting January Department unit cost performance. Arrangements have been made to provide detail information to Coextrusion Process management concerning the cost of essential material in which a defect turns up after starting through process (but before extrusion). The material consists for the most part of copper elements.

Unitization of Project CAF 847, New Fuel Cladding Facility, 333 Building, has been started. The facilities, completed last month, are to be booked to Coextrusion Production accounts established for this purpose. Depreciation accruals of about \$30,000 were made during January. Final costs will be transferred to the Plant & Equipment in Service accounts as soon as the figures become available.

Projects CAF 894, Increased Compressed Air Capacity and CAF 915, Increased Storage Space - 303 Area are also being unitized. The work is essentially complete and a draft of the unitization is being prepared.

The final report on the physical inventory of uninstalled property has been issued. Four items valued at \$741 will be written off and 47 items valued at \$30,951 (reserve of \$10,065) will be picked up on a non-fund adjustment. The 47 items picked up resulted primarily from capitalization of prototype equipment.

Several Special Equipment Budgets for FY 1964 and Revision of FY 1963 have been prepared for submittal to the controlling components. These include the Automotive and Heavy Mobile Equipment, Photographic Equipment, Radio and Audio-Visual Equipment and Office Equipment. The Automatic Data Processing Equipment, Equipment Not Included in Construction Projects and Plant Acquisition and Construction Budgets are currently being prepared and will be submitted as required.

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HW-72556

Travel costs for January amounted to \$4,000 covering eight business trips and movement of one employee. A summary of these costs and associated days in travel status is shown below:

	<u>Amount</u>	<u>Days T/S</u>
Regular Business	\$2 550	36
Transfer of Personnel	384	22
Interim Living	198	15
Movement of Personal Effects	568	
Insurance on Prior Moves	<u>302</u>	<u> </u>
	<u>\$4 002</u>	<u>73</u>

While there were no expenditures for professional and trade society meetings or offsite courses, there are commitments of \$390 and \$240 respectively for trips in these categories.

A summary was prepared for Department Management covering various aspects of benefit plans and other useful information in the preparation of employees' personal income tax returns.

Six suggestions were approved and three cost improvement proposals accepted during January with savings of \$1,093 and \$51,880 respectively. The total of these \$52,973, is 6% of the \$900,000 CY 1962 cost improvement goal. Two cost improvement proposals with estimated savings of \$11,619 are under evaluation.

As a part of the cost improvement promotional program, signs reading "Waste is Costly" have been painted on all 300 Area load lugger trash containers. This promotional effort will be publicized in an early edition of the Works News.

Computation of the January production forecast in parallel by EDP and manual means has revealed certain programming deficiencies, which resulted in forecast overproduction of certain models. These deficiencies are relatively minor and are being corrected.

HOO-AEC will commence an appraisal of the HAPO records management program on February 13, 1962. FPD records will be reviewed February 28, 1962.

No reports of unusual significance were issued during the month.

The Financial Section had no security violations during January.

Manager - Finance

WS Roe:mh

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PLANT FACILITIES OPERATIONJANUARY 1962I. RESPONSIBILITY CHANGES

None.

II. ACHIEVEMENTSA. Statistics1. Utilities

	<u>Jan.</u>	<u>Dec.</u>
Average steam generated (M lbs/hr)	111	104
Maximum steam generated (M lbs/hr)	168	156
Total steam generated (M lbs)	82,785	77,146
Coal consumed (tons)	4,044.15	3,717.84
Evaporation rate (steam/#coal)	10.23	10.37
Efficiency - Actual	69.2	65.8
Efficiency - Theoretical	76.4	74.3
No. of Boilers on: 3 2 3 4 3 2 3		
Date of Change : 7 8 18 25 26 28		
Sanitary water from 3000 Area (M Gals.)	171.36	153.39
Total water from 3000 Area (Avg. Rate GPM)	3,839	3,436
Total water from #3 & #4 wells (M Gals.)	12.40	12.37
Total water from #2 well (M Gals.)	.30	.30
Peak water consumption for 24 hours (M Gals.)	6.1	5.5

The maximum steam load of 168,000 lbs/hr is the highest ever experienced in the 300 Area. This load was 88 per cent of the rated capacity of the boilers and would have been 53 per cent over the rated capacity of the 300 Area powerhouse if the No. 6 Boiler were not available for service.

B. Operating Experience

No great difficulty was experienced in meeting the heavy demand for steam during the peak period with the steam pressures at the outlying buildings dropping as expected. During the high load period the emergency turbo-generator was operated to gather data on the unit and steam pressure at various points of the distribution system. Generator loadings up to 800 KW were achieved without difficulty but the last increment to 900 KW was hard to achieve due to

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reduced steam pressure at the turbine throttle. During this same period the west export steam flow meter exceeded its full scale range of 75,000 lbs/hr. This could have been relieved but, in so doing, the north export steam flow meter would have exceeded its range by a far greater amount. A 60,000 lb/hr orifice plate to increase the range of that meter is on hand but its installation requires a complete steam outage of the autoclaves in both the 333 and 313 Buildings as there is no shut-off valve located downstream. The routing of the 306-306A Building steam supply through the north export line would also reduce the steam drum pressure on the No. 6 Boiler at high load conditions. The only apparent disadvantage would be that filming amine would not be fed to 306-306A for short periods of time during peak periods, unless injection stations were provided.

The ash sluice transport line became plugged on January 1, 1962 and was finally cleared by alternate surging of line with compressed air and water. The specific cause of the trouble is not known.

Only Washington Coal was available during one week-end of operation and again demonstrated its generally unsatisfactory characteristics as well as the sub-standard ventilation of the ash sluicing areas. A study of this problem will be made in order that corrective action can be taken.

During graveyard shift on January 25, the powerhouse feed water pressure dropped off due to the inability of the motor driven boiler feed pump to deliver sufficient volume and pressure. The second turbine-driven pump was immediately put into service to supplement the first but the water level in the No. 6 Boiler was so low that the fire was killed in this boiler to prevent possible damage. The load was picked up on Numbers 4 and 5 Boilers and the steam header pressure within the powerhouse remained normal. After feed water pressure was restored and normal water level returned to No. 6 Boiler, firing of this unit was resumed. Although there has been no positive cause established for the incident, preliminary investigation indicates that there exists a marginal condition in respect to pump suction pressure. Low deaerator elevation above the pump and possible pressure drop in suction piping caused the hot feed water to flash to steam in the pumps.

An electrical outage occurred in the 325 Building when electrical maintenance were wiring a new circuit under "hot" conditions. Service was restored to normal within 13 minutes and no apparent

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damage resulted. Procedures for this type of work are being reviewed and will be complied with to prevent a recurrence of such an incident in the future. The primary cause of the entire building outage was failure of the sub-feeder breaker to function properly.

Revision and cleaning of the north process pond is scheduled to be complete February 2. Work was held up for a week during the extreme cold weather experienced about the middle of January. The south pond is filling rapidly. The north leaching trench from the sanitary septic tanks is also filling and flow will be diverted to the south trench.

The bearings on the cinder return fan of the No. 6 Boiler were changed out January 4 by operating this unit at reduced load. The heat slinger fan was also reinstalled in its proper position.

A total of 1,335 radiation detection instruments were repaired in the Portable Shop during January. This is a new high for the shop.

During periods of high winds, difficulty is experienced in maintaining proper zone air pressure differential on the first floor of the Plutonium Fabrication Pilot Plant. This building is not equipped with automatic zone pressure control.

Quarter inch Polyvinyl Chloride closed-cell sponge is being used as gasket material with stainless steel ductwork flanges. This material has the advantages of greater corrosion resistance, greater compressibility characteristics, and is considerably cheaper than neoprene.

C. Equipment Experience

A supply unit circuit breaker failed in the 329 Building during change of equipment sequence. The breaker contact points had fused together.

The acid mixing tank at the 384 Building has been leaking. Plant Engineering is investigating the acquisition of a new tank with better durability.

The use of a sonic whistle to break up the foaming action in Redox concentrators is being tested in the 321 Building. A special piping assembly and boom were fabricated for the test. The operator will be required to wear ear plugs and ear muffs.

Considerable unexplained equipment failures in Building 3705 required a complete inspection of transformers, service panels, neutral and ground circuits. The cause of the failures is still undetermined.

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 January, 1962.

E. Cost and Savings

Two Cost Improvement items totalling \$11,180 and suggestions of \$244 were approved to start the Section well on its way toward the CY-1962 goal of \$115,000. This total represents about 10 per cent of the goal.

F. Status of Projects and Major Jobs

Replacement of Breeching Damper and Draft Gages - Field progress is approximately 98 per cent complete with recalibration and scale changeout scheduled during February.

Modification of No. 1 I.D. Fan - Original scope of work is complete with additional work continuing on an installed emergency back-up oil pump.

384 Building Maintenance Shop - Installation of equipment by maintenance personnel is under way.

Monumenting Burial Grounds, 300 Area - The bid package will be available to contractors February 2, 1962.

Air Dryer Installation, 384 Building - Purchase Orders have been placed for all equipment with delivery scheduled for March 1, 1962.

Modification of No. 6 Sanitary Water Pump - Work is proceeding on the new support bases for the engine driver for No. 6 pump.

Auxiliary Instrument Panel, 384 Building - Design is 60 per cent complete with completion scheduled for March 15, 1962. Purchase Orders have been placed for all equipment.

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New Water Distillation Facility, 3706 Building - Equipment expected in January is now scheduled to arrive on site February 6, 1962. Further investigation indicated the need for a demineralizing system to be installed ahead of the water still. Additional funds were approved and procurement is under way.

Refrigerated Air Conditioning, 3717-B Building - Design is 50 per cent complete with the placing of Purchase Orders scheduled early in February.

Major Studies

Work Sampling, CY-1962 - Work was started January 4 and is expected to continue into February. Acceptance in the field has been good.

300 Area Emergency Power - Engineering study indicates justification for the purchase of a new 1500 KVA diesel generator to be added to the emergency power system.

300 Area Master Plan Project - The rough draft of this report has been issued for review and comments. The final draft will be issued as soon as these are received for incorporation in the report.

G. Significant Reports Issued

Proposed expansion of Standards Service.

Preliminary Report, FPD Facility Master Plan, 300 Area.

III. PERSONNEL

A. Safety, Security and Radiation Experience

Medical Treatment Injuries	28
Frequency Rate	6.41
Disabling Injuries	0
Serious Accidents	0
Security Violations	0
Radiation Incidents	0

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HW-72556

III. PERSONNEL

B. Meetings

Round Table-Staff	21
Safety and Security	20
Information	7

Manager
Plant Facilities Operation

E. Hilgeman:RTM:mkm

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