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UNION CARBIDE CORPORATION
for the
U.S. ATOMIC ENERGY COMMISSION

ORNL-TM-287
COPY NO. - 54
DATE - June 29, 1962

PROCESS DESIGN SECTION STATUS REPORT FOR MAY 1962

By

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ABSTRACT

This report summarizes the accomplishments of the Process Design Section of the Chemical Technology Division during the month of May 1962. The five major projects discussed are Transuranium, Volatility, Power Reactor Fuel Processing, Waste Studies, and Thorium Fuel Cycle Development. A number of smaller programs are reviewed under the section on Miscellaneous Projects, and project engineering accomplishments and status are reviewed in the last section.

1.0 TRANSURANIUM PROGRAM
(W. E. Unger)

1.1 Transuranium Facility, Bldg. 7920 (B. F. Bottenfield, G. B. Berry)

Final release of the Transuranium Facility Conceptual Design Report was authorized and made by AEC-ORO on May 17, 1962.

Title I engineering is approximately 97% completed. A total of 109 drawings have been received from the Architect-Engineer and reviewed. All 25 Title I report sections have been received except for the cost estimate, which is scheduled for completion by June 18 but may be delayed because of a recent suggested simplification of the vacuum system.

The Architect-Engineer was authorized by AEC-ORO on May 17 to proceed with Title II (detail) engineering on the architectural, structural, electrical, piping, and heating and ventilating design on the portion of the building which is not affected by the cell bank, as well as most of the outside utilities and site work.

1.2 Transuranium Project Critical Path Schedule (B. N. Robards)

The initial phase of scheduling the ORNL portion of the Transuranium Facility by the critical path method was begun. Arrow diagrams are being prepared for each major part of the project; these include chemical process equipment, mechanical equipment, analytical chemistry equipment, instrumentation, and target fabrication equipment. The diagrams are to be transmitted to Catalytic Construction Company by June 22, 1962, for inclusion in the project master diagram. The master diagram will then be programmed and the critical path for the project determined. Later work will include manpower leveling and the preparation of more detailed diagrams.

1.3 Special Mechanical Equipment Design (F. L. Hannon)

Intercell Conveyor. The Title I package consisting of four drawings and a written installation procedure for the conveyor housing was completed and issued. Fabrication of the mockup housing extension is continuing in preparation for installation in the mockup at Y-12 in July. Design modifications to the dolly and dolly removal fixture are in progress to adapt this equipment to a new dolly removal philosophy.

Equipment Transfer System. Detailing of mockup components is continuing; four additional drawings for the lower part of the transfer case and three for the top-mounted components have been completed. Design of in-cell equipment rack guide components has been completed; four drawings will be issued.

Cell Cubicles. Seven Title II drawings of the cell cubicle floor pan, pan support, and roof components have been completed. Detailed design of the cell cubicle lighting arrangement was completed; four drawings were issued. Detailing

of a bag-out station for Cells 8 and 9 is in progress, and four drawings have been completed. Five drawings have been completed showing the latest concepts for components included in the cell cubicle arrangement and the transfer area carrier charging and equipment transfer systems.

1.4 Disconnect Development (E. J. Breeding)

Design drawings and specifications for a cast remote disconnect are nearing completion. A decision was made to purchase 500 units for the TRU Development Facility. The fabrication performance of this initial order will be evaluated for possible improvements in the design to simplify manufacture for the TRU Processing Facility.

The proposed unit will accommodate all metallic and plastic tubing sizes up to and including 3/4 in. dia. The unit can be used for various types of gasketed joints as well as the present cone type seat design.

1.5 Process Equipment Design (W. D. Burch, O. O. Yarbro)

Development of engineering flowsheets was continued; two of the estimated 14 engineering flowsheets are now in the check print stage. Drawings of service lines to cubicle equipment racks and of a typical side equipment rack were completed and issued as check prints. Details of the mounting system for air-operated diaphragm pumps was completed and will be used for both 7920 and 4507 development equipment.

1.6 Transuranium Shielding Studies (J. P. Nichols)

The 54-in.-thick cell shielding walls for Bldg. 7920 must be made of concrete of the following characteristics to satisfy the requirements for satisfactory neutron attenuation:

	Temperature	
	75°F	212°F
Density, lb/cu ft	220	217
Water content, lb/cu ft	12.2	9.1
Iron content, lb/cu ft	104	104

Hanford attained the above characteristics with their specification HWS-6580, 2-1-60, when they used the Running Wolf ore from Montana. This ore had a 67.4% iron and 4.6% combined water content. The Montana ore would be expensive if used at ORNL because of freight costs; however, it may be required because surveys have established it to be the only known ore of high combined water content. Nearby ores of satisfactory iron content are available which might be used in combination with magnesium oxychloride cement or Serpentine aggregate to supply the necessary water retention, but confirmation of the characteristics of such a concrete would require a lengthy development program.

The E & M Division has been asked to study and make recommendations as to the best and most economical method of achieving a concrete of the required characteristics within the present TRU Schedule.

1.7 Building 4507 TRU Facility (F. L. Peishel, W. R. Whitson)

The design of the equipment for Cell 4 and supporting areas is 32% complete, based on an estimated total design time of 1284 man-days.

The E & M Division is presently designing the service piping in the operating area, equipment and layouts in the makeup area, the large equipment removal cubicle and roof plugs in the roof area, cell lighting maintenance, and the cell filters. K-25 is designing the cell tankage, tank removal details and disconnects, in-cell equipment layouts and supports, process valves, and the feasibility of electric vs. steam heating in the feed adjustment vessels.

A scale model of Cell 4 has been assembled by the K-25 design group. This model has precipitated the removal of cell manometers because of lack of space. Further minor reduction in tank freeboard volumes will be made to alleviate some crowded conditions. The basic philosophy of removal of equipment is still valid but will require some additional mechanical devices to aid the overhead hoist. The use of extended reach manipulators may be necessary to enhance further the operability of the cell; this decision will be made in the near future. Transfer pump details are in the process of being finalized.

The mixer-settlers were delayed because the Homalite Corporation had difficulty in meeting dimensional specifications. Level instrumentation for the cell equipment has been revised; density probes will be added to tanks where required. The instrument panelboard and transmitter rack are being revised to reflect these requirements.

Decontamination of Cell 4 was completed May 25, and the work of preparing the cell for the installation of the two Hastelloy-C storage tanks was begun on May 28. Removal of the concrete floor, the hot floor drains, and the gravel in the pit proceeded more rapidly than anticipated, since no radiation or serious contamination was encountered below the floor level.

The steel supports for the storage tanks and the lead shielding have been shop-fabricated in sections and now await painting prior to installation. The Nooter Corp. has tentatively scheduled shipment of tanks T-416 and T-417 on June 5.

1.8 Transuranium Waste System Review (F. N. Browder)

Flowsheets, piping plans, grading plans, vessel details, and a preliminary engineering report on the Transuranium Facility waste system were reviewed and comments passed on to the project design engineers. Except for nomenclature differences, which need to be brought into line with ORNL waste system practice, the TRU waste system design appears adequate and should fit into the ORNL waste system without major difficulty.

2.0 VOLATILITY PROGRAM
(R. P. Milford)

2.1 Program Review

It is the AEC's opinion that a second private fuel processing plant will very likely be built in the period 1964-1970 and that the new facility will be designed to process enriched uranium fuel and may well use a fluoride volatility process if one is fully proven by that time. Therefore, they are interested in completing pilot planting of all volatility process contenders by July 1, 1964; and they desire full pilot plant demonstration of the ORNL fused salt fluoride volatility process, the ANL and/or ORNL PuF_6 process, and a Zr and Al fluidized bed chloride or fluoride head-end in the ORNL pilot plant facilities by that time. They have requested ORNL to evaluate this schedule. Preliminary study indicates that the program cannot be done adequately in two years but would require a five-year effort, being complete only by approximately July 1, 1967. In ORNL's opinion the present fused salt fluoride volatility pilot plant program should be operated through January 1, 1964, to provide six short-cooled Zr-U fuel runs, processing of the EBR meltdown core, and demonstration of the process on $BeO-UO_2$, ThO_2-UO_2, and $Zr-ZrO_2-UO_2$ fuels. Concurrently a pilot plant addition would be constructed in Cell 3, Bldg. 3019, to provide equipment for demonstrating the oxidation and fluorination of graphite fuels, such as the HTGR, and a fluidized bed unit for chlorination or fluorination of Zr and Al type fuels. Finally, a single-vessel molten salt reactor or an improved hydrofluorinator and fluorinator would be installed in Cell 1 in FY 1966 and demonstrated in FY 1967.

To obtain additional data for this evaluation, G. I. Cathers, T. A. Gens, S. H. Smiley, E. C. Johnson, and R. P. Milford visited Argonne National Laboratory to review the ANL volatility programs on the zirconium fluidized bed process and the direct fluorination of low-enrichment UO_2, also in fluidized beds. The details of this trip are given in ORNL CF-62-6-73, from R. P. Milford to H. E. Goeller, "Volatility: Visit to Chemical Engineering Division, ANL, June 1, 1962, for Review of Their Fluidized Bed Volatility Program," June 27, 1962.

2.2 Assistance from BMI

Letter report BMI-X-201, "Corrosion Analysis of ORNL Pilot Plant Components," by P. D. Miller et al, dated May 15, 1962, was received. This report covered the micrometer measurements and the metallographic examination of the I-1000 instrument line and the TC-1000 thermocouple well, both of which were lengths of 3/8-in. NPS Schedule 40 INOR-8 pipe which were removed from the hydrofluorinator after Run TU-11. Results of local micrometer measurements of the two lines have been previously reported.[1] The lines had been exposed for a total of 1,359 hr to molten salt

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1 ORNL-TM-186, E. C. Moncrief, "Corrosion of the Volatility Pilot Plant INOR-8 Hydrofluorinator and 'L' Nickel After 21 Non-radioactive Dissolution Runs," March 29, 1962.

($NaF-LiF-ZrF_4$:20/43-17/41-22/58 mole %). During this time, HF was added for a total of 503.4 hr. The temperature range was 380-620°C in the vapor region and 490-675°C in the salt region. Metallographic measurements made at Battelle agreed quite well with micrometer readings at ORNL and indicated a maximum corrosion rate of 0.12 mils/hr of HF exposure at a point 1.5 in. above the distributor plate. The accentuated interface attack noted during laboratory hydrofluorination corrosion tests was not observed in the pilot plant vessel. The interface region was roughened while surfaces exposed only to salt or vapor were quite smooth. The only intergranular attack noted was found on the thermocouple well in the vapor region, 170 in. from the bottom of the hydrofluorinator.

The last half of BMI-X-201 covered the corrosion evaluation of Groups III and IV rods exposed in the VPP L-Nickel Mk-III fluorinator. Corrosion losses based on ORNL micrometer measurements for the Group III specimens were reported previously.[1] A listing of the Group III rods and their exposure conditions are as shown in Table 1.

Table 2 and Fig. 1 show bulk metal losses and corrosion rates based on fluorine exposure time, respectively. The interesting points in these results were the absence of intergranular penetration in the INCO-61 weld metal in the fluorine-conditioned specimen, the effect of small additions of magnesium to nickel in eliminating intergranular penetration, and the good performance of the HyMu-80 specimens, both from the standpoint of low metal losses and absence of intergranular penetration.

The Group IV specimens were exposed during Runs E-8 through T-10 and TU-8 through TU-10. Rod compositions were as follows:

Specimen No.	Type of Material
44	"L" Nickel with INCO 61 weldments
45	"L" Nickel with INCO 61 weldments
27	90 w/o Ni-10 w/o Fe
47A	HyMu-80
48	INOR-8
57	Inconel CX-900

Exposure conditions for the Group IV rods are shown in Table 3. Bulk metal losses and corrosion rates based on fluorine exposure time are shown in Table 4 and Fig. 2, respectively.

The INOR-8 rods proved to be the most resistant of the specimens tested with the least amount of metal loss and no intergranular penetration. Other points of interest were the slight amount of intergranular attack noted on HyMu-80 (Alloy 79-4)

[1] ORNL CF-61-6-37, from H. E. Goeller to F. L. Culler, Jr., "Process Design Section Status Report for April 1961," June 6, 1961.

Table 1. Group III Rod Compositions and Exposure Conditions

Specimen No.	Nominal Composition, w/o
53	"L" Nickel with INCO 61 weldments
54	"L" Nickel with INCO 61 weldments
8-R	99 Ni-1 Mg
34-R	99.9 Ni-0.1 Mg
37-R	99.95 Ni-0.05 Mg
47	HyMu-80, 79 Ni-17 Fe-4 Mo

(Specimen 53 was conditioned in fluorine at 600-645°C for 3.2 hr prior to the test)

Exposure Conditions

	Run TU-6	Run TU-7
Salt Composition, mole %	NaF-LiF-ZrF_4 (34-28-38 + 0.3 wt % U)	NaF-LiF-ZrF_4 (30-30-40 + 0.2 wt % U)
Without F_2 (temperature)		
Vapor region	375-350°C	360-340°C
Salt region	580-560°C	575-550°C
With F_2 (temperature)		
Vapor region	360-340°C	360-340±C
Salt region	505-500°C	510-500°C
Molten salt residence time	34 hr	65 hr
F_2 flow rate	6, 16 liters/min	6, 16 liters/min
F_2 exposure time	1.0, 0.4 hr	1.0, 0.7 hr

TABLE 2. BULK METAL LOSSES FOR GROUP III CORROSION SPECIMENS

		Loss in Diameter, mils											
		Vapor Region				Vapor-Salt Interface Region				Salt Region			
		Micrometer		Maximum Penetration by Metallography	Micrometer Plus Metallographic Maximum Loss	Micrometer		Maximum Penetration by Metallography	Micrometer Plus Metallographic Maximum Loss	Micrometer		Maximum Penetration by Metallography	Micrometer Plus Metallographic Maximum Loss
Specimen	Description[a]	Range	Average			Range	Average			Range	Average		
53[b]	"L" Nickel	1.2 – 1.3	1.25	4.0	5.3	9.0 – 12.9	11.5	5.0	17.9	7.3 – 12.1	9.3	5.5	17.6
	Inco 61 weld metal	5.4 – 10.5	7.95	–	10.5	15.3 – 23.0	19.0	–	23.0	14.7 – 15.5	15.1	–	15.5
54[c]	"L" Nickel	1.3 – 2.8	2.1	5.0	7.8	9.0 – 15.5	12.9	10.0	25.5	8.8 – 10.2	9.45	12.0	22.2
	Inco 61 weld metal	0.8 – 3.4	1.8	2.0	5.4	15.4 – 19.8	17.6	5.0	24.8	10.1 – 14.4	12.25	5.0	19.4
8-R	99 w/o nickel – 1 w/o magnesium	0.2 – 0.5	0.4	–	0.5	11.2 – 17.5	13.9	–	17.5	6.6 – 9.5	7.45	–	9.5
34-R	99.9 w/o nickel – 0.1 w/o magnesium	0.8 – 2.6	1.2	–	2.6	7.0 – 20.2	12.2	–	20.2	4.6 – 9.7	5.5	–	9.7
37-R	99.95 w/o nickel – 0.05 w/o magnesium	0.1 – 5.0	1.7	–	5.0	8.6 – 17.9	12.0	–	17.9	3.6 – 8.3	5.7	–	8.3
47	HyMu-80[d]	0.3 – 4.2	1.2	–	4.2	5.7 – 8.0	6.9	–	8.0	2.9 – 5.2	3.8	–	5.2

(a) All specimens were annealed rods 0.250 in. in diameter by 36 in. long.
(b) Control specimen – fluorine conditioned for 3.2 hr at 600 to 645 C.
(c) Control specimen – not conditioned.
(d) 79 w/o nickel – 17 w/o iron – 4 w/o molybdenum.

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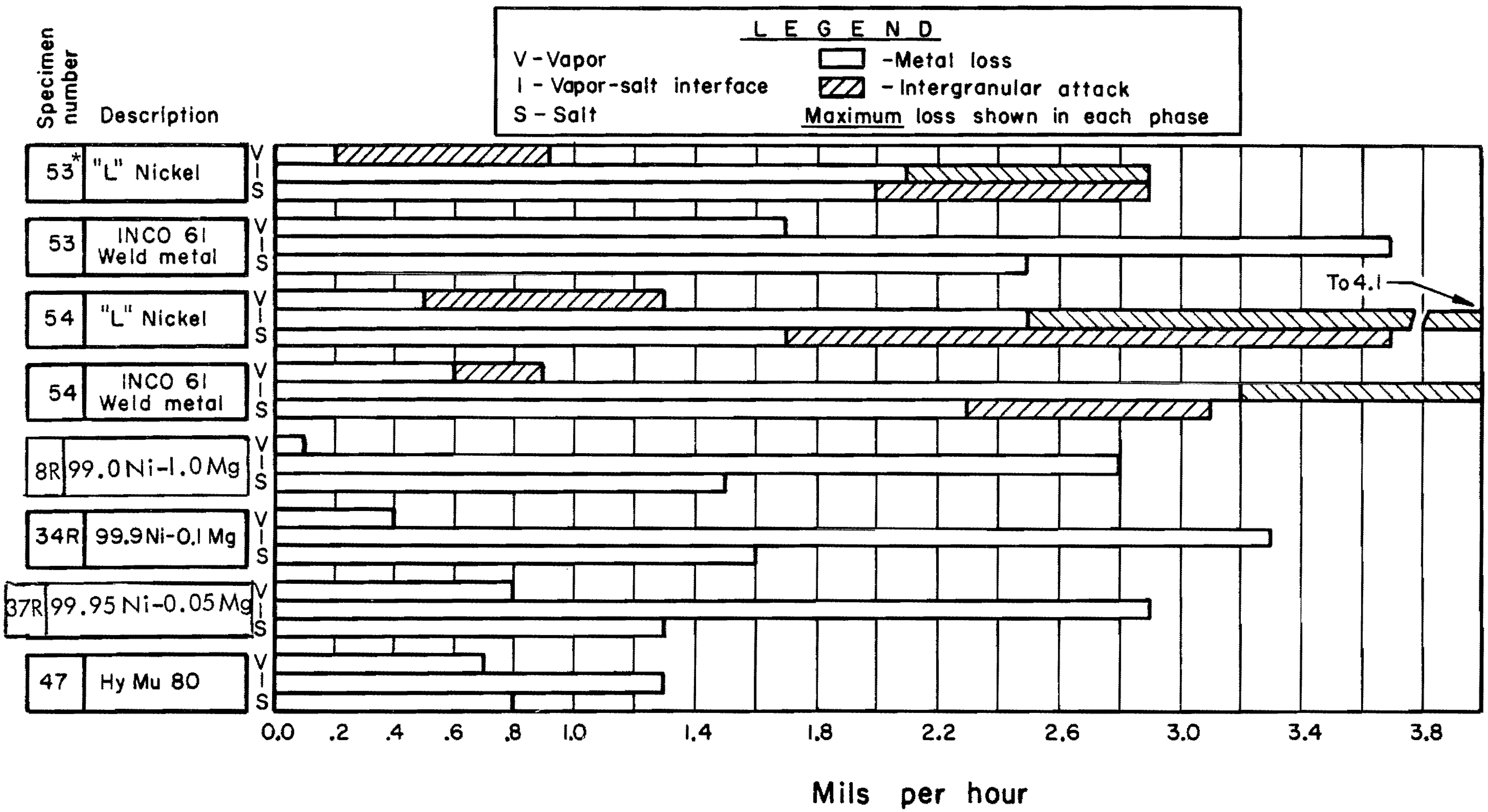

* No. 53 conditioned in F_2 for 3.2 hr at 600–645°C prior to test.

FIGURE 1. CORROSION RATES OF GROUP III RODS IN MOLTEN SALT AND FLUORINE (BASED ON FLUORINE SPARGE TIME OF 3.1 HOURS)

TABLE 3 EXPOSURE CONDITIONS FOR GROUP IV RODS

Run No.	$NaF-LiF-ZrF_4$ Salt Composition, mole %	Temperature °C Region, without F_2 Vapor	Salt	Region, with F_2 Vapor	Salt	Molten-Salt Residence Time, hr	F_2 Flow Rate (at STP), liters/min	F_2 Exposure Time, hr
T-8	20-22-58	590-340	750-525 [a]	-	-	141	0	None
T-9	27-28-45	565-335	715-515 [c]	-	-	202	0	None
T-10	27-27-46	340-330	525-500	-	-	111	0	None
TU-8	28-32-40 +0.3 wt-% U	365-330	530-500	360-330	500-495	54	6, 16	1.7, 0.3
TU-9	28-32-40 +0.2 wt-% U	390-355	535-515	365-340	525-515	33	6	1.7
TU-10	29-31-40 +0.2 wt-% U	365-340	520-505	360-340	505-500	60	6, 18	1.7, 0.4

(a) High temperature was reached during removal of high ZrF_4 content salt to waste.

(b) High temperature is result of melting salt plug in transfer line MS-1004-1 at fluorinator.

TABLE 4. SUMMARY OF BULK METAL LOSSES FOR GROUP IV CORROSION SPECIMENS

		Loss in Diameter, mils											
		Vapor Region				Vapor-Salt Interface Region				Salt Region			
		Micrometer		Maximum Penetration by Metallography	Micrometer Plus Metallographic Maximum Loss	Micrometer		Maximum Penetration by Metallography	Micrometer Plus Metallographic Maximum Loss	Micrometer		Maximum Penetration by Metallography	Micrometer Plus Metallographic Maximum Loss
Specimen	Description[a]	Range	Average			Range	Average			Range	Average		
44	"L" Nickel	0.1 – 3.0	1.42	14.0	17.0	2.0 – 2.8	2.40	20.0	22.8	2.5 – 10.8	4.35	62.0	72.8
	Inco 61 weld metal	0.8 – 3.8	2.49	1.0	4.8	3.0 – 4.0	3.50	3.0	7.0	2.1 – 3.4	2.96	5.0	8.4
45	"L" Nickel	0.2 – 3.8	2.09	12.0	15.8	3.0 – 4.2	3.60	24.0	28.2	3.5 – 5.5	4.48	14.0	19.5
	Inco 41 weld metal	0.8 – 4.2	2.34	1.0	5.2	2.8 – 3.5	3.65	4.0	7.5	4.3 – 6.5	5.34	10.0	16.5
27	90 w/o nickel – 10 w/o iron	0.9 – 6.1	3.00	4.0	10.1	6.0 – 7.1	6.70	7.0	14.1	6.4 – 14.9	8.72	8.0	22.9
47A	HyMu-80[a]	0.0 – 10.5	4.72	4.0[c]	14.5	8.2 – 12.0	10.10	4.0[c]	16.0	7.0 – 13.9	11.70	5.0[c]	18.9
48	INOR-8	0.3 – 6.5	3.25	–	6.5	6.0 – 7.1	6.42	–	7.1	6.1 – 11.9	9.27	–	11.9
57	Inconel CX-900[b]	0.5 – 4.1	1.97	2.0[d]	6.1	3.8 – 4.7	4.15	4.0[d]	8.7	5.2 – 6.6	6.10	6.0[d]	12.6

(a) Parts of this rod were first used in Group III test where HyMu-80 was numbered 47.
(b) Inconel CX-900 was exposed as a tube.
(c) Intergranular penetration and leaching layer.
(d) Leaching layer.

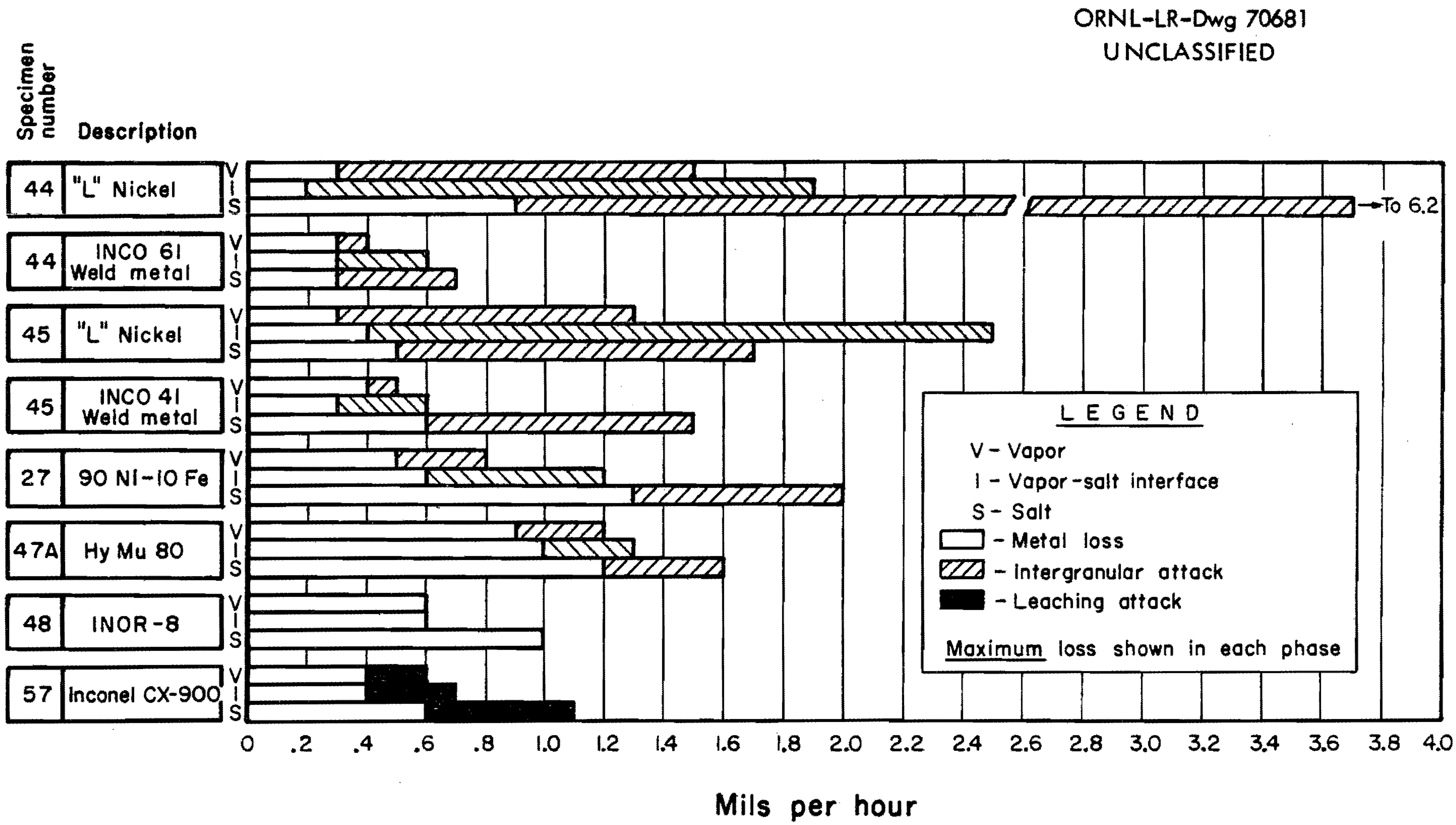

FIGURE 2. CORROSION RATES OF GROUP IV RODS IN MOLTEN SALT AND FLUORINE (BASED ON FLUORINE TIME, 5.8 HOURS)

and the much greater (31 mils) intergranular penetration of "L" Nickel specimen 44 as compared to that for specimen 45 (7 mils). The only apparent difference in the corrosion behavior of the HyMu-80 rods in Groups III and IV was in the grain sizes. The Group III rods showing no intergranular attack had much finer grain size than the Group IV rods which were attached intergranularly. Earlier BMI work indicated that the fine grain material was not annealed while the coarse grained was.

FY 1963 Program. A visit was made to BMI on May 17, 1962, to discuss the coming year's program. Items considered were as follows:

1. Study modifications of Alloy 79-4, first under hydrofluorination conditions, and then with F_2 if warranted, to determine if a Ni-Fe-Mo alloy more resistant than Alloy 79-4 can be formulated. BMI will pour experimental heats and roll the metal into sheet form.

2. Study the resistance of nickel, Inconel, Alloy 79-4, INOR-8, etc., during cyclic exposure to oxygen and F_2 at 700 and 400°C, respectively. Funds to $6,000 will be made available to finance this effort from account 3370-21 during FY 1963.

3. Determine the corrosion to be expected in the MSRE while fluorinating their spent fuel ($LiF-BeF_2-ZrF_4-UF_4$) in the INOR-8 dump tank at 500°C. Three thousand dollars is available in account 3370-130 for this effort.

4. Determine the corrosivity of any fluoride salt mixtures which Reactor Chemistry Division studies indicate show promise as fuel element hydrofluorination baths (particularly for Al fuels).

5. Check the corrosivity of the preferred flowsheets for processing:

   a. BeO-type fuels.

   b. The stainless steel—containing EBR-1, Core 2, meltdown on hand at ORNL.

The possibility of their studying corrosion in a fluidized bed reactor such as would be used for the reaction of Zr with HCl and F_2 was also discussed.

A rough draft of Kegley and Litman's report on the metallographic examination of the Group 1 and 2 VPP fluorinator rods was reviewed. A difference of opinion exists between ORNL Metallurgy and BMI as to when intergranular attack of nickel should be considered significant. Metallurgy feels that the penetration should only be considered when it is visible in the as-published, unetched condition, while BMI feels that the depth of grain-boundary modifications noted after etching is the proper value to be reported.

Status of Alloy Development Experiments. Eight experimental heats with the following compositions have been poured:

Alloy No.	wt % Ni	wt % Fe	wt % Mo
31	85	13	2
32	80	18	2
33	80	5	15
34	75	15	10
35	75	20	5
36	80	13	7
37	80	16	4*
38	85	10	5

* Alloy 79-4 nominal composition.

The individual ingots have been satisfactorily rolled into 1/8-in.-thick sheets ready for cutting to specimen size. Hydrofluorination test vessel No. 11 has been cleaned, Vidigaged, filled with 37.0-50.5-12.5 mole % LiF-NaF-BeF_2, and shipped to BMI for testing the above alloys. Vidigage results showed the vessel still usable, but a "dead ring" (~ 1 in. wide) was noted approximately 12 in. below the flange. A resonance frequency could not be established in this area, probably because of sound scattering or absorption.

3.0 POWER REACTOR FUEL PROCESSING
(E. L. Nicholson)

3.1 Mechanical Processing of Fuels (W. F. Schaffer, Jr.)

Chop and Leach Process. The cold chop-leach facility was checked-out and leak-tested in preparation for operation with aluminum-clad UO_2 simulated fuel elements in June. The minimum leakage rate was found to be 1-1/2 cfm. Provisions have been made for heating the leacher shell with steam through coils brazed to the shell. The internal components also can be preheated with steam by using the existing screen washing spray nozzles and addition lines prior to the start of operations.

During the final shearing studies on porcelain-filled stainless steel prototype fuel, the first failure of a moving knife was experienced. The knives (Square Keen #3) had been subjected to approximately 5800 cuts at this time. The knife failed to shear solid stainless steel end plugs and stalled with a pressure setting of 150 tons. Three attempts were made to shear the end plugs without success. The failure was noted when a piece of the knife was found in the container used to collect the sheared pieces. Although the leading step of the knife had been showing progressive wear in edge roundness, particularly on the ends of the step, the knife was still performing satisfactorily. Failure occurred on the leading step, although not as one would expect in the direction of thrust but actually in a direction perpendicular to the thrust. Failure probably can be attributed to blade dullness and edge wear, which allowed metal to wipe between the fixed and moving knife and cause a very high force perpendicular to the line of thrust. The chip was triangular in shape, approximately 1/4 x 1 x 1-3/4 in. at the maximum dimensions tapering to a very thin section at opposite sides.

Additional runs were made with a spare knife; unfortunately, the knife was made of a substitute tool steel (Kleencut) purchased on the basis of bids and rapidly dulled to the point where after 320 cuts its future service life was questionable.

A new knife has been designed to minimize the horizontal ledges which tend to hold up powder and metal fuel pieces; the knife also has a reversible feature which is expected to approximately double the service life before sharpening is required.

PRDC and CPPD Decladding Design Study. A simulated end hardware and fuel tube assembly was clamped in a spring-loaded fixture and set up in a standard shop milling machine for a test using a 12-in. slitting saw for severing the end hardware from the fuel tubes. The test was made with the fixture and test assembly in a tank so that the sawing could be made under a blanket of mineral oil. The saw was driven at a speed of 15 rpm with a feed of 3/8 in. per minute. The saw easily cut through the steel end hardware, until the severed parts broke free of the clamp and caused binding of the blade. Before the saw could be stopped, several teeth were damaged. The blade is repairable and was sent to the manufacturer for repair. A similar binding problem also occurred during the SRE program and was responsible for breakage of the abrasive wheels. Unless a good method for securely clamping the very flexible assemblies is developed, frequent replacement of cutting blades must be expected. Future tests will be made with simulated end assemblies potted in a plastic compound to determine if the severed ends can be retained in this manner.

3.2 Review of Program Status (E. L. Nicholson)

About three weeks were spent preparing a review article for the August Data Manual issue of Nucleonics. It is a review of the aqueous processes proposed for recovering power reactor fuels. It gives a summary of the head-end process details, the proposed solvent extraction flowsheets, and high-level and decladding waste generation. Status of the various development efforts are reviewed. The article was issued as ORNL-TM-240, "Proposed Aqueous Processes for Recovering Power Reactor Fuels."

3.3 Torrefactor Design (A. M. Rom)

Work continued on detailed equipment design for the Halogen Torrefactor Experiment. Design and drafting of the major equipment pieces required for the experiment were an estimated three-fourths finished at the end of May.

4.0 WASTE STUDIES
(J. O. Blomeke)

4.1 Plant Waste System Modifications (F. N. Browder, F. E. Harrington)

The Paducah design group has completed all drawings and specifications on the structural and heating and ventilation portions of the waste evaporator and storage tank building and sent them to ORNL for approval. All drawings and specifications were reveiwed and approved except for minor changes. This portion of the waste improvements project should be ready for bids by a lump-sum contractor in July for construction to start in August.

The Engineering and Mechanical Division design group completed all drawings for the Melton Valley collection and transfer system and submitted them to the Operations Division and to the Process Design Section of the Chemical Technology Division for approval. These drawings were also approved except for minor changes. A recheck of the original cost estimate on this portion of the waste systems improvement project showed that the costs are still within the estimate.

Design of the process portion of the intermediate-level waste evaporator and high-level storage tanks was begun by the E & M chemical design group.

4.2 Pot Calcination Pilot Plant (J. M. Holmes, E. J. Frederick)

The AEC decision to transfer the Pot Calcination Pilot Plant from the Idaho Chemical Processing Plant to Hanford has been made. Initial discussions with Hanford representatives were held at ORNL on May 1, 1962. The intent is to locate the pot calciner process in the new Fuels Recycle Pilot Plant Building, possibly integrating its operation with that of the Hanford Spray Calciner. This facility is now in Title II design.

Flowsheets. An optimized process flowsheet for the pot calciner process has been prepared and forwarded to Hanford for study. Batch and continuous operation material balance flowsheets for the calcination of TBP-25, High Sulfate Purex, and Darex wastes have been transmitted to Hanford. All material balance flowsheet design is now completed.

Mechanical Test Program. The decision to relocate the Pot Calcination Pilot Plant will not affect the mechanical testing program under way at Georgia Nuclear Laboratories. Bids have been received for fabrication of the filling station and the calcination pots, both critical items in the test program. None of the vendors could meet the required delivery data; therefore, these items are to be fabricated at ORNL. The schedule for the GNL work, shown in Fig. 3, reflects progress to date as well as the projected sequence in which the program is to proceed.

		1962						Project Complete
		May	June	July	Aug.	Sept.	Oct.	Nov.
1.	Weld Specimens							
	Leak tests (completed)							
	X-ray welds	X	XX					
	Section and metallographic		XXXXXX	XXXX				
	Burst tests (completed)							
2.	Grayloc Seal Test							
	Leak test	XX						
3.	Report, Tasks 1 and 2			XXX				
4.	Pot Calciner Mockup in Cell							
	Dolly-furnace installation (completed)							
	Controls	X	X					
	Rigging		XX					
	Instrumentation		X		X	X		
5.	Proposed Filling Station Item (1)							
	Installation			X				
6.	Proposed Alternate Head Item (2)							
	Installation						X	
7.	Welding Station		XX		XXXXXXX	XXX		
8.	Demonstrations							
	Cycling				XXXXX			
	Welded closures					XXXX		
	Mechanical closures						XXXX	
9.	Disassemble and Ship						XX	
10.	Report							XXX

Fig. 3. Georgia Nuclear Laboratories Project Schedule for Pot Calciner Mockup

The results of the automatic welding tests made on simulated calciner pot closures to develop welding procedures for in-cell operation are reported in Lockheed Report EL-5690 and are summarized as follows:

1. Sound crack-free welds can be made with all three joint designs, as determined by visual and penetrant inspection. Radiography showed Sample No. 1 to be free of internal flaws such as cracks and porosity. The remaining four samples will be radiographed for internal defects following completion of the pressure and temperature cycling tests at GNL. These welds will also be sectioned to determine the depth of penetration.

2. The electrode must be accurately positioned over the weld joint in order to obtain complete fusion of the bottom edges of the joint.

3. "Arc blow" was present during the welding of all samples. In all cases, the arc was deflected in a direction radially away from the center of rotation of the test piece.

4. The cover for the shrink fit closure tends to cock and jam during assembly of the cover into the preheated body.

5. No detrimental pressure build-up occurred in the closed vessel attached to the test pieces.

6. The NO gas present had no apparent effect on the stability of the welding arc.

Pump Test Loop. One of ORNL's responsibilities to Hanford on the Pot Calcination Pilot Plant is to specify the type of feed pump to be used in the process. Design has been completed on a pump test loop in which it will be possible to test four pumps concurrently under simulated power conditions. Individual pumps are instrumented and will provide performance data for final evaluation.

Pot Calciner Temperature Studies Program. A study has been made to determine the optimum method for controlling the pot calciner wall temperature upon completion of feeding to ensure calcination of the entire cake at 1650°F. A finite difference solution, obtained by using an analog computer, showed that a linear approximation to a wall temperature program would permit calcination of the entire cake within a temperature range of 1650° to 1850°F. A program involves heating the pot wall at 1650°F for 0.8 hr and then cooling to the required equilibrium wall temperature in 1.1 hr assuming a cake thermal conductivity of 0.2 Btu/hr·ft·°F and an internal heat generation rate of 4000 Btu/hr·ft^3. The equilibrium temperature profiles were determined from the cake thicknesses, thermal conductivities, and internal heat generation rates assuming 1650°F temperature at the surface of the interior cavity. For solids of the same heat generation rate but a conductivity of 0.1 Btu/hr·ft·°F, a heating time of 0.8 hr and a 2.5-hr cooling time to the equilibrium wall temperature is indicated.

A study was also made of the time required to heat the pot wall at 1650°F if it is necessary to re-calcine a pot full of cake with no center cavity. In this case the heating of a cake with an internal heat generation rate of 4000 Btu/hr·ft^3 and a conductivity of 0.1 Btu/hr.ft.°F for 1.87 hr and then cooling rapidly to 300°F would completely re-calcine the cake in the range of 1610 to 1820°F.

4.3 Pot Calcination Hot Cell Experiment (B. B. Klima)

A report has been prepared summarizing the advantages and disadvantages of installing the Pot Calcination Hot Cell Facility in the Pilot Pit No. 2 in lower Melton Valley. Installation of the facility there would be more remote and would cost $45,000 more; however, it would have hot and cold storage facilities for the calcined pots which are not available in Bldg. 4507.

After publication and review of this proposal, a decision will be made on the location of this facility.

4.4 Waste Disposal Hydrofracturing Experiment (H. O. Weeren)

Information has been supplied by Westco Research on the probable composition and characteristics of the cement mix that will be used in the hydrofracture experiment. The composition is as follows:

1 lb Portland cement
332 cc ORNL intermediate-level waste
9.08 g fluid loss additive
27.2 g Bentonite
2.27 g $CaCl_2$
3.17 g Calcium Ligno Sulfonate

Viscosity determinations show a mix viscosity of 10 poises for 6-1/2 hr, then a steady increase in viscosity to 60 poises in about 10 hr. This indicates a probable pumping time of about 8 hr.

Tentative plans call for the injection of ~50,000 gal of intermediate-level waste solution into the fractured shale formation. The above information on the characteristics of the mix indicates that a pumping rate of about 180 gal/min will be necessary, a capacity that can easily be supplied by a standard cementing pump.

An estimate has been made of the extent to which the wellhead area might be contaminated by the tubing string when it is pulled from the well following a Sandril operation. The airborne contamination is calculated, based on pessimistic assumptions, to be 9×10^{-5} μc/cm^3. If the contamination level is in fact anything approaching this figure, a number of expensive and inconvenient precautions will have to be taken to contain it. An alternate to the Sandril operation (and its contamination problems) is the use of shaped charges to perforate the casing. The shaped charges can be mounted on a wire line which can be enclosed much more easily than the tubing string. The chief drawback to the use of shaped charges is the poorer penetration of the formations surrounding the casing that is achieved by this method.

Shielding will be required for the mixing equipment, the high pressure pump, and the wellhead area. Preliminary calculations indicate that 1 ft of concrete will be entirely adequate for this purpose.

4.5 Waste Disposal in Salt Formations (W. F. Schaffer, Jr.)

The Health Physics Division has been requested by the AEC to investigate the feasibility of using spent ETR assemblies to demonstrate the safety of storage of calcined waste containers in salt mines. The experiment is to simulate the radiation dosage and heat loads to the salt environment so that any effects can be noted and evaluated. The Chemical Technology Division was asked for assistance in developing a method for installing the spent fuel elements in a mine and for recovering the elements after a demonstration period of approximately two years. Costs of the operation are to be estimated.

Health Physics proposed to build a carrier which could be lowered into the mine and moved to the demonstration area for loading the elements into the storage holes. An alternate proposal was made by the Chemical Technology Division to drill a small bore hole from the surface to the subterranean room so that the carrier would not have to be lowered into the mine, which would avoid the necessity of a heavy mine shaft hoist and the problems of moving and handling a heavy carrier on an irregular and broken mine floor. The proposal was accepted and work was started in locating an existing carrier if possible to handle 14 ETR type elements cooled a maximum of 45 days at the start of the experiment.

5.0 THORIUM FUEL CYCLE STUDIES
(A. R. Irvine)

5.1 Thorium Fuel Cycle Development Facility Conceptual Design (A. R. Irvine)

Giffels and Rossetti, Inc., developed the details of approximately 15 drawings and 18 sketches. These were reviewed and commented on at a meeting between Giffels and Rossetti, Inc., and UCNC at Detroit.

A very preliminary estimate of the facility was prepared by Giffels and Rossetti, Inc. The estimated cost was $\$5.5 \times 10^6$, which includes a 25% contingency.

No satisfactory valve has yet been found for a back flow preventer for cell ventilation inlet lines. A check valve normally used in compressors is being investigated. A unit having low pressure drop (1 in. water gage max.) and rapid response is required. The system currently specified for filtration of cell exhaust ventilation air consists of a high grade roughing filter located inside the cell followed by two absolute filters located in a standard filter pit outside the building. Consideration is being given to an incessant filter system in lieu of the system used at other facilities at the Laboratory. The advantages of the incessant filter unit are zero leakage past the filter and improved containment of particulates.

5.2 Th-U^{233} Fuel Rod Facility (B. B. Klima)

Design of the processing facility to produce Th-U^{233} oxide by the sol-gel process is essentially complete; however, 28% of the drawings yet await approval signatures. The main areas where drawings have not been completed comprise processing cubicle, shielding, and windows; electrical; instruments; piping; and calcining furnace door operating mechanism.

The calcining furnace has been received and will be set up in the near future. Fabrication of equipment in the shop is proceeding. The batch evaporator is estimated to be 20% fabricated, and the eight evaporator trays are estimated to be 80% fabricated. The sol tank, tray dumper, tray elevator, crucible dumper, and hopper are all fabricated. The charging hood and compressed gas station are being fabricated. The work table is being fabricated; however, it will be modified to include a weighing station so that the calcined solids can be weighed before delivery to the fuel preparation area which is located on the first and second floors of Cell 4. The uranium tank fabrication has not been started in the glass shop.

The glass-front mock-up of the blend tank has been fabricated and installed in Bldg. 4505 for test.

The vessel off-gas filter is being fabricated and is expected to be complete by June 13. The filter will then be filled with the glass fiber on June 14 and 15 and tested using DOP (dioctyl phthalate) and uranine dye (disodium fluorescein) during the week of June 18-22. Fabrication of the piping to be installed at Bldg. 3019 for the filter is essentially complete, and completion of this phase of the job appears to be possible this fiscal year.

6.0 MISCELLANEOUS PROJECTS

6.1 High Radiation Level Analytical Laboratory (W. R. Winsbro)

The prime "lump sum" contract for HRLAL construction was awarded to the Foster and Creighton Company of Nashville, Tennessee, on May 11, 1962. Construction of this new facility (Bldg. 2026) is scheduled to be completed 14 months following the start of "on-site" construction, which is presently scheduled to start on or around September 1, 1962.

The evacuation of personnel and equipment from Bldg. 2005, presently located on the HRLAL construction site, was completed and the demolition of this structure was started during the period of this report. The demolition of Bldg. 2005 to grade level is being performed by the H. K. Ferguson Company on a CPFF basis with ORNL funds. Site excavation for HRLAL construction likewise is to be performed on a CPFF basis, also by the H. K. Ferguson Company; however, funding will be from the capital project funds. Subsurface investigations will be performed by the U. S. Army Corps of Engineers following the demolition of Bldg. 2005 and prior to the start of site excavation.

6.2 Fuel Shipping Studies (L. B. Shappert)

A working meeting on the AEC Shipping Container Testing Program was held in Baltimore, Maryland, on May 2 and 3, 1962. This meeting was attended by K. W. Haff of the Isotopes Division and L. B. Shappert of the Chemical Technology Division. The results of the meeting indicated a need for additional cask testing and correlation of data which would allow cask damage to be predicted as a function of drop height. Testing of tie-downs was considered highly desirable to provide information which has been lacking in that area.

Three drops, conducted on May 7 at ORNL, were made using new 1.5-ton casks. Drop 15 was made with a horizontal water-filled cask. Drop 17 was identical to Drop 15 except the cavity was air-filled. Drop 16 was air-filled and was made with the cask at a 45° angle with the horizontal.

Drops 15 and 17 employed strain gages in identical places so that the effect of water in the cavity could be determined. Every gage in the 15-ft water-filled drop indicated higher strain than the corresponding gage on the air-filled drop.

The maximum and permanent change in the vertical diameter of the cask cavities is shown in the following table:

Instrument No.		Cask Deformation, in. Drop 15, at 15 ft	Drop 16, at 15 ft	Drop 17, at 15 ft
1	Maximum	0.343		0.219
	Permanent	0.268	0.070	0.217
2	Maximum	0.536		0.438
	Permanent	0.423	0.080	0.311
3	Maximum	0.575		0.466
	Permanent	0.453	0.057	0.358
4	Maximum	0.584		0.470
	Permanent	0.452	0.046	0.375
5	Maximum	0.497		0.473
	Permanent	0.420	0.041	0.381
6	Maximum	0.322		0.372
	Permanent	0.310	0.067	0.244

These data are consistent with the fact that higher strains were produced in Drop 15 than in Drop 17. Evidently the water pressure produced upon impact caused greater cavity deformation, which in turn produced the greater strains.

Permanent cavity deformation produced by the corner drop appears to be slight. Cavity deformation produced in these drops is two to three times greater than previously reported on previous drops from similar heights (Drops 8 and 9). The difference is due to the fact that the inner shell thickness on Drops 8 and 9 was 0.593 in. (Sch. 80 pipe) and on Drops 15, 16, and 17 was 0.250 in. (Sch. 20 pipe).

The AEC is interested in conducting some cask drop tests on a 6-in.-dia piston to determine experimentally the puncturing effect. Drop 18 was such a test. A 1.5-ton cask was dropped from a height of 3.5 ft onto a 6-in.-dia piston. The piston caused a depression of ~0.5 in. deep in the outer shell. The outer steel shell, 0.312 in. thick, was not breached; however, the shell appeared to be sheared to a depth of about 0.016 in. Drop 19 was a horizontal drop from a height of 23 ft. Further data from the latter two drops will be presented next month.

6.3 IWW Carrier (A. M. Rom)

The main uranium casting for the IWW Carrier was successfully radiographed at ORNL using a 3000-curie Co^{60} source. No flaws were detected by the radiography and the approved casting was returned to Y-12. Construction of the carrier by Y-12 shops was approximately 75% complete at the end of May.

6.4 Saline Water Studies (F. E. Harrington)

A report evaluating several "dew machines" was prepared and submitted to K. A. Kraus for consideration.

6.5 Eurochemic Assistance Program (W. M. Sproule)

No transmittal letters were sent; however, one letter requesting information was received from R. J. Sloat, and 55 Eurochemic-originated documents were received. Two previously received Eurochemic-originated documents were reproduced but not distributed. E. M. Shank spent three weeks visiting the Eurochemic Company at Mol, Belgium.

6.6 CANE Project (J. W. Landry)

A study made at ORNL of Lawrence Radiation Laboratory data on relative yields of heavy nuclides obtained in the Ivy Mike test, a 14 MT thermonuclear detonation carried out in the Pacific Ocean in November 1952, gave the following approximate relationship between the quantities of target material and neutron irradiation products:

$$\mathrm{Log}_{10}\frac{N_p}{N_t} = 0.67(A_t - A_p) \pm 0.1$$

where N_t = mols of target material of mass No. A_t

N_p = mols of irradiation product of mass No. A_p

The variation of ± 0.1 occurs as A_t and A_p vary between even and odd numbers.

This, and other studies at ORNL in which available neutron fluxes were compared, indicate that the production of detectable quantities of new nuclides in an external target suitable for use in a hypervelocity jet sampling experiment may be possible only if A_t is high. Such an experiment, when compared with nuclide production using an internal target, offers a possible advantage in that there is additional space available for moderator material and that 100% of the target material is recoverable and recoverable in a pure form.

7.0 PROJECT ENGINEERING

7.1 Process Design Section Drafting Room Status (J. H. Manney)

A list of the 36 drawings started during May 1962 is given in Table 5. In addition, 23 drawings proceeded to the check print stage and 8 to approved status; 11 older drawings were revised. In May, 13 sketches and 208 illustrations were prepared.

A breakdown of drafting time during May by cost accounts is as follows:

Acct. No.	Man-hours	% of Total	Acct. No.	Man-hours	% of Total
3370-1	69.0	2.7	3370-113	8.0	0.3
3370-20	78.0	3.1	3370-117	2.0	0.1
3370-22	138.5	5.4	3370-123	32.0	1.3
3370-30	8.0	0.3	3370-128	65.5	2.6
3370-33	111.0	4.3	3370-133	12.5	0.5
3370-34	247.0	9.7	3370-135	468.5	18.4
3370-43	44.5	1.7	3370-137	6.0	0.2
3370-56	45.5	1.8	3290-70	6.0	0.2
3370-107	40.0	1.6	3490-29	48.0	1.9
3370-108	900.0	35.1	4435-72	143.0	5.6
3370-110	80.0	3.2		2553.0	100.0

Overtime worked in May was 345 man-hours.

7.2 Engineering Department Assistance

A summary of drawings prepared during May in the Engineering Department is given in Table 6.

7.3 Material Purchase Status

Table 7 gives a listing of all outstanding purchase requisitions (except instruments) as of June 1, 1962.

7.4 Work Order Status

Table 8 presents a listing of all outstanding work orders as of June 1, 1962, for which the Process Design Section is responsible.

H. E. Goeller, Chief
Process Design Section
Chemical Technology Division

HEG:mep
Attachments: Tables 5 through 8

Table 5. Summary of Drawings Started in the PDS Drafting Room During May 1962

Job No.	Drawing No.	Rev.	Title	Date Started
507	D-46129		Pu-Al Alloy Fuel Rod Carrier, Assembly Relief Valve Housing and Mid-section Shield, Ring Details	5/25/62
602	D-46098		Waste Disposal Development, UNOP Pump Loop Piping	5/21/62
	D-46114		Waste Disposal Development, Modification to Tank CT-324	5/17/62
605	E-46106		Waste Calcination Pilot Plant Pot Calcination Flowsheet, Darex APPR Waste, Batch Operation for 8-in.-dia Pot	5/2/62
	E-46118		HAPO Proposed Hot Pilot Plant Pot Calcination Process Flowsheet	5/8/62
700	D-46124		TRU HFIR Target, Irradiation Prototype	5/15/62
702	D-45828		TRU Development, Arrgt. & Layout of Shielding & Support, T-416 & T-417	4/26/62
	D-45829		TRU Development, Process Piping for T-416 & T-417	4/26/62
	C-45830		TRU Development, Storage Tank Piping Details	5/2/62
	D-45831		TRU Development, Details of Shielding Supports	4/23/62
	C-45832		TRU Development, Disconnect Ferrule and Plug, Details	5/2/62
	E-45833		TRU Development, Process Piping for T-416 & T-417, Sheet 2	5/10/62
	D-46117		TRU Studies, Single or Gang Disconnect, Castings & Details	5/10/62
	D-46121		TRU Development, Single or Gang Disconnect, Assembly & Details	5/11/62
	E-52064		TRU Process Facility, Engineering Flowsheet #1	5/22/62
	E-52065		TRU Process Facility, Engineering Flowsheet #2	5/1/62
	E-52066		TRU Process Facility, Engineering Flowsheet #3	5/25/62
	E-52176		TRU Process Facility, Service Plug to Cubicles, Steel & Concrete Details	5/25/62

(Continued)

Table 5, Continued

Job No.	Drawing No.	Rev.	Title	Date Started
702, cont.	D-52177		TRU Process Facility, Mounting Details of Service Disconnect on Cubicle Roof	5/7/62
	E-52180		TRU Process Facility, Service Lines from Cubicle Ceiling to Equipment Rack	5/17/62
	D-52249		TRU Process Facility, TRU Diaphragm Pump Mounting, Assembly and Details	5/25/62
	D-52250		TRU Process Facility, TRU Diaphragm Pump Arrangement	5/25/62
3370-20	D-46101		Chloride Volatility Halogen Torrefactor, Assembly	5/9/62
	D-46116		Chloride Volatility Halogen Torrefactor, Hg Condenser	5/8/62
	D-46125		Chloride Volatility Halogen Torrefactor, Product Collector	5/12/62
	D-46126		Chloride Volatility Halogen Torrefactor, Hood Frame and Hoist	5/16/62
	D-46131		Chloride Volatility Halogen Torrefactor, Layout	5/26/62
3370-135	D-46051		Th-U^{233} Fuel Rod Facility, Filter Assembly & Details	5/18/62
4435-72	E-46119		MSCR, Fluoride Volatility Chem. Plant, 12 ft^3/day, Plans	5/10/62
	E-46120		MSCR, Fluoride Volatility Chem. Plant, 12 ft^3/day, Sections	5/11/62
	E-46122		MSCR, Fluoride Volatility Chem. Plant, 1.2 ft^3/day, Plans	5/11/62
	E-46123		MSCR, Fluoride Volatility Chem. Plant, 1.2 ft^3/day, Sections	5/11/62
3490-29	C-45979		Radioactive Solids Dis. Demon., Conceptual Loading Arrangement	5/18/62
	D-45980		Radioactive Solids Dis. Demon., Conceptual Underground Loading Install.	5/19/62
	D-45981		Radioactive Solids Dis. Demon., Conceptual Fuel Element Cannister	5/21/62
	D-45982		Radioactive Solids Dis. Demons., Conceptual Surface Charging Arrgt.	5/23/62

Table 6. Summary of Drawing Progress in Engineering Department for Month of May 1962

Bldg. No.	W.O. No.	Dwg. No.	Rev.	Title	Transmittal Date
3019	A-01540-11	D-36441	2	Hydrofluorination Addition Flowsheet #1	5/7/62
		D-36442	2	Hydrofluorination Addition Flowsheet #2	5/7/62
		D-36443	2	Hydrofluorination Addition Flowsheet #3	5/7/62
		D-36444	2	Hydrofluorination Addition Flowsheet #4	5/7/62
3019	A-01630-11	D-51872		Sample Ladle Tongs FV-951, Detail Sheet 2	5/21/62
		D-51898		Sample Ladle Tongs FV-951, Assembly	5/21/62
		D-51899		Sample Ladle Tongs FV-951, Detail Sheet 1	5/21/62
3019	A-93809-10	D-50422		Equipment Carriage Basic Detail and Assembly	5/7/62
		D-50423		Pallet Basic Assembly and Detail	5/7/62
		D-50482		Second Floor Plan, Sections and Details	5/7/62
		D-50483		Equipment Shaft, Elevation, Sections, and Details	5/7/62
		D-50484		Vertical Section Looking South, Stair and Platform Details	5/7/62
		D-50485		Second Floor Alpha Seal, Plan and Details	5/7/62
		D-50486		Second Floor Alpha Seal, Sections and Details Sheet 1	5/7/62
		D-50487		Second Floor Alpha Seal, Sections and Details Sheet 2	5/7/62
		D-50488		Second Floor Alpha Seal, Sections and Details Sheet 3	5/7/62
		D-50489		Second Floor Alpha Seal, Detail of Hatch Covers & Plugs	5/7/62
		D-50490		Balcony of Third Floor, Plan and Sections	5/7/62
		D-51200	A	1-in. Feeder Valve, Assembly	5/11/62
		D-51201		1-in. Feeder Valve, Detail Sheet 1	5/7/62
		D-51202		1-in. Feeder Valve, Detail Sheet 2	5/7/62
		D-51221	A	2-in. Feeder Valve, Assembly	5/11/62
		E-52451	A	Remote Welder Subassembly A	5/11/62

(Continued)

Table 6, Continued

Bldg. No.	W.O. No.	Dwg. No.	Rev.	Title	Transmittal Date
3019	A-93809-10, continued	D-53475		2-in. Feeder Valve Carriage Detail and Assembly	5/7/62
		D-53476		2-in. Feeder Valve Pallet Detail	5/7/62
		D-53477		Pallet Special Assembly and Detail	5/7/62
		D-53478		Carriage Clamp Assembly and Installation	5/7/62
3019	A-93809-11	D-50481	A	Cell 4 First Floor Gamma Shield Armor Plate Details	5/7/62
		D-50482	A	Second Floor Plan, Sections and Details	5/7/62
		D-50483	A	Equipment Shaft, Elevations, Sections, and Details	5/7/62
		D-50485	A	Second Floor Alpha Seal, Plan and Details	5/7/62
		D-50486	A	Second Floor Alpha Seak, Sections & Details, Sheet 1	5/7/62
		D-50490	A	Balcony of Third Floor, Plan and Sections	5/7/62
		D-51243		Bag-out Port Detail Sheet 3	5/22/62
		D-51248		Bag-out Port Detail Sheet 1	5/22/62
		D-51249		Bag-out Port Detail Sheet 2	5/22/62
		D-52954		Th-U^{233} Solids Processing Engineering Flowsheet	5/15/62
		D-52955	A	Blend Tank (Vessel C) Assembly and Details	5/14/62
		D-52958	A	Tank and Charging Hood Supports	5/14/62
		D-52963		Tray Dryer Assembly (Vessels G, H, and J)	5/15/62
		D-52964		Tray Dryer Details	5/15/62
		D-52965		Batch Evaporator Assembly (Vessel G)	5/10/62
		D-52966		Batch Evaporator Details	5/10/62
		D-54258		Bag-out Port Assembly	5/22/62
4505	A-70579-17	D-53382		Orbital Shear, Assembly	5/15/62
		D-53383		Orbital Shear, Detail Sheet 1	5/15/62
		D-53384		Orbital Shear, Detail Sheet 2	5/15/62

(Continued)

Table 6, Continued

Bldg. No.	W.O. No.	Dwg. No.	Rev.	Title	Transmittal Date
4505	A-70579-17,	D-53385		Rotary Wire Shear, Assembly	5/2/62
	continued	D-53386		Rotary Wire Shear, Detail Sheet 1	5/2/62
		D-53387		Rotary Wire Shear, Detail Sheet 2	5/2/62
		D-53388		Rotary Wire Shear, Detail Sheet 3	5/2/62
		D-53392		Die Housing Closure for Birdsboro Shear Install. & Details	5/15/62
		D-53393		Die Housing Closure for Birdsboro Shear Detail Sheet 1	5/15/62
		D-53394		Die Housing Closure for Birdsboro Shear Detail Sheet 2	5/15/62
9204-1	A-70442-11	D-43912	A	Cell Cubicle Frame and Support	5/23/62
		D-43913		Mockup, Cell Cubicle Floor Plan	5/23/62

Table 7. Purchase Requisition Status, June 1, 1962

Job No.	Purchase Req. No.	Date Issued	Description
Miscellaneous			
-59	D-0014	3/29/61	U Jet and explosive valve tests
-113	D-0108	2/1/62	Six inertia switches for accelerometer
-30	D-0116	3/12/62	Six 316 SS O-ring gaskets
-135	D-0121	3/27/62	30,000 Pyrex raschig rings
700	D-0124	4/6/62	8 ft of 1/2-in. Hastelloy-C seamless tubing
700	D-0128	4/30/62	Hastelloy-C seamless tubing
700	D-0129	4/30/62	Hastelloy-C plate and bar
700	D-0130	4/30/62	Taper tube expander
-20	D-0131*	5/10/62	Chromalox heating element
700	D-0132*	5/14/62	Assorted lugs and terminals
700	D-0133*	5/16/62	Polyethylene filter pump and hot plate
-20	D-0134	5/21/62	Chain hoist, 1/4-ton
-20	D-0135*	5/21/62	Five toggle clamps
700	D-0136	5/22/62	Three thermometers
605	D-0137	5/23/62	Bonnets and gaskets
-113	D-0138	5/31/62	Four cable assemblies
Waste Calcination			
605	G-1003	6/7/61	Lockheed subcontract
605	G-0119	1/18/62	One 5600-watt furnace tube
605	G-1018	1/14/62	Two limit switches
605	G-1026	5/8/62	Seal rings and blanking hubs
605	G-1027	5/9/62	Two connector assemblies
PRFP - Mechanical			
511	D-6270	3/9/62	Fabricate shear valve
Volatility			
404	D-7019	6/29/61	INOR-8 pipe and tubing
404	D-7022	12/20/61	HyMu 80 plate
TRU - Solvent Extraction Facility			
702	G-7508	2/15/62	Two Lapp Microflo Pulsafeeders
702	G-7510	2/16/62	One diaphragm pump
702	G-7516	3/30/62	Five 1/6 hp electric motors
702	G-7520	4/3/62	Two Hastelloy-C feed storage tanks

(Continued)

Table 7, Continued

Job No.	Purchase Req. No.	Date Issued	Description
TRU - Solvent Extraction Facility, continued			
702	G-7521	4/6/62	Homalite plate for MS
702	G-7524	4/27/62	One "Lo-Hed" electric hoist
702	G-7525	5/9/62	35 Gallons Amercoat
702	G-7526	5/9/62	Woven glass fabric, 40 sq yds
702	G-7527	5/3/62	8 Rolls Acetate tape, Chart Pak
702	G-7528	5/4/62	140 ft 1/4-in. SS tubing
702	G-7529	5/17/62	
702	G-7530	5/23/62	80 Bronze gate valves
702	G-7531	5/23/62	16 Brass ball check valves
702	G-7532	5/23/62	11 SS ball valves
702	G-7533	5/28/62	Six pieces Homalite plate
702	G-7534	5/31/62	Fabricate 500 disconnect plate
BNL-Kilorod Program			
-135	G-7701	1/2/62	Furnace
-135	G-7706	3/5/62	Six alumina crucibles
-135	G-7713	4/27/62	Spare parts, Hevi-Duty furnaces
-135	G-7714	4/30/62	Personnel plastic suit
-135	G-7715*	5/2/62	One piece precision bored Pyrex tube

* Issued and completed in May 1962.

Table 8. Work Order Status June 1, 1962

Number	Job Order Number	Charge Number	Engr.	Date Issued	Cost Estimate	Description	% Complete
3505	A-01619-11	3370-53-0132	FEH	2/21/62	4,113	Install Filter and Pump for Canal	
3505	A-70570-11	3370-53-0132	HBG	7/26/61	15,000	Loading of SRP Carriers	
3508	A-93126-02	3900-40-3370-0028	BFB			Modifications to Vent System	
General Division Programs							
-1	A-41624-41,-61	3370-65-0001	PLR	7/16/59	10,000	General Equipment Repair and Storage for Re-use	
IWW Carrier							
-30	A-93789-30	3902-40-3370-0030	AMR	2/15/62	15,400	Fabricate IWW Carrier	
Fuel Shipping Study							
-113	A-01570-11	3370-53-0113	LBS	9/20/61	12,000	Assistance by B. L. Greenstreet (Y-12) on Cask Drop Tests	
-113	A-01603-11	3370-54-0113	LBS	1/12/62	15,000	Design and Install Cask Drop Pad and Perform Drop Tests	
-113	A-20688-11	3370XX-113	LBS	5/18/62	15,000	Instr. for Cask Drop Tests	
BNL-Kilorod Program							
-135	A-01597-11	3370-53-0135	BBK	12/21/61	1,360	Build Mockup Cell	
-135	A-01634-11	3370-53-0135	BBK	4/5/62	900	Fabricate Experimental Th-U Blending Tank	
Volatility Program							
404	A-01533-11	3370-53-0073	RPM	6/28/61	2,000	Assistance to BMI on VPP Corrosion Tests	
Power Reactor Fuel Processing							
500	(In abeyance)	3370-XX-0020	FEH	3/7/62	5,000	Build Transfer Carrier for HRLAF	
511	A-70579-18	3370-53-0106	WFS	1/10/62	3,115	Design and Build Gamma Monitor System	
511	A-93174-01	3370-92-0106	WFS		171,600	Procure 250-ton Shear from Birdsboro Corporation	
511	A-93174-03**	3902-40-3370-0106	WFS	6/2/60	3,360	Design Auxiliaries for 250-ton Shear	
Waste Program							
603	A-93534-10	3900-40-3632	FEH			Design of Waste Tank and Evaporator	
605	A-01636-11	3370-54-0034	JMH	4/17/62	6,000	Fabricate Two Calcination Pots	
605	A-01638-11	3370-54-0034	JMH	4/24/62	2,500	Fabricate Filling Station Parts	
605	A-01645-11	3370XX-34	JMH	6/23/62	18,000	Fabricate Filling Station & Alternate	
605	A-70604-11	3370-53-0030	HOW	7/26/61	19,300	Fabricate and Install Pot Calcination Hot Cell Unit	
605	A-70604-12	3370-53-0030	JOB	8/28/61	1,980	Fabricate Densimeter and Controlled Rate Steam Jet	
Transuranium Facility							
-108	A-01607-11	3370-54-0108	BFB	1/25/62	1,500	Build Model of TRU Cells	
-108	A-43042-11	3370-53-0108	BFB	2/13/62	10,000	TRU Facility Design Support and Review by E & M	
-108	A-43042-12	3370-53-0108	BFB	2/13/62	5,000	TRU Facility Design Support and Review by I & C	
-108	A-70397-13	3370-53-0028	BBK	7/15/60	4,950	Design and Install Instruments for Transuranium Cell 3 Glove Box	
-108	A-70397-14	3370-53-0028	BFB	12/12/60	39,500	Fabricate and Install Mockup of Intercell Conveyor	
-108	A-70397-18*	3370-53-0028	BBK	5/26/61	5,400	Instrumentation Design and Installation, TRU SOX, 4507 Mockup	
-108	A-70442-11	3370-53-0108	BFB	8/21/61		Assignment of F. L. Hannon to CTD for TRU Mechanical Design	
-108	A-70442-12	3370-53- 0108	BFB	6/19/61	30,000	I & E Assistance for Design of TRU Laboratory 3500	
-108	A-70442-16	3370-53-0108	BFB		25,000	Fabricate Mockup of TRU Transfer Carrier	
-108	A-70489-61	3370-53-0108	WEU	4/25/61		Architect-Engineer Design Assistance, TRU Mechanical Equipment	
-108	A-70611-11	3370-53-0108	FLP	1/8/62		Design of Two Mixer-Settlers	
-108	A-70611-12	3370-53-0108	FLP	1/24/62	3,000	Design Drive for TRU Mixer-Settlers, 4507	
-108	A-70611-20	3370-54-0108	FLP	3/16/62	4,250	Fabricate Mixer-Settler	
-108	A-70615-11	3370-53-0108	FLP	2/2/62	1,120	Design Filters for Cell 4, 4507	

ıble 8, Continued

Job umber	Job Order Number	Charge Number	Engr.	Date Issued	Cost Estimate	Description	% Complete
108	A-70615-12	3370-53-0108	FLP	3/12/62	1,120	Design Transfer Port, Cells 3 to 4, Bldg. 4507	
108	A-70615-13	3370-53-0108	FLP	3/27/62	700	Fabricate 30 Seals for 2-1/2-in. Pipe Sleeves	
108	A-70615-14	3370-54-0108	FLP	4/19/62	1,650	Design Replaceable Manipulator Boot	
108	A-70617-11	3370-53-0108	FLP	2/3/62	280	Design Service Piping Extensions	
108	A-70617-12	3370-53-0108	FLP	2/3/62	1,850	Design Makeup Area Equipment	
108	A-70617-13	3370-53-0108	FLP	2/3/62	1,120	Design Solution Addition Glove Box	
108	A-70617-14	3370-53-0108	FLP	2/3/62	560	Design Pipe Sleeve Inserts	
108	A-70617-15	3370-53-0108	FLP	2/3/62	1,400	Design Service Piping, Makeup Area	
108	A-70617-21	3370-53-0108	FLP	3/16/62	4,010	Fabricate 500 Lead Bricks	
108	A-70617-22	3370-53-0108	FLP	4/9/62	7,500	Modifications to Cell 4, Bldg. 4507	
108	A-70617-23	3370-53-0108	FLP	4/9/62	600	Fabricate Two Disconnect Clamps	
108	A-70617-24	3370-XX-0108	FLP	5/2/62	1,100	Fabricate Hastelloy Pipe	
108	A-70617-25	3370-XX-0108	FLP	4/27/62	3,700	Install Shielding Support in Cell 4	
108	A-70617-26	3370-XX-0108	FLP	5/2/62	4,200	Install Piping for T-416 and T-417	
108	A-70618-11	3370-53-0108	FLP	1/24/62	14,000	Design Equipment Removal Cubicle, 4507	
108	A-70619-11	3370-53-0108	FLP	1/24/62	9,680	Design Sample Removal Cubicle	
108	A-70620-11	3370-53-0108	FLP	2/3/62	2,240	Design In-Cell Service Piping	
108	A-70620-12	3370-53-0108	FLP	2/3/62	560	Design Electrical Sleeve Inserts	
108	A-70621-11	3370-53-0108	FLP	2/8/62	840	Design Carrier for Sample Cubicle	
108	A-70622-11	3370-53-0108	FLP	2/3/62	1,680	Design Electrical Equipment for TRU Solvent Extraction Facility	
108	A-70623-11	3370-54-0108	FLP	1/16/62	5,344	TRU Instrumentation Design, Solvent Extraction Facility, 4507	
108	A-70623-12	3370-53-0108	FLP	1/16/62	9,403	Procure Instruments for TRU Solvent Extraction Facility	
108	A-70623-13	3370-53-0108	FLP	2/21/62	5,347	Fabricate and Install Instruments for TRU Solvent Extraction Facility	
108	A-70625-11	3370-53-0108	WDB	4/12/62	11,800	Fabricate Experimental Pulse Column Set	
108	A-70625-12	3370-XX-0108	WDB	4/23/62	500	Fabricate Test Parts for Mixer-Settler	
108	A-70627-12	3370-53-0108	EJB	4/3/62	180	Fabricate Parts for TRU Disconnects	
108	A-70627-13	3370-53-0108	EJB	4/3/62	200	Fabricate Model of TRU Disconnect	
108	A-70627-14	3370-53-0108	WDB	4/9/62	150	Roll Tantalum and Hastelloy-C Tubing	
108	A-70633-11	3370-XX-0108	WDB	5/4/62	14,000	Pre Title II Design Studies for TRU Chem. Proc. Instr. (Replaces A-70442-12)	
108	A-70660-11	3370-53-0108	FLP	4/16/62	2,600	Fabricate One 16-Stage Mixer-Settler	
108	A-70666-11	3370-XX-0108	BFB	5/2/62	10,000	Assignment of F. L. Hannon to TRU Mech. Design Studies	
108	A-70666-12	3370-XX-0108	BFB	5/2/62	1,500	Fabricate Model of TRU Cells	
08	A-70667-11	3370-XX-0108	FLH	5/16/62	34,000	Design Equipment Transfer System	
08	A-70668-11	3370-XX-0108	FLH	5/16/62	4,400	Design Cell Cubicle Components	
08	A-70669-11	3370-XX-0108	FLH	5/16/62	8,500	Design Transfer Area Cubicle Carrier Parts	
08	A-70670-11	3370-XX-0108	FLH	5/16/62	3,400	Design Manipulator Booting Assemblies	
08	A-70671-11	3592-	WEU	5/3/62	30,000	Assignment of B. N. Robards to TRU Critical Path Scheduling	

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