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PROCESS DESIGN SECTION STATUS REPORT FOR AUGUST 1961

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 August 1961. The four major projects discussed are Transuranium, Volatility, Power Reactor Fuel Processing, and Waste Studies. 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.

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1.0 TRANSURANIUM PROGRAM
(W. E. Unger)

1.1 Transuranium Laboratory, Bldg. 7920 (B. F. Bottenfield, E. J. Breeding, G. B. Berry)

The facility numerical designation has been changed from 7511 to 7920. All drawings and specifications will be changed to reflect this change.

Meetings were held with the Architect-Engineer, Catalytic Construction Company, in Philadelphia on August 9 to 11, 1961, to redefine the scope of the proposed facility at a $14,000,000 level. The increased scope includes the addition of two shielded cells for special chemical separations, an increase in bulk shielding of the cell bank to 6 ft of magnetite concrete, addition of two laboratories and increase in auxiliary space, amounting to an increase of approximately 50% to the present unshielded building space. Catalytic is to complete a revised conceptual design report and cost estimate by November 7, 1961. The redesign will require about 35 new drawings.

Catalytic's effort on the conceptual design and arrangement of the cell target fabrication equipment for the Transuranium Facility is being terminated. A design group from K-25, functioning under the guidance of the ORNL Metallurgy Division, will assume this responsibility and has initiated detailed design of equipment for development studies at ORNL.

1.2 Transuranium Project Cost Estimates (B. F. Bottenfield, W. G. Stockdale)

A preliminary cost estimate, made jointly by the Commission and ORNL for budgetary purposes, has been submitted to the AEC at $14,000,000. This total includes the estimated cost of all the chemical and target fabrication processing equipment, laboratory equipment, and supplemental carriers and handling equipment, as well as the revised building and cell structure. This number is rough and is intended only for interim use until Catalytic's conceptual design estimate is available on November 7, 1961.

An estimate of the equipment costs for the Transuranium Facility varied from a low of 5.4 million to a high of 6.4 million dollars, depending upon whether all cells and laboratories were fully equipped at the end of initial construction. These estimates must be considered preliminary pending rechecking of the various sections of the estimates and review of the preliminary design.

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

Intercell Conveyor. Life testing of the conveyor is continuing. Design of a control to actuate automatically the lifting and lowering mechanism as well as the dolly drive is in progress to evaluate better all operations of the conveyor system. Fabrication of the chain length simulator and the automatic port closure is under way.

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Modifications are being made on the portable control station to provide a reduction of the number of positions on the switch and a better indication of dolly location.

Equipment Removal System. Detailed design of the equipment transfer case is in progress, and preliminary design of the transfer station and associated components has been started. Equipment rack handling within the cell cubicle is being studied. A partial mock-up of the transfer case has been built to study and evaluate the door operation. Desirable modifications will be included in the detailed design.

Cell Cubicle. New drawings have been prepared to show which portions of this item will be designed by the Architect-Engineer and which portions by ORNL; clarification of certain construction details has been included. Detail design is continuing on a mockup of the cubicle to duplicate more closely the present concept. This will replace the existing cubicle mockup in Bldg. 4505.

1.4 Process Equipment Studies (W. D. Burch, J. E. Bigelow, O. O. Yarbro)

The month of August was spent in revising flowsheets and equipment layouts to conform with the increased scope of the project.

1.5 Transuranium Shielding and Hazards Studies (J. P. Nichols)

Shielding Studies. Studies have been made of methods for estimating the spontaneous fission neutron attenuation properties of glass windows which contain little or no hydrogeneous material. Multigroup IBM-7090 neutron transport calculations have been correlated with experimental data on thin sections of glass and thick sections of dehydrated concretes to provide approximate methods for estimating the neutron spectrum as a function of glass thickness for a given neutron source strength. These methods have been applied to evaluate the neutron shielding effectiveness of existing Bldg. 4507 cell windows and the proposed TrU cell windows after an inadvertent loss of oil.

It is estimated that the outside surface of a window consisting of 48 in. of 3.3 glass and 2.5 in. of oil, such as a 4507 cell window, would survey approximately 0.25 mrem/hr of predominantly resonance energy neutrons for an SF neutron source of 5×10^8 neutrons/sec located 1 ft from the inside face. This neutron source strength would correspond to approximately 170 μg californium obtained by MTR irradiation, or 55 μg californium obtained by HFIR irradiation assuming that the HFIR Cf^{253} capture cross section is 3 barns. Ten inches of supplementary water shield placed on the inside of the 4507 window would cause the surface dose rate from 1 mg of HFIR produced californium to be approximately 0.25 mrem/hr.

An SF source that would cause a surface dose rate of 0.25 mr/hr in the current 6-ft-thick, glass-oil-Plexiglas TrU window would cause a dose rate of approximately 1 rem/hr after loss of the oil. If oil were substituted for the Plexiglas in the window and this oil were also inadvertently lost, the outside surface dose rate would be approximately 100 rem/hr.

Hazard Evaluation Studies. Hazard evaluation studies indicate that the downwind personnel exposures and fallout levels arising from the maximum credible accidents in the TrU Facility are within safe limits. Since the secondary containment region, which surrounds the alpha laboratories and cells, is to be maintained at a vacuum of -0.3 in. w.g. at all times, there is essentially no mechanism for a release of activity to the atmosphere except through filtered ventilation streams, even in the maximum credible glove box or cell cubicle rupture. The filter removal efficiency and atmospheric dilution factor are adequate to protect the environment in these maximum credible accidents.

Although the hazard presented to the environment by TrU is small, the hazard to the TrU operating personnel is large. Alpha laboratory personnel could inhale a lethal quantity of actinides in a single breath in the event of the maximum credible glove box rupture or a spill from a carrier rupture. This hazard will be combatted by limiting glove box and transfer operations to those which have an adequately low probability for dispersing activity within the building.

1.6 Transuranium Development Facilities at Bldg. 4507 (B. B. Klima, F. L. Peishel)

Design of the Pa-U program facility was completed.

Because the solvent extraction separation of actinides and rare earth fission products now appears quite feasible, design of experimental units for head-end and solvent extraction development in Cells 3 and 4 of Bldg. 4507 has taken precedent over the former ion exchange facilities; and design of equipment, using solvent extraction, was begun. The existing ion exchange equipment will be put in standby and a report will be issued summarizing the design of the ion exchange facility and proposed modifications which appeared desirable following the 4507 mockup tests.

Under present plans the Am and Cm from the Cell 1 Pu-Al processing raffinate will be recovered first; then Am targets and possibly Cm targets irradiated in the MTR will be processed. The head-end equipment for the latter operations will be installed in Cell 3 and the solvent extraction equipment for all separations in Cell 4. A schedule for the operation and design of these facilities has been issued. The necessity for obtaining data to be utilized for the design of TrU-CP equipment requires that Cell 4 equipment be installed by mid-1962 and Cell 3 facilities by the end of 1962.

After completion of the above programs, a study will be made to determine the feasibility of adapting these cells to the processing of a HFIR target that has been irradiated for six months.

A design criteria memo was issued explaining the proposed method of installation and operation of the Cell 4 equipment for recovering the Am-Cm from the Cell 1 Pu-Al processing raffinate. This same solution will be used for testing the proposed TrU-CP solvent extraction flowsheet. The memo assumed the use of a completely removable

cubicle which is no longer valid for Bldg. 4507 or the TrU-CP under revised layout criteria. In addition, it was decided to operate Cells 3 and 4 together as a processing complex.

It is now planned to design these cells to allow remote removal of all major equipment items via a transfer box. The equipment will be installed in a modular arrangement utilizing disconnects to effect easy removal and revision. This will permit flexibility equivalent to laboratory type operations.

2.0 VOLATILITY PROGRAM
(R. P. Milford)

2.1 Volatility Pilot Plant Service

INOR-8 Procurement. The Division's order for INOR-8 plate, sheet, and rod was placed with Haynes Stellite Company on August 31 for delivery by October 13, 1961. The order totalled $10,824.40 for an estimated 2746 lb of metal. An apparently satisfactory bid for 300 ft of 3/8-in. Schedule 40 pipe and 150 ft of 1/4-in.-o.d. x 0.035-in. wall tubing has been received from Wall Tubing, Newport, Tennessee. The costs are $13.50 and $6.05 per ft, respectively, with an expected February 1962 delivery date.

2.2 Volatility Economic Studies

A preliminary flowsheet which indicates the major processing vessels and includes material and energy balances has been issued for the economic evaluation of a full-scale volatility plant.[1] This first-issue flowsheet was essentially a scale-up of the Volatility Pilot Plant and is thought to be a good starting place for flowsheet development, since the present plant is presumed to be functional. Modifications to this basic VPP flowsheet which have been investigated in the interest of achieving a minimum cost operation are as follows:

1. The basic salt cost for processing 1 gram of U is $0.09 if 37.5 LiF--37.5 NaF--25.0 ZrF_4 is recycled to obtain the initial Zr charge, as opposed to $1.30 if the salt is used on a once-through basis. Using 37.0 LiF--50.5 NaF--12.5 BeF_2 on a once-through basis, a salt cost of $0.18 per gram of U is predicted. The conceptual plant was selected to use the recycle basis.

2. Material balance considerations, based on the use of a 30-fold excess of F_2, indicate that an 84% recovery of F_2 may be realized if a F_2 recycle system were installed. Annual savings in chemical costs of F_2 and KOH would be $11,000.

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[1] W. E. Dunn to W. H. Lewis, "Preliminary Flowsheet for a Full-scale Volatility Plant (First Issue)," (August 21, 1961).

The basic equipment cost of a diaphragm compressor and F_2 storage tank was estimated to be $24,000, and the over-all increased plant capital investment with the recycle system was $140,000 using the factor method of costing outlined by Chilton.[2] If the system cost were depreciated over a 10-year period, the savings in chemical costs would be outweighed by the depreciation charges of the recycle system. Thus, the operation of a F_2 recycle system appears uneconomical. Liquid waste storage volume from the F_2 scrubber would be less if the plant were operated with a F_2 recycle system; however, this cost was not assumed to contribute significantly in the recycle evaluation.

3. An appreciable reduction of liquid waste volume can be obtained if a 45 wt % KOH rather than a 10% KOH solution is used in the HF neutralizer. Solubility limits[3] of the KF-KOH-H_2O system would not be exceeded if an initial batch of 45% KOH is completely neutralized. However, there is some indication that gel formation occurs.[4] Experimental investigation regarding the feasibility of using 45% KOH for the neutralizer is warranted. A study of the effect of increased viscosity on contacting efficiency should be included in the experiment.

4. A charcoal burner[5] is being considered as an alternate means of F_2 disposal as opposed to the F_2 scrubber. Preliminary heat transfer calculations indicate a maximum skin temperature of 450°C in an uncooled charcoal reactor. Intuitively, the economics appear to be strongly in favor of the charcoal burner reactor. The safety factor seems controlling.

5. Savings in refrigeration and heating requirements would result if a portion of the HF vapor stream from the reboiler were superheated, compressed, and stored as vapor for return to the hydrofluorinator. The merit of this plan is dependent upon the feasibility of a high capacity (2000 scfh) HF vapor compression system.

2.3 Assistance from BMI and Metallurgy Division

Molten Salt Corrosion Studies at BMI. A letter report was received summarizing the corrosion resistance of Hastelloy X, tungsten, and a tungsten--5 Ni--5 Cu alloy

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[2] C. Chilton, Cost Engineering in the Process Industries, p. 304, McGraw-Hill Book Co., Inc., New York (1960).

[3] E. W. Mautz, "Solubility of KF, NaF, and NH_4F in H_2O, Their Respective Hydroxides-H_2O, and HF-H_2O Systems. A Compilation of Data from the Literature," NLCO-730 (1958).

[4] J. L. Whitten, "Volatility Pilot Plant Modifications - Design Criteria for FV-1009, An Aqueous Neutralizer for Hydrofluoric Acid," CF-58-10-108, October 1958.

[5] H. W. Schmidt, "Design and Operating Criteria for Fluorine Disposal by Reaction with Charcoal," NASA Memo 1-27-59E (February 1959).

under hydrofluorination conditions in molten NaF-LiF, at 700°C, while ZrO_2 was being dissolved.[6] Issuance of the memo on HyMu 80 fluorination corrosion awaits completion of one photomicrograph.

The results of the test to check the corrosion resistance of L-nickel to 27.5-27.5-45 mole % NaF-LiF-ZrF_4 at 500°C with periodic additions of UF_4 during fluorination are presented in Table 1.

Table 1. L-Nickel Fluorination Corrosion Results

	Penetration, mils/month		
	Weight Loss	Micrometer	Metallograph
Vapor	0.1-0.2	Not detectable	5
Interface	2.8-3.8	12	27
Liquid	0.8-1.3	Not detectable	25

Very little difference in the corrosion resistance of INCO 41 and 61 weld metal deposits was noted, although the latter may have been slightly better. The L-nickel fluorination data presented is the third in a series of tests to compare INOR-8 and HyMu 80 with L-nickel, the current material of construction for the fluorinator. Comparative data for the three metals are shown in Table 2.

Table 2. Comparison of INOR-8, HyMu 80, and L-Nickel During Fluorination

Conditions: 27.5-27.5-45 mole % NaF-LiF-ZrF_4
500°C, 150-hr run, UF_4 additions

	Penetration, mils/month			
	INOR-8 (wt loss)	HyMu 80 (wt loss)	L-Nickel (wt loss)	L-Nickel (Metallographic)
Vapor	< 0.1 - 4.7	0.1 - 0.5	0.1 - 0.2	5
Interface	7.3 - 11.2	2.5	2.8 - 3.8	27
Liquid	6.9 - 11	1 - 2	0.8 - 1.3	25

[6] F. W. Fink, P. D. Miller, and E. L. White, "Corrosion Investigation of Hastelloy X and Tungsten During Dissolution of ZrO_2 with HF" (July 31, 1961).

Metallographic examination of INOR-8 and HyMu 80 showed essentially no intergranular attack as compared to a significant rate of attack for L-nickel in the liquid and interface areas.

While HyMu 80 continues to appear favorable as a fluorination metal, procurement of tubing apparently will be difficult. Three companies submitted "no-bids" in response to our preliminary inquiry for HyMu 80 tubing and pipe with letters promised from two of them.

Memo and Paper Status. The CF memo on hydrofluorinator and fluorinator corrosion after 14 dissolution runs has been completed. A draft of the Electrochemical Society paper on Volatility corrosion for presentation in Detroit on October 2 has been completed and slides are in process of preparation.

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

3.1 Trilaurylamine Extraction of Plutonium (E. L. Nicholson)

The proposed trilaurylamine plutonium tail-end flowsheet was evaluated with respect to waste production and equipment requirements. The flowsheet was compared with (A) the current two-cycle Purex tail-end TBP extraction cycle for plutonium followed by continuous anion exchange and evaporation of the plutonium product and (B) the batch anion exchange purification of the plutonium stream from the partitioning column. The TLA system assumed processing of the IBP stream, discard of acetate-containing solutions, neutralization of the amine salt after each pass through the solvent recovery system, diluent washing of the IBP before feed preparation, and of the TLA system aqueous product before final evaporation. Batch anion exchange assumed dilute fluoride with aluminum nitrate added as corrosion inhibitor in feeds and resin washes and "heat kill" of the trivalent plutonium in the IBP stream. The waste comparison results are approximately as follows:

	TLA	Purex A	Purex B
HNO_3 process wastes, relative volume	30	37	67
HNO_3 process wastes, M	2.4	3.0	7.2
$SO_4^{=}$, Na^+, Fe^{+++} moles in HNO_3 process wastes	3.5	3.8	1.7
Al^{+++} and F^-, moles in HNO_3 process wastes	0	~0.2	1.6
Solvent recovery wastes, relative volume	4.8*	0.4	0

* Includes volume and moles of HNO_3 plus acetic acid from neutralization and disposal of final product evaporator condensate with the solvent recovery systems.

	TLA	Purex A	Purex B
Na, moles in solvent recovery wastes	7.8	~0.03	0
Acetate, moles in solvent recovery wastes	2.6*	0	0
Diluent stripping of feed and product solutions	Probably	No	Probably not

Rough comparisons of equipment requirements indicate that the complete TLA and Purex A systems require about the same number of equipment items, while the Purex B requires much more. Geometric safety and the operational advantage of a continuous system are best for the TLA and Purex A systems. The TLA system has a bad solvent recovery waste situation because of the requirement to neutralize the amine salt. However, this may result in a more effective removal of activity from the solvent than with the TBP solvent systems. Plutonium is routinely recycled in Purex A raffinates and probably would be required with the B system.

All the preceding comments are speculative as the TLA flowsheet is not yet demonstrated, and the comparisons are based on using optimum demonstrated Purex systems.

3.2 Pu-Al Processing Facility, Bldg. 4507 (E. J. Frederick)

Installation of equipment continued but at a less accelerated pace due to a shortage of craftsmen. Priority was given to completing the in-cell equipment modifications to permit the operating group to initiate cold equipment testing. All in-cell work is now completed except for the installation of the lead shielding over the pit tanks and around the slug chute and providing sample points in the resin discharge line and vessel off-gas system. The viewing glass has been installed in the product glove box and containment covers have been installed over the cell hatch openings. This completes all of the work in the gallery.

The dry well located at the southeast corner of the waste storage pit has been completed and the sump pump installed. Solid rock was encountered at the 12-ft level during drilling operations; hence the pit depth is 3 ft short of the specified 15 ft. This should present no problem, however, since the level of the well is about 1 ft 10 in. below the foundation of the pit.

The stainless steel liner has been installed in the deep part of the waste storage pit. Installation of 4 in. of lead shielding around the periphery of the pit is near completion.

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* Includes volume and moles of HNO_3 plus acetic acid from neutralization and disposal of final product evaporator condensate with the solvent recovery systems.

The installation of the T-30 waste storage tank is scheduled for early in September. It is anticipated that the entire installation will be completed during September so that the completed facility can be turned over for operation around October 1, 1961.

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

Shipment of Fuel from Atomics International. The third and final shipment of fuel was received from Atomics International on August 7. The shipment contains three complete and three partial fuel assemblies and a canister of irradiated fuel samples for experimental work.

Atomics International has asked for verification of the contents of the partial assemblies due to uncertainties existing in their inventory records. They have also requested samples of the NaK with a "putty-like" consistency which appeared to be in a solid state.

Atomics International also reported that they have no pre- or post-irradiation hardness data on the fuel, but they believe the pre-irradiation hardness to have been around R_C 20. No complete unirradiated Core 1 fuel elements are on hand, although some individual rods may exist.

Segmenting Cell Activities. During the past month 60 fuel rods, or approximately 8-1/2 fuel elements, were processed at an average rate of 6.96 kg U/hr; the maximum rate obtained was 10.3 kg U/hr and the minimum rate was 4.6 kg U/hr. These rates are based on actual operating time and omit the time used to make special measurements on the jackets and slugs, the taking of photographs, and equipment maintenance. Based on a total elapsed working time for the month, the average processing rate was 3.22 kg U/hr.

The maximum processing rate of 10.3 kg U/hr, or one element in 6.7 hr, exceeds the estimated minimum processing rate of one element in 8.8 hr stated in the paper prepared for the AEC Symposium at Richland, Washington, in October 1959 (TID-7583, p. 394). The maximum rate was obtained on an element in which three of the seven rods were processed by hydraulically flushing out the slugs.

The equipment, in general, has been operating above the limits for which it was designed. Nevertheless, very few mechanical failures have been experienced. Undoubtedly, the average processing rate could have been increased by a factor of at least 2 to 3 if the properties of the stainless steel jacket had not differed so radically from those predicated by Atomics International and other sources based on tests made on irradiated stainless steel specimens. Physical, chemical, and metallurgical examinations of selected jackets are not yet complete. Based on cold work, jacket expansions from 30 to 80 mils under 1300 to 1600 psig hydraulic pressure were measured which allowed hydraulic removal of slugs warped up to 25 mils. Little or no expansion was achieved on the majority of the irradiated fuel processed to date. The following measurements were made on fuel element A-21 processed on August 29, one of the elements where consistently high expansion pressures were obtained.

Rod No.	Hydraulic Pressure, psig	Average mils Expansion
1	2600	7.5
2	2500	5.1
3	2450	3.0
4	2400	2.8
5	2500	2.8
6	2100	4.1
7	2450	3.0

This, incidentally, is also the element for which the maximum processing rate was obtained.

In-cell maintenance was performed three times during the month. The canning machine was inspected in the cell and later was removed from the cell remotely for out-of-cell maintenance. This was definitely an error in judgment for the repair required, since the only repair necessary was an adjustment of the lift platform, a matter of 1 hr total time. After repair, during the return of the canner to the cell, the lifting yoke broke, allowing the canner to fall. The lifting yoke was designed as a welded assembly, but was actually secured by only two small machine screws. This deficiency was not noticed during the original installation. The canning equipment was damaged and a total of three days was lost before the equipment was reinstalled for operation.

The steam lance had to be replaced for the second time as a result of line plugging. At the same time the pusher cylinder expander was serviced. Both of these repairs were relatively simple, since the craftsmen were experienced in previous servicing.

The third in-cell repair was required to replace the NaK reactor dump valve which began to leak during a run. A piece of wire used in an attempt to clean the steam lance during previous maintenance had apparently been broken off in the reactor and became lodged in the dump valve liner (Teflon), damaging the liner and causing leakage. Even though NaK leaked and ignited, no serious difficulty was experienced.

During this period two canister caps could not be removed, even with the use of the 1-in. impact wrench, and had to be removed by pulling the canister into the cell and sawing off the cap. In the past we have experienced sieges of broken saw blades sometimes as high as one per fuel assembly; the present saw blade has cut two canisters and five elements and is still serviceable.

The improvements in operation during the past month are largely attributable to the skill achieved by the operators. They are now much easier on the equipment, which is evident by the increased length of service-free performance of manipulators, booting, and saw blades.

Processing of the nineteenth fuel element was completed during the month. Four

complete assemblies and three partial assemblies, consisting of six fuel rods and one cut rod, remain to be processed. It is estimated that the operation will be completed during the third week of September.

Current planning is to remove all SRE processing equipment from the cell after preliminary decontamination. After further decontamination, the equipment will be prepared for storage and stored in the operating area of the Metal Recovery Building.

In-cell maintenance to date has totaled 108 hr. This time was accumulated when the personnel passed through the charging room door; however, the time spent in the actual radiation field is less. The total dose received was 5097 mr, which averages 0.79 mr/min and 124 mr/man. The average working background was 418 mr/hr, the maximum 4000 mr/hr, and the minimum 60 mr/hr.

Shipment of Fuel to Savannah River for Processing. An AEC directive, ORO-110707, "Shipment of Declad SRE Core 1 Slugs," dated June 22, 1961, calls for shipment of the declad SRE Core 1 fuel to the Savannah River Plant for chemical processing. Discussions with Savannah River personnel during the past several months, which resulted in the above directive, resulted in agreement to ship the fuel in sealed aluminum canisters, each containing three cans of fuel for a total of 36 fuel slugs or ~29.6 kg U. Two canisters can be shipped in the ORNL 50-in. carrier. SRP operations originally requested that the canisters be sealed by brazing or welding; however, they have agreed to accept a mechanical closure employing a tapered joint, gasket, or other sealing device. Sketches are being prepared for a prototype canister for test and examination. Fuel shipments are to start in January 1962.

Chop and Leach Program. Installation of the services to the shear were completed during the early part of the month. Two representatives of the Birdsboro Corporation visited the Laboratory to assist in the initial checkout of the shear. Some preliminary difficulties in the setting of the hydraulic controls were encountered which resulted in the rupturing of the hydraulic lines at the fittings. After the controls were properly set, the shear was satisfactorily placed in operation. A prototype test bundle was successfully sheared to a residual length of approximately 2 in. using one of the new model experimental gags.

Movies and photographs of the shear were taken in preparation for the Annual Information Meeting in September.

The leacher and conveyor are still not complete in the shop, but are promised early next month.

4.0 WASTE STUDIES
(J. O. Blomeke)

4.1 Plant Waste Improvement Studies (F. N. Browder)

Clinch River Diversion Study. A study was made to determine the economic feasibility of bypassing 10% of the flow of the Clinch River, after Melton Hill Lake is established, through Melton Valley to dilute ORNL radioactive waste discharges to MPC_W levels in the creek behind White Oak Dam. A memorandum submitted to F. R. Bruce explaining the results of the study indicated that it would cost considerably more to make this proposed diversion than to provide treatment facilities to decontaminate ORNL process waste sufficiently to achieve MPC_W levels in White Oak Creek without the additional dilution. The major requirements for the proposed river diversion scheme were:

1. A channel over 6000 ft long with cuts ranging from 40 to 60 ft deep over 50% of its route would be required to move water by gravity from the nearest arm of Melton Hill Lake to Melton Branch. A bridge would have been required to get the Fast Burst Reactor access road over the channel.

2. A gate at the upper end of the channel to permit shut-off and to accommodate varying levels in the lake would be required. The course of Melton Branch would have required widening and straightening over its entire length (about 2 miles) to accommodate the greatly expanded normal flow (from the present 11 cfs to 50 cfs or 500 cfs, the two flows considered).

3. The radioactive mud in the basin behind White Oak Dam would have to be removed to avoid sweeping undetermined quantities of strontium-90 into the Clinch by the expanded flow. An alternative to dredging the basin would be the construction of a bypass channel around the basin and dam to protect the radioactive mud from normal creek flow.

Recirculation of Low-level Waste. A description of a proposed total recirculation scheme for ORNL low-level waste was prepared and sent to Frank L. Parker at the International Atomic Energy Agency in Vienna, Austria. This agency's Health, Safety, and Waste Disposal Division had expressed interest in the scheme and had requested the inquiry from Parker. It was pointed out that the demineralization treatment step of the total waste recirculation proposal might be applied to other sites more effectively than at ORNL because of the complexity of the existing piping arrangement at the Laboratory, which directs only about 20% of process water to the process waste system. The other 80% has so little chance to become radioactively contaminated that it is directed to sanitary or storm sewers and thus bypasses the process waste system entirely.

The present ORNL arrangement adversely affects the total process waste recirculation proposal if all process water is recirculated. Under the total recirculation system, the

heavy load on the demineralization system would occur during the first few passes through the system because the dissolved natural solids in the water far exceeds the amount added by the users. Thus, once demineralized, the load on the cleanup system would be relatively light. With the present ORNL plant piping layout, about 80% of this advantage would be lost if the demineralized process waste were recirculated into the ORNL system into which large volumes of undemineralized water would be added. Thus, if such a system were employed at ORNL, the Laboratory would be faced with either a large capital expenditure to reroute piping or a large operating expense if the piping remained unchanged.

4.2 Revisions to Plant Waste System (F. E. Harrington)

Drafting was completed and revised drawings were issued which reflect the current plans for the proposed waste tank and evaporator and the Melton Valley waste collection and transfer system. The preliminary proposal for this project was issued by Engineering and Mechanical Division, was reviewed, rewritten in part, and returned for changes.

4.3 Ion Exchange Pilot Plant (J. M. Holmes, W. R. Whitson)

The installation of the Low-level Waste Pilot Plant in Bldg. 2528 was completed except for the feed line from the lime-soda plant and a portion of the instrumentation. At present, shakedown tests are under way on the flocculator and clarifier using Oak Ridge tap water for feed. The Eimco-Burwell plate and frame filter is only being used temporarily to determine general filterability of the treated water, since it cannot be used when the plant processes contaminated water without extensive containment modifications. Present plans call for replacement of this filter with a more suitable unit when the facility goes hot. An enclosed vacuum filter will probably be used for this service during hot operation and efforts are now under way to locate a suitable continuous vacuum filter.

4.4 Pot Calcination Hot Cell Facility (H. O. Weeren)

A preliminary design of the calciner vessel to be used in hot cell pot calciner tests has been completed. This vessel, 4 in. dia x 24 in. long, will be located in an electric furnace and will be used for evaporation and calcination of the wastes. It will be replaced after each test by a new vessel. It is planned to ship wastes from HAPO and the Idaho Chemical Processing Plant in the proposed IWW liquid waste carrier or to utilize wastes produced in Bldg. 4507 operations for feed for these experiments.

Evolution of mercury and mercuric compounds has been found to be a problem in cold calcining experiments. The mercury is driven off from the waste during calcination and condenses in the relatively cold piping connections immediately above the calciner pot, where it would be troublesome during long-term storage. In the proposed hot cell equipment, the piping connections immediately above the calciner pot will be kept heated to a temperature above the condensation temperature of the mercuric compounds (450°C) to determine whether mercury and its compounds can thereby be driven out of the calciner pot entirely.

Feed solution will be charged to the equipment from the IWW carrier now in the final design stages. This transfer can most conveniently be made from the roof of the cell; an enclosed box will be required here for containment in the event that a leak occurs.

4.5 Pot Calcination Pilot Plant (J. M. Holmes)

Preparation of chemical flowsheets for the waste calcination pilot plant to be located in Cells 2, 3, and possibly 1 of the ICPP hot pilot plant is in progress. A total of eight flowsheets will be made: one batch and one continuous flowsheet each for the processing of TBP-25, Darex, high sulfate Purex, and low sulfate Purex process wastes. Since TBP-25 process waste calcination will be the first tested at Idaho, this flowsheet is receiving prime attention. However, since the equipment must be sized for maximum flow rates, feed rates for all of the processes must be determined before equipment design can be started.

Laboratory data on vapor-liquid equilibrium, density, boiling point, and ruthenium volatility for each feed solution are being analyzed for use in process calculations. These calculations are necessary in order to define operating conditions which will minimize the volatility of ruthenium with a minimum of stripping water added to the evaporator. Optimization of the stripping water requirement is necessary because it will determine the size of the rectification equipment. Tentative operating conditions proposed for TBP-25 batch and continuous calcinations are as follows:

TBP-25 feed: from ICPP tank WM-182
Pot size: 12 in. dia x 6 ft active length
Volume of feed/pot: 210 gal
Volume of cake: 33.5 gal
Stripping water/feed ratio: 2.4-4.0 lb/lb feed
Total feed time: 17.5 hr
Total time for calcination: 30 hr
Evaporator DF for entrained solids: 10^5
Minimum evaporator DF for ruthenium: 200
Organic content of feed to calciner: <0.1%
Activity in condensate from fractionator:
gross gamma ~ 1200 d/min/ml
gross beta ~ 3100 d/min/ml

The design of mechanical equipment for demonstration of the pot calciner positioning, connecting, and sealing procedures is about 60% complete. The equipment is sized for testing at either the Lockheed Nuclear Products cells at Dawsonville, Georgia, or for the ICPP hot pilot plant Cell 2. A contract for the demonstration has been presented to Lockheed but cannot be consummated until the Air Force agrees to a lease of the Dawsonville facility to Lockheed. ORNL has set a deadline of September 30, 1961, for their proposal.

5.0 MISCELLANEOUS PROJECTS

5.1 Safety and Containment

Building 4507 Containment (A. M. Rom). Additional caulking of the penthouse seams, particularly around the ceiling line and the gantry crane door frame, was done in an effort to improve leak-tightness. The "Q-panel" flutes at the east and west penthouse ceiling line were filled with cut pieces of fiber glass, then primed with "traffic yellow," followed by cocoon. Leak-tightness was improved but still not satisfactory, and additional work is in progress in order for the penthouse to meet the required specification of 0.3 in. ΔP (H_2O) within 20 seconds after a "containment" signal.

Initial testing of Cell 2 leak-tightness revealed an inleakage rate that exceeded the permitted 0.6 cell volume per hour with a 2 in. ΔP (H_2O) across the cell walls. Several days were then spent in sealing unsuspected openings and cracks to reduce the inleakage to the permitted level.

All pressure drop instrumentation was installed and is now undergoing final adjustments. Containment radiation instrumentation was about 60% completed. Installation of the containment radiation instrument panelboard was begun, as well as installation of the radiation monitor in the process waste header located in the 4505 cold tunnel. Delivery and installation of the extra constant air monitors required for the building were also incomplete at the end of the month.

Metal Recovery Canal (F. E. Harrington). Work Order A-70570-12F was issued to install a cleanout jet at the canal discharging to W-5. The required work is scheduled for October 9 to October 19. Actual cleanout will immediately precede the first shipment of BNL fuel to SRP.

A memo containing information on the number of carriers to be shipped to SRP and the expected heat and activity content per carrier was written, reviewed locally, and transmitted to SRP for their review, comment, and approval.

Building 3106, Air Filters for Bldgs. 4501, 4505, and 4507 (W. G. Stockdale). Instruments for pressure drop measurements are now being installed with completion scheduled for September 15, 1961. This will complete Directive CL-232 with an underrun of authorized expenditures of approximately $10,000. The total cost of the project is approximately $185,000. A project report will be issued following completion of construction.

HRLAL Cell Ventilation Filter System, Bldg. 3019 (W. G. Stockdale). Construction of this facility by the Hixon Construction Company was 94% complete at the end of August. Scheduled completion date by the contractor is October 15, 1961. ORNL forces will receive beneficial occupancy shortly after September 1, with scheduled operation of the filter by September 20, 1961.

Building 3019, Sample Gallery Ventilation (W. G. Stockdale). Design of a ventilation system for the sample gallery in Bldg. 3019, under Work Order A-01546-11, is scheduled for completion October 15, 1961.

Shielded Carrier for Cell Ventilation Filter Removal (W. G. Stockdale). The preliminary study is complete on a shielded carrier for the removal of hot filters from the cell ventilation systems servicing the Chemical Technology Division facilities. The carrier will have the equivalent of 2 in. of lead shielding to provide a surface dose rate of less than 500 mr/hr during credible conditions. After the cost estimate on the carrier is complete, a formal proposal will be made to the Policy Committee for construction approval.

5.2 Alpha Laboratory, Room 211, Bldg. 3019 (E. L. Nicholson, P. L. Robertson)

Installation of the above facility was about 60% complete at the end of August.

5.3 Building 2026, HRLAL, Design (W. R. Winsbro)

The Title II design of the High Radiation Level Analytical Laboratory being done by the Vitro Corporation was 50% complete at the end of August.

5.4 Eurochemic Assistance Program (E. M. Shank)

One transmittal letter listing 15 documents and three miscellaneous items was sent. One specifically prepared document containing ORNL-originated information was sent to Eurochemic via DIA. The categorized list (ORNL CF-59-4-84, Rev. 1, Supplement 1) of information sent to and received from the Eurochemic Company from January 1961 to July 1, 1961, was issued. Five Eurochemic-originated documents were reproduced but not distributed.

5.5 Fuel Shipping Study (L. B. Shappert)

Forty to fifty check-out drops have been made with a 1-ton steel framed lead weight. These drops were made to gain familiarization with the problems associated with such drops and to determine the workability and reliability of the instruments to be used in the test program.

Most of the drops have been made from a height of 6 to 10 ft, although eight to ten drops have been from a height of 15 ft. At the latter height, the unrestrained lead showed obvious signs of cold flow. After the last drop the lead had extruded itself approximately 3/4 in. on two sides of the original steel base. The average dynamic flow pressure for lead is 12,000 psi.

In these preliminary check-out drops, the deceleration experienced by the accelerometer fastened at the center of the lead block dropped from a height of 6 ft has been in

the order of 500 G's. In a completely contained system this deceleration would not necessarily be expected to be the same.

5.6 CANE Project (J. W. Landry)

Reliability tests were made of the valve that was developed by the Pitman-Dunn Laboratory Group of Frankford Arsenal for the CANE sampler. The valve is a single-use, explosive-operated valve. It is a normally-open type and operates to close. All of the 45 valves tested operated successfully. Features of the valve are: (1) actuation is by a 5-volt and 2-ampere electrical pulse; (2) full cycle operation is complete 40 μsec following pulse arrival; (3) flow is straight-line; (4) bore is continuous and identical with connecting tubing; (5) pressure strength is identical with connecting tubing; (6) leakage is absolute zero, including leakage to exterior and to line, before and after operation; and (7) cost is less than $10.

5.7 Fuel Processing Cost Study for 1000 Mw_e AHBR (W. L. Carter, F. E. Harrington, W. G. Stockdale)

Paul Kasten of the Reactor Division has requested assistance from the Process Design Section in the development of a conceptual plant and capital cost estimates for an on-site chemical reprocessing facility to process the fuels from the two reactor complexes presented in SL-1875, "1000 Mw_e AHBR Plant Capital Cost Evaluation." The completed information will be incorporated into a Reactor Division report to be issued in January 1962. To meet this date, our portion should be completed during November.

The items which will be prepared to obtain a realistic capital cost estimate are:

1. Preparation of preliminary material balance flowsheet.

2. Preparation of block equipment flowsheets.

3. Sizing of equipment items for both plants.

4. Shielding calculations.

5. Layout study.

6. Cost estimate.

7. Composition of report.

Work on steps 1, 2, and 4 has begun. About 0.5 to 1 man-year of effort will be required to provide data at the same level as that presented in SL-1875.

5.8 Equipment Design Assistance to Chemical Development (A. M. Rom)

Plasma Jet. The brass reaction chamber was received from the shop, installed, and tested. It performed satisfactorily in preliminary operations. An additional reaction chamber and auxiliary equipment to be fabricated from Monel and used for feeding various gaseous mixtures to the plasma jet were also designed and submitted to the shop for fabrication.

Purex IWW Carrier. Construction drawings of the IWW carrier were about 30% complete at the end of August.

Gas-solid Chloride Volatility Equipment. Preliminary design of a reaction vessel and auxiliary equipment was started. The reaction vessel will be fabricated from "Pyroceram" and material was placed on order.

6.0 PROJECT ENGINEERING

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

A list of the 71 drawings started during August 1961 is given in Table 3. In addition, 28 drawings started earlier proceeded to the check print stage and 41 to approved status. In August, six sketches and 71 illustrations were prepared.

A breakdown of drafting time during August by cost account is as follows:

Account No.	Man-hours	% of Total
3370-1	33	1.9
3370-20	164	9.4
3370-22	184	10.5
3370-24	32	1.8
3370-28	12	0.7
3370-33	92	5.3
3370-34	12	0.7
3370-55	28	1.6
3370-57	6	0.3
3370-108	582	33.4
3370-113	74	4.2
3370-115	22	1.3
3370-123	500	28.7
3290-	4	0.2
Total	1745 hr	100.0 %

There were 89 hr of overtime worked in August 1961.

6.2 Engineering and Instrument Department Assistance

A summary of drawings prepared during August in the Engineering and Instrument Departments is given in Table 4.

6.3 Material Purchase Status

Table 5 gives a listing of all outstanding purchase requisitions (except instruments) as of September 1, 1961.

6.4 Work Order Status

Table 6 presents a listing of all outstanding work orders as of September 1, 1961, for which the Process Design Section is responsible.

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

HEG:mep

Table 3. Summary of Drawings Started in the Process Design Section Drafting Room During August 1961

Job No.	Drawing No.	Rev.	Title	Date Started
503	C-44694		Pu-Al Alloy Fuel Rod Carrier, Relief Valve Housing	8/7/61
	D-45696		Immi Contactor Solv. Extr. Sys. Waste Hold-up Tank Pit & Dry Well	8/17/61
504	D-34567	3	Shipping Cask D-38 Assembly and Details	8/30/61
	D-45650		3-Liter Solution Bottle & Carrier Insert for Shipping Cask D-38	8/10/61
	D-45762		IWW Carrier Assembly	8/23/61
	D-45766		IWW Carrier Subassembly and Details	8/26/61
505	D-45653		Cell 2 Optical System of Bottom Section	8/29/61
506	D-45757		Exhaust Air Filter for Air Leak, Lab. 211, Bldg. 3019	8/21/61
604	D-34553	1	Clarifier Arrangement	8/16/61
	D-34555	2	Flocculator and Clarifier Arrangement	8/16/61
	D-45754		Clones for Clarifier	8/17/61
701	E-34238		TrU Lab., TrU Process Flowsheet Cell 3	8/30/61
	E-45652		TrU-CP Proposed Header Locations	8/7/61
	D-45664		TrU-CP Impact Wrench Modification	8/7/61
	E-45682		TrU-CP Proposed Building Layout #28	8/11/61
	E-45683		TrU-CP Sections A-A and B-B	8/2/61
702	D-34275		Liftable and Carrier Dolly Tracks, Assembly	8/7/61
	D-34366	1	Pa-U Program Ion Exchange Column, Assembly and Details	8/3/61
	D-34440	2	Liftable Alterations	8/16/61
	D-34455	2	Heaters and Thermowell Auxiliaries	8/11/61
	D-34458	2	Miscellaneous Mechanical Details, Sheet 3	8/18/61
	D-34543	1	Pa-U Program, Batch Extraction System	7/28/61
	E-45662	1	Pa-U Program, Dissolver Assembly, Equipment Rack A	8/9/61
	C-45663	2	Pa-U Program, Dissolver	8/10/61

(Continued)

Table 3, continued

Job No.	Drawing No.	Rev.	Title	Date Started
702, continued	D-45668		Pa-U Program, Cell 3 Interim Closure Detail Sheet 1	8/10/61
	D-45676		Pa-U Program, Cell 3 Interim Closure Detail Sheet 5	7/26/61
	D-45679		Pa-U Program, Cell 3 Electrical Installation Sheet 2	8/15/61
	D-45680		Pa-U Program, Cell 3 Interim Closure Detail Sheet 6	7/20/61
	C-45681	1	Pa-U Program, Cole Connector, Assembly and Details	8/17/61
	C-45685	1	Pa-U Program, Instal. Dets. Polyethylene Disconnect Support Brackets	8/2/61
	D-45687	1	Pa-U Program, Cell 3 Northeast Roof Plug	8/15/61
	D-45688		Pa-U Program, Cell 3 Slug Chute, Assembly and Details	8/3/61
	E-45689	1	Pa-U Program, Processing Box, Back Elevation	8/2/61
	E-45693	1	Pa-U Program, Equipment Rack B	8/2/61
	D-45694		Pa-U Program, Precipitator	8/7/61
	D-45697		Pa-U Program, Cell 3 Ion Exchange Panelboard	7/27/61
	D-45699		Pa-U Program, Separatory Funnel Assembly	8/1/61
	D-45700		Pa-U Program, Cell 3 Pa-U Piping Flowsheet	8/2/61
	D-45701		Pa-U Program, Cell 3 Service Piping Operating Area	8/29/61
	C-45702		Pa-U Program, Slug Chute Tail Piece	8/3/61
	D-45703		Pa-U Program, 1-Liter Bottle Carrier	8/4/61
	D-45704		Pa-U Program, Main Panelboard	8/4/61
	D-45706		Pa-U Program, Electrical Schematic	8/8/61
	D-45707		Pa-U Program, Roof Area Piping and Equipment Layout	8/10/61
	D-45708		Pa-U Program, Calciner	8/15/61
	D-45709		Pa-U Program, Gas Scrubber	8/15/61
	D-45710		Pa-U Program, Arbor for Pellet Press	8/21/61
	D-45711		Pa-U Program, Service Piping Elec. & Instr. Additions to 2" Lead Tandem Cave, Sheet 1	8/18/61
	E-45712		Pa-U Program, Service Piping Elec. & Instr. Additions to 2" Lead Tandem Cave, Sheet 2	8/18/61
	D-45713		Pa-U Program, Bldg. 4507 Cell 3 Electrical Specifications	8/22/61
	D-45714		Pa-U Program, Bldg. 4507 Cell 3 Engineering Flowsheet	8/23/61

(Continued)

Table 3, continued

Job No.	Drawing No.	Rev.	Title	Date Started
702, continued	D-45715		Pa-U Program, Auxiliary Panelboard Wiring Diagram	8/23/61
	D-45725		TrU, Ion Exchange, Process Flowsheet	8/3/61
	D-45726		TrU, Ion Exchange, Electrical Schematic	8/4/61
	D-45727		TrU, Ion Exchange, Process Flowsheet 2	8/9/61
	D-45731		TrU, Ion Exchange, Box Side Lights 4505 Cell Mock-up	8/10/61
	D-45732		TrU, Ion Exchange, Box Side Lighting	
	D-45734		TrU, Ion Exchange, Lift Table and Alpha Box Misc. Details	8/15/61
	D-45735		TrU, Ion Exchange, NSE Flask Mounting Plate, Details	8/16/61
	D-45736		TrU, Ion Exchange, NSE Flask Mechanical Details	8/16/61
	D-45751		Piping Bldg. 4507, Cell Mock-up	8/12/61
	D-45752		Piping South Wall, Bldg. 4507 Cell Mock-up	8/12/61
	D-45753		Electrical Installation, Bldg. 4507 Cell Mock-up	8/12/61
3370-1	D-45756		Plasma Jet Gas Feed Apparatus	8/21/61
3370-28	D-44693		California Shipping Container	7/31/61
3370-30	D-45768		Calciner Pot	8/30/61
3370-57	D-45758		Belgium Model, Mixer-settler Mark IV, Assembly	8/23/61
	D-45759		Belgium Model, Mixer-settler Mark IV, Detail Sheet 1	8/23/61
	D-45760		Belgium Model, Mixer-settler Mark IV, Detail Sheet 2	8/23/61
	D-45761		Belgium Model, Mixer-settler Mark IV, Detail Sheet 3	8/23/61
3370-113	C-44690		Carrier Drop Test Instr. Mounting Bracket Carrier 1 through 8	8/7/61
	C-45767		3-Liter Stainless Steel Sample Bottle for D-38 Carrier	8/29/61

Table 4. Summary of Drawing Progress in Engineering and Instrument Departments for Month of August 1961

Job No.	Job Order Number	Drawing Number	Rev.	Title	Transmittal Date
4505	A-01491-11	D-43686	A	Screw Drive Trap Door Valve, Assembly	8/22/61
		D-43687	A	Screw Drive Trap Door Valve, Detail Sheet 1	8/22/61
		D-43688	A	Screw Drive Trap Door Valve, Detail Sheet 2	8/22/61
		D-43689	A	Screw Drive Trap Door Valve, Detail Sheet 3	8/22/61
4505	A-70442-11	D-43847	0	Mock-up Conveyor Chain Drag Simulator, Subassembly D and Details	8/4/61
4505	A-93174-02D	D-37248	0	Traveling Knife Model II	8/9/61

Table 5. Purchase Requisition Status September 1, 1961

Job No.	Purchase Req. No.	Date Issued	Description
Miscellaneous			
-59	D-0014	3/29/61	U jet tests and explosive valve tests
4507	D-0043	5/26/61	Periscope alterations
-59	D-0058	7/25/61	7 Conax explosive valves
4507	D-0060	7/28/61	Four removable boot assemblies
-59	D-0061*	8/1/61	O-Seal brass connectors
-59	D-0062	8/1/61	12 Hose clamps
4507	D-0066	8/10/61	Non-browning prisms
4507	D-0067	8/10/61	4 Right angle prisms
4507	D-0068	8/15/61	One telescope and camera
-59	D-0069	8/16/61	Field costs, Gnome test
-133	D-0070*	8/16/61	Carbon steel eye bolt
-133	D-0071*	8/21/61	1/3 hp Centrifugal pump
-59	D-0072	8/29/61	One Conax valve assembly
Transuranium - 4507			
700	D-0303	12/28/60	Bids request, fabrication of TrU carrier
700	D-0328	3/24/61	Two manipulator boots for alpha box
702	G-9701	6/29/61	30 Air-operated polythene valves
-123	G-9704	7/6/61	12 Teflon filters
-123	G-9713	7/20/61	20-125 V 7-prong connectors
-123	G-9715	7/21/61	One 1/6 hp gear motor
-123	G-9717	7/21/61	One 2-ton lift table
-123	G-9718	7/21/61	Two 1/2-ton electric hoists
702	G-9722*	8/1/61	Two Teflon bellows pumps
-123	G-9723*	8/2/61	Six 3000-liter Pyrex flasks
-123	G-9724*	8/2/61	12 Kw Cromalox heater
-123	G-9725	8/3/61	150 SS Swagelok fittings
-123	G-9726*	8/3/61	Polyethylene filter cloth
-123	G-9727*	8/3/61	50 SS Swagelok unions
702	G-9728	8/3/61	1/10 hp 1550 rpm Electric motor
702	G-9729	8/7/61	Teflon air-operated valve
-123	G-9730	8/7/61	Air-operated screw clamp
-123	G-9731*	8/7/61	Sprocket wheel and auxiliaries
-123	G-9732*	8/7/61	Two cast aluminum glove ports
-123	G-9733	8/9/61	Neoprene gaskets
-123	G-9734*	8/10/61	0-15 sec Timer

(Continued)

Table 5, continued

Job No.	Purchase Req. No.	Date Issued	Description
Transuranium - 4507, continued			
-123	G-9735	8/10/61	Six 3-way shutoff cocks
-123	G-9736*	8/11/61	36 Steel couplings
-123	G-9737	8/16/61	One straight bore stopcock
-123	G-9738*	8/18/61	1 ft^2 2-1/2-in. aluminum plate
-123	G-9739*	8/18/61	12-Ton hydraulic jack
-123	G-9740	8/22/61	84 Swagelok connectors
-123	G-9741	8/29/61	Six Aero-seal clamps
-123	G-9742	8/30/61	Six Varigrip clamps
Waste - Calcination Pilot Plant			
605	G-1002	4/27/61	One centrifugal pump for ANN
605	G-1003	6/7/61	Lockheed subcontract
Waste - Ion Exchange Pilot Plant			
604	F-2004	5/31/61	Chemanalyzer for water analysis
604	F-2008*	7/6/61	6-in. Gold gasket
604	F-2009*	7/13/61	1-in. PVC sheet
604	F-2010*	7/14/61	300 Barytes blocks
604	F-2011*	7/28/61	50 lb ea Cellite and Supercel
604	F-2012	8/3/61	10 lb ea Cellite 501 and 535
Power Reactor Fuel Processing - Mechanical			
510	D-6247	5/26/61	Twelve 18-in.-dia cutoff wheels
504	D-6261*	8/7/61	Niobium tubing
504	D-6262	8/7/61	Stainless steel tubing
510	D-6263*	8/21/61	165 gal Bayol D
510	D-6264	8/24/61	Oil Dyne pump and motor
Power Reactor Fuel Processing - Chemical			
503	D-6414	3/21/61	Glove boxes and auxiliaries
Transuranium - 3508			
700	D-6613	3/17/61	One pair ANL Model 8 manipulators
-123	D-6614	4/5/61	Fabricate tandem shielded glove box

(Continued)

Table 5, continued

Job No.	Purchase Req. No.	Date Issued	Description
Transuranium - 3508, continued			
3508	D-6819	7/25/61	12 Filter cartridges
702	D-6820	8/17/61	18 Replacement bearings
Volatility			
404	D-7019	6/29/61	INOR-8 pipe and tubing
404	D-7020	6/26/61	INOR-8 sheet and plate
404	D-7021	8/2/61	1200 ft HyMu 80 pipe

* Issued and completed in August 1961.

Table 6. Work Order Status September 1, 1961

Job Number	Job Order Number	Charge Number	Engr.	Date Issued	Cost Estimate	Description	% Complete
3019	A-01546-11	3370XX-125	WGS	7/24/61		Ventilation System for Sample Gallery	0
3019C	A-93249-01	329090	WGS	6/29/60	9,100	Hot Analytical Cell and Hood Vent Filters, Titles I, II, and III	98
3019C	A-93249-02	329090	WGS	6/29/60	2,600	Hot Analytical Cell and Hood Vent Filters, ORNL Participation	90
3019C	A-93249-03	329090	WGS	6/29/60	1,500	Hot Analytical Cell and Hood Vent Filters, I & C Div. Participation	10
3019C	A-93249-04	329090	WGS	6/29/60	82,600	Hot Analytical Cell and Hood Vent Filters, Lump-sum Contract, Hixon Construction Co.	94
3505	A-70570-11	337053-132	HBG	7/26/61	15,000	Loading of SRP Carriers	0
3505	A-70570-12	3370XX-132	FEH	8/4/61	1,500	Install Jet and Line from 3505 Canal to W-5	0
4507C	A-01362-11	337053-20	AMR	6/15/60	10,115	Temporary Containment Changes for Cell 2	100
4507	A-01559-11	3370XX-133	AMR	8/31/61	1,900	Final Adjustments for 4507 Containment	0
4507C	A-93114-02	337090-01	AMR	7/29/60	11,300	4507 Containment Changes, ORNL Participation	0
4507C	A-93114-03	337090-01	AMR	7/29/60	106,000	4507 Containment Changes, CPFF Contract	0
4507C	A-93114-04	337090-01	AMR	7/29/60	21,000	4507 Containment Changes, Detection Instruments	0
4507C	A-93114-05	337090-01	AMR	7/29/60	5,000	4507 Containment Changes, Title II Engineering	0
4507	A-93560-30	337092-133	ELN	3/10/61	11,000	Install Valve Pit and Underground Waste Line	15
General Division Programs							
-1	A-01549-11	3370XX-1	WGS	8/4/61		Design and Estimate for Off-gas Filter Portable Shield	0
-1	A-41624-41 & -61	337053-01	PLR	7/16/59	10,000	General Equipment Repair and Storage for Re-use	100
CANE Project							
-59	A-01545-11	3370XX-59	JWL	7/24/61	7,318	Fabricate Gnome Sampler Vessels	30
-59	A-20475-11	337053-59	JWL	3/16/61	6,508	Fabricate Instrumentation for Gnome Sequenced Sampler	90
-59	A-20484-11	337053-59	JWL	4/14/61	5,000	Design and Fabricate Transistorized Timer	95
Fuel Shipping Study							
-113	A-01499-11	337053-113	LBS	5/5/61	15,000	Fabricate Three Carrier Models for Drop Test	70
Pa-U Program							
-123	A-01553-11*	3370XX-123	BBK	8/17/61	150	Amercoat Interior of Cell 3, Bldg. 4507	100
-123	A-70499-11*	337053-123	BBK	5/26/61	18,900	Fabrication and Installation of Pa Process Equipment, 4507 Mockup	100
-123	A-70499-12	3370XX-123	BBK	5/26/61	10,800	Fabricate Carrier for Pa	20
-123	A-70499-13	3370XX-123	BFB-FLH	5/31/61	1,900	Alpha Seal Adapt. for Castle Manipulator	25
-123	A-93483-01	337092-123	BBK	5/29/61	34,900	Install Shielded Glove Box and Equipment, Lab 1, Bldg. 3508	70
-123	A-93687-01	3370XX-123	BBK	7/21/61	6,875	Convert Model 8 Manipulators in 4507 Mockup for Heavy Duty Service	0
Homogeneous Reactor Program							
304	A-20345-11	337053-109	BFB	5/18/60	3,707	Instruments for Spectrophotometric Fuel Analysis Loop	100
Volatility Program							
404	A-01533-11	337053-73	RPM	6/28/61		Assistance to BMI on VPP Corrosion Tests	0
Power Reactor Fuel Processing							
500	A-20428-11	337053-22	ARI	11/30/60	580	Instrumentation for Experimental Flowmeter Test	0
503	A-70447-11	337053-133	ELN	1/16/61	50,000	Modification of Immi Equipment for Pu-Al Processing	100
503	A-93553-01	337092-133	ELN	3/7/61	3,350	Fabricate Accessories for Pu-Al Carrier	70
506	A-01528-11	337053-132	WRWh	6/27/61	1,765	Install Glove Box Sampling Station, 3019	30
506	A-93636-01	337092-132	WRWh	5/19/61	4,730	Install and Pipe U-233 Storage Tank	90
506	A-93636-03	3370XX-132	WRWh	7/10/61	2,850	Install 6-in. Lead Shield Around U-233 Storage Tank	5

(Continued)

Table 6, Continued

Job Number	Job Order Number	Charge Number	Engr.	Date Issued	Cost Estimate	Description	% Complete
Power Reactor Fuel Processing, continued							
510	A-01418-11	337053-106	WFS	9/2/60	14,113	Final Design Items, Segmenting Facility	83
510	A-01525-11	337054-106	WFS	6/12/61	6,850	Maintenance on SRE Equipment	95
511	A-01448-11	337053-106	WFS	12/14/60	18,234	Fabrication of Inclined Conveyor	100
511	A-01491-11	337053-107	WFS	4/19/61	12,000	Design of 250-ton Shear Auxiliary Equipment	45
511	A-93174-01	337092-106	WFS		171,600	Procure 250-ton Shear from Birdsboro Corporation	100
511	A-93174-02,3,4,5	337093-106	WFS	6/2/60	3,360	Design Auxiliaries for 250-ton Shear	5
Waste Program							
603	A-93534-10	363290-00	FEH			Design of Waste Tank and Evaporator	98
604	A-01524-11	337053-34	JOB	5/3/61	3,000	Install PVC Line from 3518 to 2328	0
604	A-70455-11	337053-34	JOB	3/2/61	30,000	Fabricate and Install Equipment for Ion Exchange Pilot Plant	65
604	A-70455-12	337053-34	JOB	2/28/61	10,000	Procure and Install Instruments for Ion Exchange Pilot Plant	100
604	A-70455-13	337053-34	JOB	3/30/61	2,000	Decontamination of Used Equipment for Ion Exchange Pilot Plant	50
605	A-01484-11	337053-34	JOB	3/27/61	15,000	Design Pot Seals for Calciner Pilot Plant	50
605	A-01547-11	3370XX-30	HOW	7/26/61	19,300	Fabricate and Install Pot Calcination Hot Cell Unit	0
605	A-01558-11	3370XX-33	JOB	8/28/61	1,980	Fabricate Densimeter and Controlled Rate Steam Jet	0
Transuranium Facility							
7511	A-01550-11	3370XX-108	WDB	8/8/61	2,000	Design Revision of TrU Concepts	5
7511	A-70489-61	3370XX-108	WEU	4/25/61		Architect-Engineer Design Assistance, TrU Mechanical Equipment	5
7511	A-70397-14 to -18	337053-28	BFB	12/12/60	24,500	Fabricate and Install Mockup of Intercell Conveyor	5
702	A-01480-11*	337053-108	BBK	3/21/61	2,150	Piping and Electrical Design Revisions to Transuranium Alpha Box Cell 3, 4507	100
702	A-70397-13	337053-28	BBK	7/15/60	4,950	Design and Install Instruments for Transuranium Cell 3 Glove Box	100
702	A-70397-15	337053-28	BBK	3/22/61	12,000	Install Alpha Box and Equipment in Cell 3, 4507	70
702	A-70397-16	337053-28	BBK	5/26/61	18,900	Modify Cell 4, Bldg. 4507, and Install TrU SOX	0
702	A-70397-17	337053-28	BBK	5/26/61	28,100	Fabricate and Install TrU SOX Equipment, 4507 Mockup	0
702	A-70397-18*	337053-28	BBK	5/26/61	5,400	Instrumentation Design and Installation, TrU SOX, 4507 Mockup	closed
702	A-70442-13*	3370XX-108	BBK	6/28/61	7,740	Design Changes on TrU Transfer Box, 4507	closed
702	A-70442-14*	3370XX-108	BBK	7/21/61	5,500	Provide New O-Ring Seals on TrU Transfer Box	closed
702	A-70442-16	3370XX-108	BFB	8/21/61	25,000	Fabricate Mockup of TrU Carrier and Alpha Container	0

C - Work Orders concerned with containment.

* - Request for close-out submitted.

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