ORNL 1054
Progress Report

AEC RESEARCH AND DEVELOPMENT REPORT

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

June, 1951

OAK RIDGE NATIONAL LABORATORY
OPERATED BY
CARBIDE AND CARBON CHEMICALS COMPANY
A DIVISION OF UNION CARBIDE AND CARBON CORPORATION
UCC
POST OFFICE BOX P
OAK RIDGE, TENNESSEE

[redacted]

ORNL 1054
This document consists
of 23 pages. Copy 55
of 55. Series A.

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

June, 1951

W. E. Thompson

Date Issued:

JUL 10 1951

OAK RIDGE NATIONAL LABORATORY
Operated By
CARBIDE AND CARBON CHEMICALS COMPANY
A Division of Union Carbide and Carbon Corporation
Post Office Box P
Oak Ridge, Tennessee

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

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PROGRAM 1000 - RESEARCH FACILITIES

Research Laboratory Building #4500

Work on this building is approximately 36% complete. Concrete foundations are complete. Structural steel erection is complete. Metal roofing has been applied. Built-up roofing is being applied on Wing #4. Exterior masonry walls are 35% complete. Concrete floor slabs are 60% complete. Sheet metal duct work is being installed. Plumbing, heating and service piping are 30% complete. Electrical underground and services are 17% complete. Electrical services in building are 20% complete.

Isotope Research and Semi-Works Building #4501

Work on this building is approximately 35% complete. Concrete foundations are complete. Concrete work on Semi-Works cell block is complete. Concrete work on Isotope Research cell block is approximately 38% complete. Structural steel erection is complete. Plumbing, heating and service lines are 18% complete. Sheet metal duct is being installed. Concrete floor slab is 27% complete. Electrical services in building are 28% complete.

High Voltage Laboratory Building #4503

This building is approximately 6% complete. Concrete foundations for the reactor tower between columns 5 and 6 have been poured. Forms and reinforcing steel for the grade beam on the east side of the building from column lines A to D are being erected. Excavation for footings is in progress.

Health Physics Waste Disposal Research Building #3504

This building is approximately 50% complete. Foundation walls, concrete floors and platforms are complete. Exterior walls and roof are approximately 90% complete. Underground mechanical services are complete. Mechanical services within the building are being installed.

Chemical Isolation and Purification Laboratory Building #23

This contract has been awarded to the Fred E. Hicks Construction Company of Knoxville, Tennessee. Notice to proceed will be executed July 5, 1951.

Test Facilities Building #22

Bids were opened on this job June 27, 1951. The V. L. Nicholson Construction Company of Knoxville, Tennessee, was the apparent successful bidder.

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PROGRAM 2000 - SOURCE AND FISSIONABLE MATERIALS

TBP Process for Waste Metal Recovery (AEC Activity 2802-2)

The equipment installation in the ORNL Metal Recovery Plant is now about 90% complete. One of the unique operations in this building will be the use of spray drying for the conversion of uranyl nitrate to uranium trioxide. This equipment has now been installed and preliminary tests are in progress. As indicated in the previous report, the recovery of uranium from the ORNL metal waste will not start until after the initial phases of the SCRUP separations program.

Purex Process (AEC Activity 2802-3)

The Purex Process has now been demonstrated in the ORNL Pilot Plant with full Hanford level uranium feed. This is approximately equivalent to that activity level expected at Savannah River. The plutonium product met specifications based on both chemical and radiochemical criteria, while the uranium product met specifications for plutonium concentration and beta decontamination. The gamma activity in the uranium product appeared to be high by a factor of 2. The overall uranium and plutonium losses were 0.1% and 0.2%, respectively.

The IAW nitric acid recovery evaporator has continued to give satisfactory decontamination factors of approximately 5×10^5 for gross beta. Nitric acid and ruthenium equilibrium studies are in progress in the laboratory, and these have indicated that the amount of ruthenium distilled along with the nitric acid is a function of the time of heating and the concentration of nitric acid. By maintaining the nitric acid concentration below 8 to 9 molar, the ruthenium distillation should not be a serious problem.

The laboratory work on the final purification of plutonium by ion exchange is continuing; however satisfactory operation of this step was demonstrated in the Pilot Plant in the runs described above. Solvent extraction studies have been initiated to increase the uranium concentration in the IA column and to increase the tributyl phosphate concentration from 10 to 30% in the plutonium second cycle. An electrolytic head-end treatment is now being studied for the removal of ruthenium; however Pilot Plant results have indicated that a head-end treatment probably will not be required to meet the product specification.

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PROGRAM 3000 - WEAPONS

RaLa Development (AEC Activity 9541)

Laboratory studies for the MTR RaLa Process were continued to establish the conditions required for the recovery of Uranium-235 by the use of a modified 25 solvent extraction procedure. It was not possible to modify the 25 Process sufficiently to recover the uranium from the high concentration of sulfate ion that was present. However, it has been possible to modify the RaLa Process to reduce the total amount of sulfate ion by a factor of 20.

SCRUP Separations (AEC Activity 3XXX)

The carriers have now been completed for the transfer of irradiated uranium from Chalk River to ORNL for processing. The initial shipment will be made about the middle of July. The construction of the metal storage canal at the ORNL plant for handling the Chalk River materials is now approximately 90% complete and the installation of special storage facilities for the Chalk River waste is approximately 75% complete.

The off-gas from the Chalk River dissolving is to be scrubbed with concentrated nitric acid to remove the nitrogen oxide. Gases which are not adsorbed contain the radioactive xenon, krypton, and iodine and will be transferred to the Chemistry Division for further separation and purification.

Special Separations (AEC Activity 3670)

A two-arc calutron designed to operate at the high temperature that will be required for $PuCl_3$, up to 1000°C, has been operated satisfactorily with UCl_3 as charge material.

Facilities for processing highly alpha active materials are being prepared; the recycle chemistry laboratory is 90% complete, with the gloved boxes now being installed; modification of wash lines has begun; and transfer methods are being developed.

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PROGRAM 4000 - REACTOR DEVELOPMENT

MATERIALS TESTING REACTOR

LITR Operation (AEC Activity 9543)

The Low Intensity Training Reactor has been operated at very low power during June while the shim rods were being calibrated. Phillips Petroleum personnel have participated in the operation of the LITR and the rod calibrations. The reactor now has sufficient cooling to enable operation at 750 KW; heat exchangers and pumps are available to allow operation above 1 megawatt.

Pre-Installation Assembly of MTR Components (AEC Activity 9541)

The MTR tank and its components shipped from ORNL in May and June were received at Arco without difficulty or delay. The only remaining MTR equipment to be shipped from ORNL is (1) the control instrumentation, (2) tank section B, and (3) miscellaneous small fittings. Tank section B (the expansion joint) is being held here for final machining to fit tank section A after its installation at Idaho. The shipment of these items will complete ORNL's responsibility for the procurement and fabrication of MTR components. The Laboratory's remaining responsibility then will be for assistance to the Idaho Operations Office and Phillips Petroleum Company during start-up and shakedown tests of the reactor.

Idaho Chemical Plant Design (AEC Activity 9541)

The status of the ORNL responsibility for the Idaho Chemical Plant design was revised, and it was found that approximately 1100 man-months would be required to complete our responsibilities. This program will include field engineering and plant start-up, manual preparation, development and design of the fumeless off-gas system, development and design of the facilities for the MTR-B program (MTR-RaLa), acceptance testing of the equipment and plant start-up.

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HOMOGENEOUS REACTOR PROJECT

Experimental and Design Engineering (AEC Activity 4264)

One of the model 100A Westinghouse pumps which had operated in UO_2SO_4 for several hundred hours without undue wear or corrosion was found to be using excessive current about 70 hours after being started up on fresh fuel solution which was put in while alterations to the system were being made. The pump was dismantled and found to have rather severe corrosion on the impeller surfaces. It is believed that the hydraulic balance had been upset, causing an axial thrust which pushed the impeller against the housing. This caused mechanical wear plus cavitation corrosion which is attributed to vibration from unbalance of the impeller and/or the high turbulence.

Another 100A pump which has been operating equally as long under similar conditions shows no evidence of undue corrosion or wear.

Some progress has been made in developing means for eliminating oscillations in the gas let-down system. A full scale gas let-down system is being installed in the HRE mock-up for testing under actual operating conditions.

HRE Reactor Chemistry (AEC Activity 4263)

Evidence from the dynamic loop studies indicates that the presence of a partial pressure of oxygen in the system is definitely beneficial to solution stability. Current effort is devoted to determining the effect of varying the pressure and composition of the gas.

Building 7500 - HRE (AEC Activity 4261)

The D_2O system is approximately 90% complete and is expected to be ready for leak testing in July. Fuel system components are being fabricated, but no piping is being installed as yet. The overall facility is about 35% complete.

HR Fuel and Blanket Study (AEC Activity 4263)

It has been reported that by spray drying and denitrating uranyl nitrate solution, it is possible to produce uranium oxide particles in the submicron range. The spray dryer that has been installed for the metal recovery plant will be used in its initial break-in run to produce uranium oxide by this procedure. This material will then be examined to determine its particle size range. The success of this technique would be a significant

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aid in the preparation of slurry fuels for reactors.

AIRCRAFT NUCLEAR PROPULSION PROJECT

ANP Central Design (AEC Activity 4271)

The pressure shell and all components of the ARE core are now on order. Design of the fluid circuit is nearing completion and requisitions have been issued for much of the piping, dump tanks, pumps, etc. Quotations for the helium blowers in the Na to He to H_2O heat disposal are being received. Detailed design is now in progress on monitoring circuits and other instrumentational features. Remote handling equipment is being designed both for cutting open the welded pressure shell after a test and for cutting the individual fuel tubes for recovery of the fuel.

A summary report (HKF-111) of the nuclear aircraft system in which a UBi circulating fuel reactor powers a XB-52 type aircraft has been issued by the ORNL subcontractor, The H. K. Ferguson Company, Incorporated. The study indicated that the circulating fuel reactor is adequate to propel the system at 0.8 M at 35,000 feet. However, the system has less reserve power than the corresponding NaOH homogeneous reactor system (HKF-109) primarily because of the temperature limitation and poor heat transfer efficiency of UBi.

The Nuclear Developments Associates', Incorporated, analysis of the supercritical water reactor has now encompassed reactivity, flux distribution dynamics and control. In particular, a most favorable core design has emerged in which the water makes two passes in series; the first pass a moderating pass and the second, through the fuel elements, the heat removal pass. Such a design maintains a high average water density, a rather simple flow structure, avoids 'boiling disease' flow instability and makes fairly good use of heat transfer surface.

ANP Experimental Engineering (AEC Activity 4271)

At the beginning of June, seven loops were in operation with sodium at 1500°F; additional ten loops were put into operation during the month. Materials under test included Inconel and Inconel X, and 410, 430, 310, and 347 stainless steels. Ten terminations occurred, three of which were failures; the remainder were loops which had completed 1000-hour tests. Two failures occurred in 347 stainless steel loops and were probably caused by external electrical arcing; the other was in the hot leg of a 310 loop and was apparently due to faulty tubing. Other materials completed

the tests. Fluoride fuel capsule tests operated for 600 hours during the month with 200- and 400-hour capsules completing tests. A total of 3875 hours were accumulated on liquid metals systems during the month of June, 1951.

A Figure-Eight Loop fabricated from 347 stainless steel has been assembled, equipped with electrical components, insulated and filled with sodium. Cleaning will be attempted by repeatedly flushing the system with sodium until the impurity content remains consistently low. Clean sodium will be provided when required. A mechanical pump designed in the ANP Experimental Engineering Section has been incorporated into the loop for circulating the sodium. Another Figure-Eight Loop is under construction which will use a heat exchanger and electromagnetic pump cell, both of which have been modified by ANP personnel.

Sodium purification techniques currently in use consist of filtering sodium from one melt tank into another tank where the sodium is aged at 350°F for at least 24 hours to allow settling of suspended material which may have passed through the first filter. This sodium is again filtered during filling of liquid metals systems. Analytical results show an oxygen content of 0.017% after the first filtration. Electrostatic precipitation has shown sodium condensation in gas supply lines to be due to solid aerosol phenomenon. Sodium particles condense at such a rate that the precipitator has been re-designed to allow periodic melting of sodium for return to the main tank. Precipitator fabrication has been completed. Tentative cleaning procedures for liquid metals systems and components involve contact with molten caustic which converts oxides to either water or acid soluble products. Following caustic treatment, the equipment is washed with dilute acid followed by a water rinse.

Liquid Metals Research (AEC Activity 4275)

Inconel tube-to-header specimens were fabricated by manual inert arc welding and treated in sodium at 1000°C for 100 hours prior to testing. Tensile strengths of 89,000 psi based on the tube dimensions were obtained. Elongation was increased from 15% in three inches for the as-welded material to 35% for the material tested in sodium; this was caused by the annealing heat treatment at 1000°C for 100 hours.

Apparatus for the fabrication of tube-to-header joints by the cone-arc technique has been installed and preliminary experiments indicate that complete penetration can be realized with proper control of current, time and geometry. These variables have been found to be very critical. High

speed motion picutres have been made for determination of the nature of the arc.

Apparatus for fatigue testing of tube-to-header welded joints has been delivered. A preliminary test specimen received approximately 300,000 cycles at approximately 40,000 psi of alternating stress before failure. This apparatus will be used to evaluate the relative merits of complete versus incomplete penetration.

In further experiments with the "rubber static pressing" technique described last month two fractions of sintered UO_2, -60 to + 100 mesh and -100 to + 200 mesh, were sintered at 1300°C and the powder layers containing 30% UO_2 in stainless steel powder formed an excellent bond with the 316 stainless steel fuel tube. Samples containing B_4C powder mixed with stainless steel powder were pressed as possible methods of fabricating control rods. The first sample which contained 25% by weight B_4C was sintered at 1150°C and exhibited some melting and separation of the mix. A second sample containing 50% B_4C has not yet been examined.

The corrosion tests in hydroxides of sodium, strontium and barium have been completed and partially evaluated. It has been found that the attack by sodium hydroxide is generally much more severe than the attack by strontium and barium hydroxides under similar test conditions. A comprehensive research program is being initiated to study the corrosion of metals and alloys by a selected fluoride mixture and several hydroxides.

Liquid Fuel System for High Temperature Reactor (AEC Activity 4275)

Fluoride Systems. Phase diagrams for the ternary systems $NaF-PbF_2-UF_4$, $KF-PbF_2-UF_4$, $KF-RbF-UF_4$ and $NaF-RbF-UF_4$ have been well established during the past month. In addition, considerable information on the four component system $NaF-KF-PbF_2-UF_4$ has been obtained. While melting points considerably lower than those obtainable in the three component systems are not expected, it is anticipated that the range of uranium concentration available without undue increase in melting point will be improved by use of the four component systems.

Hydroxide Systems. Sodium hydroxide which assays 100.0% by standard acid titration has been prepared by recrystallization of commercial caustic from absolute alcohol. The phase diagram of the binary system LiOH-NaOH has been determined.

Corrosion of Metals by Fused Salts. Standard corrosion tests in the vacuum furnace have demonstrated repeatedly that pretreatment of the molten fluoride fuels with stainless steel and inconel virtually eliminates subsequent corrosion by these materials. Samples so treated may be contained in inconel and various stainless steels at 800°C for at least 250 hours without appreciable attack.

Bulk Shielding Analysis and Lid Tank Studies (AEC Activity 4277)

The Shielding Reactor has very nearly completed measurements on an aircraft unit shield. A unit shield is one which exists entirely around the reactor. The data appear to agree quite well with previous estimates based on Lid Tank data.

Liquid metal duct tests have been proceeding more rapidly since the method of detection has been changed from small foils to large BF_3 counters. Results so far obtained indicate that liquid metal filled ducts will not constitute very serious radiation leakage paths if made even slightly tortuous.

A theoretical program is well under way for calculating the secondary gammas which are produced in a lead-water shield. It is hoped that this will lead to information on similar shields of different compositions.

A study has been started on the use of liquid ammonia to replace water in an aircraft shield. If refrigeration machinery weight is not included the saving will be almost ten tons on some of the current designs. Cycle studies are being carried out to optimize the design with respect to weight. Since the density of liquid ammonia increases appreciably with decreasing temperature, it is possible that refrigeration machinery may prove advantageous. Alternately, it may be desirable to forego the use of refrigeration machinery and resort simply to a strong container capable of keeping the liquid under pressure. It may also be desirable to operate the inner part of the shield which takes most of the heat from the reactor as a separate cycle. It is still a question what temperature and pressure is desirable, since the improvement in density achieved must be compared to the disadvantages of added machinery or structure. Insulation may or may not be desirable, depending on whether the advantage of keeping the shield cool is greater than the disadvantages due to the volume the insulation displaces.

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Aircraft Reactor Experiment (AEC Activity 4271)

The contract for construction of the ARE building will probably be awarded to the V. L. Nicholson Construction Company, who was the low bidder. Structural steel for this building has been on order for some time so that the earliest possible delivery could be obtained.

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PROGRAM 5000 - PHYSICAL RESEARCH

PRODUCTION OF RADIOISOTOPES

Radioisotope Production, Development and Operation (AEC Activity 5111)

The total accumulated KWH for pile operation during June was 2,436,838, averaging 3713 KW per operating hour. Pile down time was 8.9% as compared with 8.2% during May. There were no ruptured slugs.

The total number of radioisotope shipments during June was 677.

PRODUCTION OF STABLE ISOTOPES

Calutron Operation and Process Development (AEC Activity 5121)

Several experimental runs to electrodeposit lithium metal were made using ethylene diamine as a solvent for lithium iodide. This did not prove as sucessful as the previously tested pyridine solvent. The reaction between ethylene diamine and carbon dioxide from the atmosphere produced a carbamate which coated the electrodes with an insulating film, decreasing the conductivity of the cell. In order to remove the free iodine present in the cell, other experimental runs were made using various oils of high iodine number as additives. Tung oil gave the best results of any oil tried. The experimental production cell was completely assembled and tested for mechanical, electrical, and chemical operation. One electrolytic run was made using lithium iodide in pyridine solution; the results satisfied design predictions. Difficulty was encountered in recrystallization of the lithium iodide in the flow lines. A procedure for premixing the solution is being investigated.

A literature survey was completed of possible methods of concentrating the isotopes of the inert gases with special attention given to the thermal diffusion process for enriching the isotopes of argon. It is intended to begin adding the enriched isotopes of the inert gases to the stable isotopes inventory in the near future.

Strontium collections that were started in May were completed early in the month in the Beta channels. These runs yielded an estimated 39.3 grams of isotopes while 31.0 grams of vanadium were collected in the Beta channels during the remainder of the month. Lithium operations were in progress throughout the month in the Alpha channels. This series of collections was started in March and an estimated total of 345.3 grams of

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lithium isotopes have been collected thus far.

There were 24 stable isotope shipments during June.

PHYSICS

Short Lived Activities (AEC Activity 5211)

Preliminary trials have been successful in displaying the presence of coincident gamma rays as a two-dimensional pattern of dots on an oscilloscope screen. The first gamma ray imposes an x-displacement proportional to its energy, the second imposes a y-displacement proportional to its energy and the coincidence intensifies the image so as to register a dot. A glance at such a pattern enables one to determine whether coincident gamma rays are present; and if they are the approximate energy associated with them can be readily estimated.

Short Lived Isomers (AEC Activity 5211)

An excited state of Dy^{160} has been observed following the beta decay of Er^{160}. The Dy^{160} excited state has a half-life of 1.8×10^{-9} sec and decays with an 85-KV transition gamma ray.

Scintillation Spectrometry (AEC Activity 5211)

It has been observed that the greatest single factor controlling the resolution of scintillation spectrometers appears to be the treatment of the surface of the sodium iodide crystals. Liquid polishing, as used in the past, has been found to be deleterious; it is far better to leave the surface slightly rough from the dry grinding. This procedure, together with other minor modifications, has led to the achievement of peak to valley ratios of about 42 for the Cs^{137} gamma ray, whereas in the past a ratio of about 15 was considered good. The above performance corresponds to about 9-10% in energy resolution at 660 Kev.

Neutron Diffraction (AEC Activity 5211)

The coherent scattering cross section of carbon 13 has been measured by studying the neutron diffraction from normal $BaCO_3$, 40% C^{13} $BaCO_3$ and 50% C^{13} $BaCO_3$. It was found that the scattering cross sections of carbon 13 is identical with that of carbon 12 within experimental error.

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The 86-Inch Cyclotron (AEC Activity 5261)

The best performance obtained to date has been a 90 minute period of continuous operation during which a beam of 400 μa was maintained at 22 Mev without a single interruption due to sparking or other factors. Operational innage has been less than desired due to over-heating of the support structure of the dee system. Modifications incorporated in a second dee system are expected to give improved cooling and thereby to increase the innage.

The 63-Inch Cyclotron (AEC Activity 5261)

Shimming of the magnetic field has now reduced variations to ± 0.1% out to a radius of 21.5 inches. Changes which should correct variations over a larger area are being made. Design and fabrication of components are progressing satisfactorily.

Electromagnetic Fundamentals (AEC Activity 5261)

Equipment is being assembled for use in the investigation of dc injection of ions in the cyclotron. The ions will be collected after one, two, or three revolutions.

Isotope Analysis Methods Laboratory (AEC Activity 5261)

Atomic Spectroscopy. Zeeman echellograms have been obtained at a field strength of 25,000 gauss for mercury and thoriated tungsten. Attempts at obtaining spectra of uranium have been unsuccessful so far.

Spectro-isotopic assay of lithium samples has continued. Synthetic standards prepared by dilution of natural material have been used to set up a working curve. Precision of the line intensity ratio, Li-6/Li-7, is of the order of one percent for a given sample operating at constant conditions; reproducibility checks, however, on the same source at a different time show variability of as much as three percent. It is thought this may be due to slight helium pressure differences.

Microwave Spectra. The S-band Stark cell has been improved to permit study of gases up to 300°C and down to about -80°C.

X-Ray Spectroscopy. The feasibility of a direct uranium L X-ray absorption method for detection of reactor fuel rod leaks into a sodium coolant was investigated. Experimental checks indicate a lack of sensitivity at the concentration level expected (<1 ppm uranium).

Reactor Fuel Element Leak Detection Studies. Results on fluorophotometric investigations of uranium leaks into a sodium coolant have been summarized. ANP sodium metal now in use shows fluorescent response indicative of possible uranium self-contained in the sodium at an equivalent level of concentration of about 20 uranium atoms per billion sodium atoms. Investigations of hot Na (initial Na 24 activity of the order of 0.1 mc) reveal negligible interference effects from beta and gamma radiations at this activity level.

CHEMISTRY

Chemical Separation of Isotopes (AEC Activity 5361)

The isotope separation reference file is now essentially complete for the open literature. Only the 1950 abstracts remain to be searched. Arrangements have been completed with the Technical Information Division of AEC to make a corresponding survey of the project literature.

A study of the rate of exchange of lithium in the two-phase system, lithium thiocyanate-tributyl phosphate-water, was undertaken after favorable distributions were found. Using stable isotope tracer technique and enriched Li^7 solutions, this exchange was shown to be quite rapid. A multistage batch extraction system did not show any measurable isotopic shift.

A large scale laboratory Rayleigh-type distillation of the $Fe(NO)SO_4$ system was started but met with difficulties not apparent from previous small scale preliminary tests. However, it is expected that samples sufficient to evaluate the isotopic effect of this system will be obtained soon.

Lithium Isotope Separation (AEC Activity 5361)

The design of the lithium isotope separation pilot plant is approximately 90% complete; construction has been started in the field.

The following points of pilot plant design have been established by tests in the laboratory: (1) aqueous pump design, (2) aqueous level control, (3) baffle design, (4) flow characteristics in stirred trough with and without baffles, and (5) water lift for pumping mercury at the desired rate.

The 48 foot by one-inch exchange trough has been made ready for operation and one test run has been made.

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Chemistry of Uranium Raw Materials (AEC Activity 5361)

Samples of Bartow Clay, a part of the overburden from the Florida phosphate fields, have been received. Studies of methods for recovering uranium from this material have been started.

A report giving a tentative process for handling the Marysvale type ores was issued as Document Y-747.

A program aimed at a general investigation of the application of liquid-liquid extraction methods to raw material processes has been started.

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PROGRAM 6000 - BIOLOGY AND MEDICINE

BIOLOGY

General (AEC Activity 6400)

The staff of the Biology Division has been increased 15% by summer visitors. Thirteen of these are research participants, two are temporary employees and three are research assistants brought to the Laboratory by the summer visitors at their own expense.

This staff increase was made possible by the facts that working space and facilities were available and that the visitors' research projects were closely related to the research program of the Biology Division.

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PERSONNEL SUMMARY

	Number of Employees June 30, 1951	New Hires June	Terminations June
Admininstration	101	6	0
Operations*	118	0	0
Engineering, Shops, and Mechanical	919	1	5
Laboratory and Research	1346	98	8
Protection	171	0	2
Service	371	16	5
TOTAL	3026	121	20

* Includes Electrical Distribution and Steam Plant as well as the Operations Division.

RADIOISOTOPE SALES

Sales	April	May
Transfer within AEC	10,717.25	21,185.50
Cash Sales	25,564.45	25,464.73
Foreign	3,702.00	1,123.35
Cancer Program (Free)	37,154.05	39,347.63
Technical Cooperation Plan	550.00	50.00
Total Sales and Transfers to Date	1,647,483.44	1,705,682.52
Total Cancer Program (Free) to Date	820,730.10	860,077.73
Technical Cooperation Plan (Shipments to Date)	7,543.04	7,593.04

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GROSS OPERATING COSTS
(Including X-10 & Y-12)

(a)	Actual Cost for May, 1951	3,141,196[1/]	
	Construction - Program "H"	103,021	
	Total Operating & Constr. Cost		3,244,217[1/]
(b)	Estimated Operating Costs for June, 1951		2,741,768
(c)	Actual Accumulative FY 1951 Operating Cost through May, 1951	23,134,075[2/]	
	Actual Accumulative FY 1951 Const. Cost through May, 1951	836,254	
	Total Accumulative FY 1951 Operating and Const. Cost through May, 1951		23,970,329[2/]
(d)	Estimated Operating Cost FY 1951 through June 1951.		26,712,097

1/ Includes $21,758 for May cost of stripping Building 9201-3 handled as deferred charge.

2/ Includes $132,477 cost to date of stripping Building 9201-3 handled as deferred charge.

[redacted]