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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JUNE 1952

RESEARCH AND DEVELOPMENT REPORT



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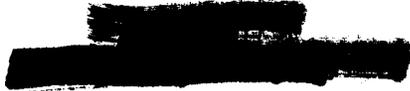
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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

June, 1952

J. P. Lane

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

June, 1952

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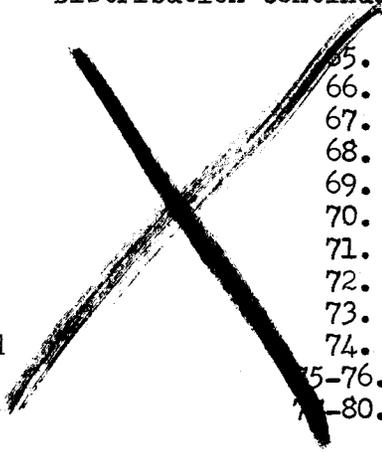
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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

June, 1952

PROGRAM 2000 - SOURCE AND FISSIONABLE MATERIALS

Purex Process (AEC Activity 2803.2)

Four runs have been completed in the pilot plant since the equipment was modified. The uranium product purity has improved and may be satisfactory. The pilot plant study is primarily concerned with the improvement of the ruthenium separation from the uranium product. Other problems also of interest include the sodium contamination of the uranium product and re-evaluation of the solvent recovery procedure.

The nitration of Purex solvent by mixtures of nitric acid and nitrous acid was investigated and found to be negligible ($<0.02\%$) under contemplated process conditions.

SCRUP Separation (AEC Activity 2344)

The research runs in which the plutonium product was isolated according to the irradiation history of the metal have been completed. The production runs are now in progress.

PROGRAM 3000 - WEAPONS

RaLa Production (AEC Activity 3982)

The RaLa run #47, which was completed June 6, 1952, yielded the largest product processed to date. The next run began June 28. Dummy runs have been made to improve the separations process.

PROGRAM 4000 - REACTOR DEVELOPMENT

MATERIALS TESTING REACTOR

LITR Operations

The LITR operated at 1500 KW per operating hour during June. Down time was 9.9% as compared with 16.6% in May.

HOMOGENEOUS REACTOR PROJECT

Homogeneous Reactor Experiment (AEC Activity 4261)

Early in June a critical test of the dump tanks while all the fuel was stored in them established that essentially no multiplication could be obtained in the present system. Following this the high temperature critical experiment program was started. The effect of variables introduced by connecting the low pressure system was studied. It was found that oxygen flow, the use of the pulsafeder pump, and steam pressurization have no measurable effect on reactivity.

The fuel and the reflector temperature coefficients were measured up to 220°C. The effect of the reflector level and control rod positions was redetermined at 200°C and additional data were taken for the inhour curve. The high temperature critical experiments are now complete and the next step in the schedule is operation at higher power levels.

Experimental Corrosion Studies (AEC Activity 4264)

Studies of the effect of pH on the corrosion of stainless steel by uranyl sulfate solutions indicate that in the range of 200 g U/l when the pH is above or below that of stoichiometric UO_2SO_4 , corrosion is more severe; thus, it seems unlikely that the addition of UO_3 will decrease corrosion rates in this concentration range. Also, evidence has been obtained to indicate that higher oxygen pressures cause increased corrosion.

Dynamic Corrosion Studies (AEC Activity 4264)

Recent failures of the Inconel cans around the rotors in three Westinghouse Model 100A pumps indicate that even below 100°C corrosion of Inconel by 100 g U/l uranyl sulfate solution is rather severe. However, the indications are that the corrosion of 347 stainless steel under these conditions is less than 0.5 mils per year.

A new loop has been put into operation using 700 g U/l uranyl sulfate solution at 100°C. Another loop containing UO_2F_2 with about 20% UO_3 to give 300 g U/l has been placed in operation at 250°C. The HRE mock-up is now being started up for a long term test with 40 g U/l uranyl sulfate at 250°C. Loops with UO_2SO_4 solutions containing 5 and 40 g U/l are also in operation at 250°C. A new loop containing major components fabricated of titanium is being constructed.

PROGRAM 4000 - REACTOR DEVELOPMENT Continued

Boiling Reactor Studies (AEC Activity 4264)

The current plan is to equip the Homogeneous Reactor Experiment #2 building so that a number of successive reactor cores can be tested. This will probably be done by mounting the reactor cores in a pit which can be flooded with water after completion of the experiments to allow the core to be removed to a connecting storage canal. When the reactor is in operation, the pit would be empty and shielded on the sides by earth and on the top by concrete. It is believed that this arrangement is considerably cheaper and more adaptable than other arrangements which have been considered.

Slurry Pumping Studies (AEC Activity 4264)

The 100A slurry pumping loop has been operated for 100 hours at 250°C with a 200 g U/l slurry. During this period there was no detectable corrosion or erosion, although the rod-shaped UO₃ particles were found to have decreased from ~2 x 20 microns to nearly spherical particles about 2 to 3 microns in diameter. Inspection of the pump impeller and housing following the test showed no evidence of corrosion or erosion in the regions of highest flow rates and turbulence. The loop is now shutdown for minor alterations.

Homogeneous Reactor Slurry Studies (AEC Activity 4264)

An improved procedure for preparing pure UO₃.H₂O, consisting of alternate calcination and hydration through four cycles, was developed. Slurries prepared from this material contained small sized particles which did not grow on heating at 250°C and exhibited low settling rates.

Static corrosion of 347 stainless steel by 250 g/l slurries of 93.4% enriched uranium at a temperature of 250°C in the X-10 pile at a flux of about 10¹¹ was investigated. Preliminary results indicate a low corrosion rate.

Homogeneous Reactor Chemical Processing (AEC Activity 4268)

The standard Purex process was found to yield good fission product decontamination in processing of 15 day cooled material. However, neptunium IV and VI followed the uranium and plutonium products as contaminants. Neptunium V was decontaminated by a factor of 100 in the Purex process.

Plutonium adsorption on the reactor walls to the extent of 1.7 mgs./sq. in. is likely to occur under Homogeneous Reactor operating conditions.

PROGRAM 4000 - REACTOR DEVELOPMENT Continued

AIRCRAFT NUCLEAR PROPULSION PROJECT

Aircraft Reactor Experiment (AEC Activity 4271)

The fluid circuit details are now 75% complete. The surge tank with modified liquid level indicators is being redesigned. Automatic control of liquid level is no longer contemplated. The manual system gives a much simpler arrangement requiring less elaborate instrumentation.

A glass mock-up of the core circuit was tested with water and with zinc chloride to study filling and emptying characteristics of the core. The tubes of the core were filled satisfactorily when the liquid was introduced into the evacuated system. The core could be emptied of some 80% of the fluid by blowing out the liquid with a gas pressure of 12 psi.

ANP Experimental Engineering (AEC Activity 4271)

Corrosion tests were continued by circulating within Inconel and 316 stainless steel the fluoride eutectics, particularly those containing zirconium. The high vapor pressure of zirconium fluoride has resulted in gas line plugging and heavy deposits of sublimed ZrF_4 above high temperature free surfaces. Cold traps are being developed as a means of alleviating this problem.

Since the fluorides have a positive coefficient of expansion, it is difficult to remelt the materials in plugged lines without bursting the pipe. As the current ARE design includes tube bends from which the fluorides cannot be drained, experiments are underway to determine whether very slow heating rates will prevent pipe bursting.

Work is underway to develop a header arrangement which will give equal flow distribution to all tubes of a proposed multi-tube one pass reactor core. A plexiglas mock-up of such a system is ready for testing.

Three types of pumps for high temperature fluoride systems are being installed in loops:

- A. A gas seal down-flow centrifugal pump designed for operation at temperatures above 1500°F.
- B. An Inconel braid, graphite and nickel powder packed seal pump designed to operate with fluorides with temperatures approaching 1500°F.
- C. The first ARE fluorides pump constructed of stainless steel and designed to operate at temperatures to 1500°F.

PROGRAM 4000 - REACTOR DEVELOPMENT Continued

ANP Metallurgy (AEC Activity 4275)

A "seesaw" test of a 50% Na-50% Pb alloy contained in 310 stainless steel was completed. The container was examined after 100 hours of operation at 1500°F and no crystal formation was detected. These results indicate that a Na-Pb reactor coolant may be satisfactory.

Alloys for brazing molybdenum are under investigation. Several alloys show adequate wetting properties; the flowability of the alloys and the mechanical strength of the joints will be determined.

A series of tensile tests for Inconel butt-braze specimens was completed. The brazing alloy was 75% Ag-20% Pd -5% Mn and test conditions were both room temperature and 1500°F. At room temperature the average tensile stress of the brazed joint was 55,900 psi and the average elongation was 9% but at 1500°F they were 19,700 psi and 2.5% respectively. Further work is intended for determining joint efficiency.

A laboratory for testing structural materials in creep under various corrosive environments has been completed. The equipment consists of six creep frames and four tube burst apparatus. The equipment has been calibrated and is in proper order to test the effect of fluoride mixtures on the creep properties of structural metals.

The results of tests of containing NaOH in Inconel are as follows:

<u>Temp. of Test, °C</u>	<u>Results</u>
350	No attack, no change in thickness, no weight change.
450	Same as above.
550	Three to four mils of intergranular penetration (0.0050 gms/in ² weight gain).
593	Three to four mils of intergranular penetration (0.0060 gms/in ² weight gain).

ANP Reactor Chemistry (AEC Activity 4275)

Fuel compositions for the ARE were established as follows:

Fuzrna 27 (m.p. 510°C)	Fuzrna 30 (m.p. 520°C)
ZrF ₄ 50 mol %	ZrF ₄ 46 mol %
NaF 46 " "	NaF 50 " "
UF ₄ 4 " "	UF ₄ 4 " "

PROGRAM 4000 - REACTOR DEVELOPMENT Continued

The major constituent in solidified Fuzrna 27 is a solid solution of NaUF_5 in NaZrF_5 . Fuzrna 30 conforms exactly to the stoichiometry of such a solid solution, and has a lower vapor pressure. The vapor pressure of Fuzrna 27 was 12 mm at 800°C ; this complicates the reactor design problems. The viscosity was 15 centipoise at 600°C .

Fluoride mixtures containing ZrF_4 can perhaps be used as a moderator coolant in contact with BeO because of the formation of a protective layer of ZrO_2 ; the rate of deposit of ZrO_2 decreases with time.

ANP Corrosion (AEC Activity 4275)

NiF_2 heated to 750°C in alkali fluorides gave a deposit of metallic nickel in spite of rigorous efforts to exclude reducing agents. Twelve or more complex fluorides of structural metals were synthesized for comparison with corrosion products.

Hydrogenation and hydrofluorination in the molten state was effective in reducing the corrosiveness of the finished fuel by five to ten fold. Sulfur contamination was also removed by this process.

Heat Transfer and Physical Properties Research (AEC Activity 4275)

The thermal conductivity of the fluoride mixture $(\text{Na-K-Li-U})\text{Fx}$ (10.9-43.5-44.5-1.1 mole %) has been measured as approximately 2 Btu per hr. ft. $^\circ\text{F}$ in the temperature range 500 to 800°C ; that of the lead-bismuth eutectic is approximately defined by the equation $k = 5.0 / 0.0014t$ where t in $^\circ\text{F}$ is $400 < t < 1100$.

The viscosity of the fluoride mixture $(\text{Na-Zr-U})\text{Fx}$ (46-50-4 mole %) as measured by the modified Brookfield viscometer is represented by the equation

$$\mu_{cp} = 0.17 e^{\frac{4000}{t}} \quad \text{where } t \text{ in } ^\circ\text{K} \text{ is } 800 < t < 1100.$$

Analytical studies have been undertaken as heat transfer in several systems of current interest; (a) preliminary results indicate only 1% of the reactor heat would be removed by the circulating moderator in a circulating fuel - circulating moderator arrangements; (b) calculation of flow velocity in thermal convections loop indicate the velocity to be around ~ 0.1 ft. per sec.; (c) a simplified analysis of a postulated stagnation region in a reactor fuel circuit indicated that excessively high temperatures would be present.

Reactor Physics (AEC Activity 4277)

Machine calculations have been carried out on various embodiments of a reactor with a liquid, homogeneous fluoride core, with a thick beryllium oxide and/or carbon reflector. The moderation obtained from the reflector is sufficient to give quite reasonable critical masses, i.e., less than

PROGRAM 4000 - REACTOR DEVELOPMENT Continued

25 lbs. for core diameters up to 32 inches. No conclusive calculation has been made as yet regarding the temperature coefficient of such a reactor. Apart from its mechanical simplicity, this type of reactor would have an advantage that some neutrons (those reflected into the core) would have a lifetime around 2.6×10^{-4} sec.

Placing a BeO "island" in the center of the core reduced the critical mass of the 16 in. diameter core to about 12 lb., while using a 1/4 in. thick Inconel shell between the core and the reflector increased the critical mass about 15%. Use of reactor grade graphite in place of the BeO for the reflector and the island gave a critical mass of about 40 lb.

PROGRAM 5000 - PHYSICAL RESEARCH

PRODUCTION OF ISOTOPES

Radioisotope Production (AEC Activity 5111)

The total accumulated KWH for pile operations during June were 2,277,511 averaging 3601 KW per operating hour. Pile down time was 12.1% as compared with 11.6% in May. There was one slug rupture which was discharged without difficulty.

There were 922 radioisotope shipments during June.

Stable Isotope Production (AEC Activity 5121)

The calutron tank time was devoted to the collection of boron, barium, and chlorine isotopes. Over-all innage for the four calutrons was 1050 hours with an integrated output of 22,345 ma. hrs. for the Beta channels and 4,067 ma. hrs. for the two Alpha channels. Outage time was 27.6% as compared with 30.8% during May.

Chemical processing refinement was conducted on isotopes of calcium and tin. Chemical services were supplied to the calutrons for the separation of isotopes of boron, barium, chlorine, lithium and neodymium. Preparations were made for the production of charge material for the separation of isotopes of ruthenium.

Ion deceleration experiments were continued. One assay reported from a previous run showed the purity of Li^6 to be 86%.

There were 21 stable isotope shipments during June.

PHYSICS

Scintillation Spectrometry and Instrument Development (AEC Activity 5211)

It has been observed that lithium iodide crystals activated with europium perform much better than tin activated LiI for neutron detection. The light output is 40% of that for NaI(Tl); the resolution is such that neutron energy measurements can be made with fair accuracy. The width of the peak in the pulse height spectrum when irradiated with thermal neutrons is about 5%. When irradiated with 2 Mev neutrons, a sharp peak at a correspondingly higher energy is obtained.

Short Lived Isomers (AEC Activity 5211)

The decay scheme of the gamma rays following the beta decay of Ha^{181} has been studied with sources enriched in Ha^{180} . The K shell internal conversion coefficient of the 481 Kv transition indicated that it is of the $E2 / M1$ type. The directional angular correlation of the 133-481Kv cascade of Ta^{181} has been re-examined with both dry and solution sources. An appreciable effect of the chemical state of Ha^{181} sources on the angular correlation has been observed. The anisotropy ranges from 8% with dry sources to 35% with dilute solutions. The maximum anisotropy expected is 62%.

PROGRAM 5000 - PHYSICAL RESEARCH Continued

Angular Correlation of Gamma-Rays (AEC Activity 5211)

The measurement of the angular correlation of the γ -rays emitted in the decay of excited states of Cd^{114} has been completed. The correlation obtained, $\omega(\theta) = 1 \mp .111 P_2(\cos\theta) \mp .023 P_4(\cos\theta)$ or $\omega(\theta) = 1 \mp .084 \cos^2\theta \mp .106 \cos^4\theta$, allows the spin assignment of $0 - 2 - 2$ for the ground state and the two excited states of Cd^{114} , respectively. The first γ -ray of the cascade is a mixture of 97% magnetic dipole and 3% electric quadrupole radiation with the electric and magnetic components in phase.

High Voltage Program (AEC Activity 5211)

The total cross sections of cerium, cadmium, selenium, and mercury have been run from 0.5 to 3.5 Mev. This new data fits the cross section-energy-atomic number diagram which recently appeared in the Physical Review, #86.

Neutron Velocity Selector (AEC Activity 5261)

Recalibration of the instrument has been completed. Measurement of the transmission of thorium is in progress. Samples of U^{236} and highly purified U^{238} are now on hand and their cross sections will be measured as soon as practicable.

Electronuclear Machines (AEC Activity 5261)

A beam of nitrogen ions of a few microamperes was observed at the maximum cyclotron radius of $25\frac{1}{2}$ inches. The beam, incident on a water-cooled brass target, produced gamma radiation which was approximately 400 times background. Uninterrupted runs of several hours duration on the cyclotron are now possible. Experimental difficulties have thus far prevented precise beam current measurements at the outer radii.

Bombardment of an internal ZrD target produced at least two activities of several hours half-life.

The 86-Inch Cyclotron (AEC Activity 5261)

Additional shielding has been added and other improvements are being made to the target handling facility in the cyclotron pit. These changes will make it possible to remove highly gamma-active targets from the machine with a minimum of exposure to operating personnel. A 42-inch deep window, made from a Lucite box which is to be filled with zinc bromide, and a mechanism for removing targets from behind this window, have recently been installed.

Two isotope production runs totaling more than 60,000 μah were completed. The assayed yield from both runs was higher by a factor of two than the average yield obtained prior to the cyclotron modification.

Four zinc bombardments for the production of Ga^{67} were made for ORINS.

PROGRAM 5000 - PHYSICAL RESEARCH Continued

Isotope Analysis Methods Laboratory (AEC Activity 5261)

Nuclear Resonance. The nuclear resonance of Se^{77} has been observed in H_2Se and a chemical shift detected in this compound. Measurements on $NaCl$ and $NaBr$ in D_2O were:

$$\frac{\nu(Na^{23})}{\nu(D^2)} = 1.72326 \pm .0001$$

Microwaves. The microwave spectrum of vinyl acetylene (C_4H_4) was observed for the first time in the $J = 2$ to $J = 3$ ($\Delta K = 0$) transition. The molecule is of the slightly asymmetric rotor type with a small dipole moment and weak spectrum. No hyperfine structure due to quadrupole coupling is expected. Rough Stark effect measurements correlate with predictions.

Optical Spectroscopy. Experiments have been made on uranium sources in a magnetic field to secure optimum source conditions for Zeeman studies of plutonium. A high intensity uranium hollow cathode source has been developed by press filling an aluminum cathode with a 1:10 U_3O_8 to powdered aluminum mixture and drilling out the central section.

Spectro-Isotopy. Direct reading photoelectric spectro-isotopic analysis of lithium has been performed at a sampling rate of one sample per man hour, with precision of about 5%.

X-Rays. X-ray investigations of about 80 samples were made for studies of plugged reactor solution loops, uranium-beryllium fluoride phase systems, and other reactor problems. The possibility of high precision X-ray fluorescence analysis for Zr in U_3O_8 is being investigated; preliminary results indicate precision of 0.05% Zr in the range 1.0% to 3.0% Zr.

Mass Spectrometer Laboratory (AEC Activity 5261)

Exploratory investigations of hydrogen-deuterium mixtures have been made. A gas sample system incorporating a micromanometer was built and installed. A special ion source was also built and put in operation.

CHEMISTRY

Nuclear Chemistry (AEC Activity 5311)

Recent availability of perm-selective ion exchange membranes has led to a redirection of basic studies away from conventional granular exchangers. The electrochemical properties (conductivity, ionic transport numbers, endosmosis, etc.) of these new materials are being investigated with the view to practical application in demineralization and ionic separations problems, particularly in continuous counter-current procedures. Extensive studies of radiation stability of both cation and anion materials are being conducted.

PROGRAM 5000 - PHYSICAL RESEARCH Continued

Radiation Chemistry (AEC Activity 5311)

A study is being made of the electrical conductivity of alkali halide crystals on heating at a constant rate after exposure to gamma rays. Conductivity maxima have been observed in sodium-chloride at temperatures close to those observed for glow-curve peaks and are attributed to thermal release of trapped electrons or positive holes. A decrease in ionic conductivity has been observed in all of the alkali halides studies. This decrease is attributed to the trapping of positive holes by positive ion vacancies. Most of the initial conductivity is restored on heating to 200°C.

Aqueous solutions of sulfuric acid at pH 1.0 or lower behave as if they contain a radical remover when irradiated with cobalt gamma rays. The yield of the forward reaction $2\text{H}_2\text{O} \rightarrow \text{H}_2 + \text{H}_2\text{O}_2$ has been observed at pH 1.5 to be increased by the presence of benzene. A decreased yield for the forward reaction is observed in highly acid solutions.

Chemistry of Uranium Raw Materials (AEC Activity 5361)

The studies of the solubility behavior of $\text{UO}_2\text{HPO}_4 \cdot 4\text{H}_2\text{O}$ in phosphoric acid have been extended down to 0.002M H_3PO_4 . Above 0.02M H_3PO_4 the solid phase, $\text{UO}_2\text{HPO}_4 \cdot 4\text{H}_2\text{O}$, has been identified but below 0.02M H_3PO_4 , $(\text{UO}_2)_3(\text{PO}_4)_2 \cdot 4\text{H}_2\text{O}$, has been found as the stable solid phase. A solid sample of uranous phosphate has been prepared from a uranous phosphate solution, 1M in HClO_4 and chemically identified as $\text{U}(\text{HPO}_4)_2 \cdot 4\text{H}_2\text{O}$.

Extraction of sulfuric acid leach liquor from Marysvale ore with di-2-ethylhexylphosphinic acid in kerosene followed by stripping in 8N sulfuric acid has given excellent recoveries of uranium and has yielded strip solutions containing greater than 40 grams uranium per liter. The separation of uranium from other metals seems satisfactory. Preliminary results using di-2-ethylhexylphosphate are also encouraging.

Uranium can be extracted from lignite ash by a simple water leach if the roast conditions are controlled. Treatment of the ash with $(\text{NH}_4)_2\text{CO}_3$ is also attractive. The NH_3 can be recycled. CO_2 is readily available from the stack gases, and the $(\text{NH}_4)_2\text{SO}_4$ formed during the leach can be recovered as a marketable product.

Instrumentation for Nuclear Chemistry (AEC Activity 5361)

A pulse analyzer system which incorporates a cathode ray tube with a special grid structure installed within has been developed. The cathode ray beam is focused on this grid and as the beam is deflected across the grid a series of pulses is obtained. The pulses are fed into a scaler which is used as the discriminator. With this system a fifty channel analyzer would have essentially only one trigger circuit.

A linear pulse amplifier utilizing double differentiation as a means of pulse shaping is under development. This amplifier will permit energy measurements

PROGRAM 5000 - PHYSICAL RESEARCH Continued

at counting rates five to ten times higher than previously possible without a degradation of resolution. The system also improves the overload characteristics of the amplifier by the same factor. These characteristics are especially useful in scintillation spectrometry.

Chemical Engineering Research (AEC Activity 5361)

A "concatenated" pulse column system, consisting of linked short column sections connected by lines containing check valves, is being developed for application to Purex and Thorex process plants. Initial tests of this system under Purex stripping conditions have shown slightly greater extraction efficiency per unit of column length than a straight column. The over-all height requirements for a complete "concatenated" column system in a production plant has been estimated to be approximately 16 feet, versus about 35 feet for a straight column Purex plant and about 48 feet for a straight column Thorex plant.

Thorex (AEC Activity 5361)

A flowsheet employing 54.5% TBP, which has a higher processing capacity than the previous flowsheet, was developed and found operable in pulse columns.

METALLURGY

Fundamental Radiation Damage (AEC Activity 5411)

Germanium has been bombarded in the low temperature facility located within the X-10 pile. In these radiation damage experiments the electrical conductivity was measured as a function of neutron bombardment. The rate of damage introduced by fast neutrons at -140°C appears to be at least twice as high as at ambient temperatures. The excess damage appears to anneal out at temperatures lower than -70°C .

Fundamental Physico - Metallurgical Research (AEC Activity 5411)

As-swaged rod of both iodide and commercial titanium was found to develop a duplex $[210]$ - $[631]$ fiber texture type of preferred orientation with minor $[421]$ and $[221]$ components. Upon annealing to effect recrystallization, the $[631]$ increased at the expense of the $[210]$ component.

Ceramics Research (AEC Activity 5411)

The development of a fluoride resistant ceramics coating is underway. This material would be particularly applicable to the lining of tanks used in certain phases of the gaseous diffusion process at K-25.

Hafnium oxide was changed from the monoclinic to the cubic crystal form by addition of 8 mol percent of CaO and firing in air for one hour at 1600°C . The thermal expansion behavior of hafnia from room temperature to 1300°C was observed and no inversions were found. X-ray examination indicates that

PROGRAM 5000 - PHYSICAL RESEARCH Continued

hafnium silicate was synthesized by firing equimolecular mixtures of HfO_2 and SiO_2 for one hour at 1500°C .

A study of the compatibility of selected refractory materials with various oxides, metals, carbides, and halides is in progress. Crucibles have been successfully cast of HfO_2 , ThO_2 , ZrSiO_4 , and ZrO_2 . It is proposed to fire these crucibles and investigate their behavior in contact with the various materials mentioned above at elevated temperatures.

PROGRAM 6000 - BIOLOGY AND MEDICINE

BIOLOGY

Mammalian Genetics (AEC Activity 6400)

The Hiroshima investigations have verified the fact that radiation seriously damages the embryos of pregnant mammals in the early stage of development. Of eleven pregnant women in a 1000 meter zone from "ground zero" who were in the first trimester, seven gave birth to infants who were seriously affected. The first indications of genetic changes have been found in the population that was within the 1000 meter range during the bomb explosion. These somewhat agree with the studies of genetical effects of radiation on mice. Many years will be required to evaluate conclusively these findings.

Biochemistry (AEC Activity 6400)

The use of ion exchange methods for separating biologically important compounds has been extended and has given promising results.

BIOPHYSICS

Physics of Radiation Dosimetry (AEC Activity 6510)

A cooperative program is being conducted with the Air Force to irradiate monkeys in the Bulk Shielding Facility. ORNL will measure the dosimetry in the exposure chambers and will act in a general advisory capacity, while the study of the radiation effects on the animals will be conducted by the Air Force Primate Laboratory. The necessary detection instruments are now being prepared prior to the exposure of the animals. These experiments are being conducted to determine permissible aircraft crew radiation dosage.

A program for measuring "W values" (energy loss per ion pair) for polonium alpha particles in various gases is underway. Several values for pure gases have been determined, and emphasis is now being placed on gas mixtures.

PROGRAM 9000 - RESEARCH FACILITIES

Research Laboratory Building #4500

The first floor of the administrative area immediately adjacent to Wing #1, including Central Files vault and Wing #1 should be finished in the coming week. The basement area is being checked out and is expected to be acceptable by July 11. The hood installation in Wing #4 has been completed by John F. Humphrey Company. The hood installation is now being made in Wing #3, and the expected completion date is on or around July 19. The contractor's work is 99% complete.

Conversion of Jones Construction Camp (Central Shops Building #7012)

An excavation of pier footings is about 95% complete. Concrete pier footings continue to be poured.

Gas Decontamination Facilities

Hand excavation is nearly complete. Further pouring continues for the concrete floor slab, and forms for tunnel walls are being erected.

High Voltage Laboratory Building #5500

The interior of the building has been completed by the contractor. The work on the exterior should be completed within one week.

RADIOISOTOPE SALES

<u>Sales</u>	<u>April</u>	<u>May</u>
Transfers within AEC	\$ 298.00	\$ 10.75
Cash Sales	13,960.30	7,631.25
Foreign	948.15	1,684.05
Cancer Program (Free)	49,723.20	40,285.50
Technical Cooperation Plan	-0-	435.00
Total Sales and Transfers FY 1952 to Date	2,334,214.06	1,044,766.46 ^{1/}
Total Cancer Program (Free) to Date	1,338,530.58	1,378,816.08
Technical Cooperation Plan (Shipments to Date)	14,517.55	14,952.55

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

(a) Actual Cost for May 1952	2,252,893.00	
Actual Plant and Equipment Cost	537,009.00	
Construction Program "H"	59,736.00	
Total Operating and Construction Cost for May 1952	<hr/>	2,849,638.00
(b) Estimated Operating Cost for June 1952		3,415,262.00
(c) Actual Accumulative FY 1952 Operating Cost through May 1952	25,574,252.00	
Actual Accumulative FY 1952 Plant and Equipment Cost through May 1952	4,177,444.00	
Actual Accumulative FY 1952 Construction Program "H" Cost through May 1952	474,589.00	
Total Accumulative FY 1952 Operating, Construction, and Plant and Equipment Cost through May 1952		<hr/> 30,226,285.00
(d) Estimated Operating Cost FY 1952 through June 1952		33,641,547.00

^{1/} This figure reflects fiscal year costs to date. Previously it has reflected total costs to date.

PERSONNEL SUMMARY

	<u>Number of Employees</u> <u>June, 1952</u>	<u>New Hires</u> <u>June</u>	<u>Terminations</u> <u>June</u>
Administration	80	1	1
Operations*	119	0	2
Engineering, Shops and Mechanical	902	7	2
Laboratory and Research	1559	94	6
Protection	182	3	0
Service	393	6	4
Total	3235	111	15

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