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LABORATORY RECORDS

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

NOVEMBER 1952

AEC RESEARCH AND DEVELOPMENT REPORT



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OAK RIDGE NATIONAL LABORATORY
STATUS AND PROGRESS REPORT

November, 1952

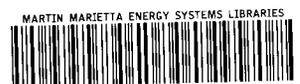
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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

November, 1952

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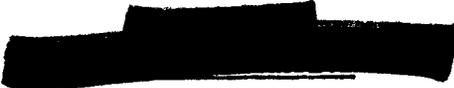
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OAK RIDGE NATIONAL LABORATORY

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PROGRAM 2000 - SOURCE AND FISSIONABLE MATERIALS

Purex (AEC Activity 2803.2)

Runs with 60 day cooled 600 MWD/Ton irradiated Hanford slugs are in progress. The crud which forms due to the presence of the high radiation level was successfully removed by continuous centrifugation.


PROGRAM 4000 - REACTOR DEVELOPMENT

HOMOGENEOUS REACTOR PROJECT

Homogeneous Reactor Experiment (AEC Activity 4103.1)

Installation of a filter in the cell ventilation system was completed and operation of the reactor resumed early in November. A power level of 30-40 kilowatts was reached during a short test and afterward while the reactor was operating at about one kilowatt a leak developed in the same oxygen addition line that leaked before, although in a different place.

The oxygen line has been removed and the fuel spill recovered satisfactorily. Repairs and alterations to the oxygen system are being made.

ISHR Design (AEC Activity 4109.1)

Preliminary design criteria and flowsheets for the two-region ISHR have been prepared and are being reviewed. Design of individual components of the system has been started.

Dynamic Corrosion Studies (AEC Activity 4109.4)

Samples of zirconium exposed to 5 g U/l UO_2SO_4 for 800 hours at 250°C showed that arc-melted zirconium sponge suffered the greatest weight loss while crystal bar, 2.5% tin alloy, and 5% tin alloy were attacked about equally and to much smaller degree than the arc-melted sponge.

Engineering Development (AEC Activity 4109.5)

The 50,000-gpm loop for flow studies with an 8-foot core is being assembled. The core arrangement to be studied first has two tangential, equatorial inlets with two polar outlets.

A loop has been designed for testing high-pressure catalytic recombiners. A platinized alumina catalyst will be tested for efficiency as a function of temperature, pressure and poisoning; another recombiner using a shell and tube arrangement with platinum supported by rough stainless steel tubing is being constructed. In the latter unit the heat of reaction will be used to produce diluent steam for the gas stream.

Homogeneous Reactor Fuel Reprocessing (AEC Activity 4109.81)

Experiments have shown that precipitated PuO_2 settles too slowly from Homogeneous Reactor fuels to be useful as a method of separation. When the reactor is operated at 100°C instead of 250°C, the plutonium does not

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PROGRAM 4000 - REACTOR DEVELOPMENT Continued

hydrolyze to PuO_2 at a rate sufficient for continuous filtration or centrifugation which precludes the use of this method for removing Pu from the UO_2SO_4 fuel solution.

Slurry Studies (AEC Activity 4412.31)

Equipment for slurry critical experiments has been tested and is now being reassembled at the critical experiment facility, building 9213. The effects of agitation and settling upon criticality will be studied.

Design of a loop for pumping thorium oxide slurries is under consideration. Preliminary investigations indicate that concentrated slurries are highly thixotropic and that pumping may be a problem. The hardness of thorium oxide particles is approximately the same as stainless steel and abrasion of stainless steel by the slurry has already been observed in tests.

Work on the preparation and properties of UO_2CO_3 slurries indicates that with a small amount of Na_2CO_3 these slurries can be stabilized to some extent, giving a much slower settling rate. The UO_2CO_3 slurries show more desirable properties from the standpoint of settling than $\text{UO}_3\cdot\text{H}_2\text{O}$ slurries and can be prepared in a more finely divided form. Experiments for studying thermal and radiation stability are being undertaken.

AIRCRAFT NUCLEAR PROPULSION PROJECT

Aircraft Reactor Experiment (AEC Activity 4401.1)

A comprehensive schedule was drawn up for completion of the reactor assembly in the Y-12 Shops. A considerable amount of work remains to be done on the pressure shell and, therefore, it will be impossible to complete the entire pressure shell assembly before March 1, 1953. This imposes a set-back of some two months to the ARE completion date.

Installation in the building has proceeded satisfactorily. The control room equipment is 90% complete as far as installation is concerned and some electrical wiring of the relay panels has been made. The control rod actuator parts have been received. The installation of the vacuum, water, hydraulic, and rod cooling systems are now approximately 75% completed in the building.

The fuel circuit heat exchangers have been finished but have not yet been received from the vendor. In addition, the motor generator sets have not yet been received but procurement generally is on schedule.

Final design details for the off-gas system were completed. Slight modifications were found necessary in the fission chamber shielding and in the final fuel disposal system. All designs are now sufficiently completed to allow construction and installation to proceed.

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PROGRAM 4000 - REACTOR DEVELOPMENT Continued

ANP General Design (AEC Activity 4401.1)

Analytical work on sodium-to-air radiators indicates that superior performance can be obtained from fin spacings of the order of 30 fins per inch instead of the 15 fins per inch used in test work to date. The size, weight and number of tubes should all be cut drastically by the close spacing if the assumptions made in the analytical work are valid. As there is no existing data which is applicable to this problem, a core element with the close fin spacing has been assembled and will be tested.

Plans are being made to build a mock-up of a 3 MW "Fireball" reactor using a helium-cooled reflector consisting mainly of graphite but employing a "lining" of the BeO blocks left over from the ARE. Preliminary sketches indicate that the complete system including reactor, heat exchangers, pumps and blowers can be enclosed in a cylindrical tank approximately 9' in diameter and 13' long.

ANP Experimental Engineering (AEC Activity 4401.1)

The first ARE pump which has a frozen fluorides seal has been received from the shop and is being assembled into its test loop. This seal is packed with Inconel braid to inhibit leakage around the shaft and provisions are made at the back of the packing to freeze the slight leakage. Since the pump is also to be used with NaK, provisions for solid sodium seals are also included. This comprises a heated annulus for molten sodium outboard of the packing and cooling coils at either side of the annulus. This seal is to be used for pumping NaK during cleaning of the fuel circuits, and is the primary seal for the pumps in the NaK moderator coolant circuit.

The bi-fluid heat transfer system for measuring over-all heat transfer coefficients from the fluorides to liquid metals has been completely assembled and shakedown runs with (Na-Zr-U) F_x and NaK have been made.

A rotameter type flowmeter has been operated for more than 600 hours in a high temperature fluorides loop measuring the fluid flow at 1300°F. This instrument incorporates a tapered core operating inside an induction coil as the float position indicator.

Tests to determine the extend of gas line plugging from vapors of a bath of the fuel 46% NaF: 50% ZrF_4 : 4% UF_4 (mol %) (Fuzrna #27) at various elevated temperatures indicate the following:

1. Fuzrna #27 at 1050°F caused no gas line plugging to the termination of the test at 1488 hours.
2. Fuzrna #27 at 1300°F caused all gas lines to partially plug after 266 hours, reducing gas flow rate to .1 of its initial value.

[REDACTED]

PROGRAM 4000 - REACTOR DEVELOPMENT Continued

3. Fuzrna #27 at 1500°F caused all lines to be plugged solid in less than 100 hours of operation.

These tests indicate that gas lines may be expected to operate satisfactorily in a system containing Fuzrna #27 providing the free surface of the fuel adjacent to the entry of the gas lines is maintained at a temperature of 1050-1100°F. Other tests were conducted to determine at what temperature metal container walls must be kept in order to minimize or prevent the deposition of ZrF_4 on metallic surfaces. Results of these tests indicate that ZrF_4 vapors given off from Fuzrna #27 at 1500°F will deposit on any surface at 1250°F or below. When the temperature of the container walls is kept greater than 1250°F, no ZrF_4 crystals are found.

Tests conducted to determine the weight loss of BeO when exposed to high temperature NaK under dynamic conditions indicate that there may be a BeO weight loss in excess of 10% when agitated in 1400°F NaK for 100 hours or longer.

At the present time it is planned to circulate high temperature NaK in the ARE fuel circuit for precleaning. It is anticipated that approximately 95% of the NaK can be drained or blown from the fuel circuit; however, the remaining NaK must be removed by vacuum distillation. An experimental unit has been fabricated and the first test of vacuum distillation of NaK has been conducted. Results indicate that all residual NaK could be removed from the ARE in this manner.

ANP Metallurgy (AEC Activity 4401.5)

The thermal convection loop fabricated from quartz has been used to study the mass transfer effects of columbium metal in molten lead. A 500 hour test indicated that no constriction formed. Metallographic examinations of columbium samples located in both the hot region (800°C) and the cooler region (400°C) are under way.

The search for methods of producing spherical particles of uranium-containing alloys to be used in solid fuel elements is continuing. One method under study is to melt the alloy in a platinum crucible, and to force the molten alloy with compressed inert gas through a small opening in the bottom of the crucible.

In the study of high heat conducting fin material for use in aircraft radiators, the compatibility of materials, such as copper, gold, silver with structural materials Inconel and stainless steel are being investigated. Fins are being made of copper and oxidation resistance is being imparted to this material by cladding with Inconel and stainless steel and by electroplating with chromium. The fins will then be brazed into tubes and the sub-assembly will be operated for long periods of time at 1500°F in an air atmosphere. After these tests, the specimens will be examined for oxidation protection of the copper,



PROGRAM 4000 - REACTOR DEVELOPMENT Continued

diffusion of copper into the parent metal, changes in the mechanical properties and corrosion resistance. The effectiveness of the brazed joint will also be studied.

Seesaw tests on various sodium-lead mixtures contained in 430 stainless steel have been completed. The results are listed below:

Bath	Average, Temp., C°		Remarks
	Hot Zone	Cold Zone	
5% Na-95% Pb	850	570	One mil subsurface voids in hot zone.
10% Na-90% Pb	845	580	One mil subsurface voids in hot zone.
15% Na-85% Pb	825	575	One mil subsurface voids in hot zone.
20% Na-80% Pb	810	575	One mil subsurface voids in hot zone.
25% Na-75% Pb	810	560	No apparent attack.
30% Na-70% Pb	830	610	No apparent attack.

Tensile-shear tests were conducted on spot-welded clad fuel elements and relatively high tensile strengths were obtained. In all cases, a plug-type failure occurred. This is to be distinguished from the brittle-shear type failure associated with weak spot welds. On a clad element thickness of 0.030 inch, a spot weld made under ideal conditions pulled a plug with a force of 575 pounds. Under conditions of moderate weld metal expulsion, a force of 750 pounds was required. Welds made on 0.030 inch stainless steel should have a load carrying ability of at least 800 pounds, but the UO₂ core has a limiting effect upon weld nugget size and, therefore, upon the tensile strength.

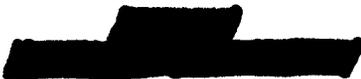
Heat Transfer and Physical Properties Research (AEC Activity 4401.5)

The viscosities and densities of the two fluoride mixtures NaF-ZrF₄ (50-50 mole %) and NaF-ZrF₄ (50-25-25 mole %) have been measured on the modified Brookfield viscometer. The viscosity of the first mixture ranged from 15 centipoise at 610°C to 5 centipoise at 1030°C. The viscosity of the latter ranged from 20 centipoise at 650°C to 11 centipoise at 880°C.

Preliminary forced convection heat transfer data have been obtained for the circulation of molten Flinak (NaK-KF-LiF: 12-42-46 mole %) in long tubes. Mathematical heat transfer studies in annulus systems are being conducted.

Reactor Physics (AEC Activity 4401.7)

A preliminary mock-up of a "Fireball" reactor was assembled with available material and was brought to criticality. A reactor calculation method, using



[REDACTED]

PROGRAM 4000 - REACTOR DEVELOPMENT Continued

the method of images to solve the Fermi age equation, was developed. An approximate expression was obtained for the temperature dependence of neutron absorption in the case in which the absorption cross section shows a resonance.

GENERAL REACTOR RESEARCH

Idaho Chemical Plant (AEC Activity 10543)

The construction contractors are expected to have the chemical plant completed in December. Cold uranium runs are in process; the removal of silica from dissolved MTR type fuel elements and the mercury contamination of the uranium product are problems under investigation. The Waste Evaporator is being tested with water and the testing of the Off-Gas System is scheduled for December. Nine ORNL people are located at the site.

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PROGRAM 5000 - PHYSICAL RESEARCH

REACTOR OPERATIONS

The total accumulated KWH for X-10 pile operations during November were 2,601,149 averaging 3950 KW per operating hour. Pile down time was 3.5% as compared with 8.2% in October. There was one slug rupture, which was discharged without difficulty.

The total accumulated KWH for LITR operations during November were 971,353 averaging 1,497 KW per operating hour. Down time was 9.9% as compared with 7.5% in October.

ISOTOPE PRODUCTION

Radioisotope Production (AEC Activity 5111)

There were 835 radioisotope shipments during November.

Stable Isotope Production (AEC Activity 5121)

Lithium and sulphur were processed during the month yielding six isotopes. Production innage for the four calutrons was 1797 hours, while 229 hours of XBX time was devoted to non-productive exploratory runs. Outage time was 14.4% as compared with 17.8% last month. The integrated output was 858,773 ma hours for the Alpha channels and 14,635 ma hours for the Beta channels.

There were 20 stable isotope shipments during November.

PHYSICS

High Voltage Program (AEC Activity 5211)

The angular distribution of the deuterons from the $\text{He}^3(\text{T,D})\text{He}^4$ reaction, with respect to the beam, was observed to be isotropic in center of mass to within 10%.

Low Temperature and Nuclear Alignment (AEC Activity 5211)

The electrical resistance of zirconium has been measured from 1°K to 300°K. It behaves as a normal metal in that, in the liquid hydrogen region and below, the resistance has a fifth power dependence on temperature. The Debye theta has been determined from these measurements to be about 290°K at 300°K and 160°K at 77°K. This falling off of the Debye theta with temperature is common to many metals.

[REDACTED]

PROGRAM 5000 - PHYSICAL RESEARCH Continued

The magnetic susceptibility of UF_3-LaCl_3 solid solutions has been measured at liquid helium temperatures. While pure UF_3 is anti-ferromagnetic at room temperature, the magnetic susceptibility of these dilute solid solutions is found to follow a Curie-Weiss Law in the liquid helium temperature range with a Weiss constant less than $0.1^\circ K$. The determination of the magnetic susceptibility of these solid solutions serves as the basis for the measurement of the hyperfine structure coupling of the U^{235} nucleus to the surrounding magnetic electrons in trivalent uranium.

Magnetic susceptibility measurements on manganous chloride reveal that this material becomes anti-ferromagnetic at about $2^\circ K$; only two other compounds investigated have anti-ferromagnetic transitions at such low temperatures. The two transition temperature means that the electron spin super-lattice is relatively loosely bound and it is possible then to study the transition from anti-ferromagnetism to paramagnetism produced by the application of a magnetic field below the Néel temperature. These studies will lead to the entropy of this salt which is a measure of the electron spin ordering.

The polarization of the manganese-55 nucleus has been observed as a change produced in its neutron capture cross section by changes in the relative neutron spin orientation. A change of $4.0 \pm 0.3\%$ has been observed at $0.22^\circ K$ and of $0.8 \pm 0.3\%$ at $1.2^\circ K$. This change of cross section due to nuclear polarization should be proportional to $1/T$, and this is found to be true within experimental precision. At present, the lower of the above two temperatures ($\sim 0.2^\circ K$) is being measured, using a thermodynamic cycle. The results of measurements by two independent methods have given $T = 0.20^\circ \pm 0.02^\circ K$ and $T = 0.24^\circ \pm 0.02^\circ K$.

Mathematics and Computation (AEC Activity 5211)

A special purpose digital computer for solving large systems of simultaneous linear algebraic equations has been installed at ORNL. This machine, originally constructed by NEPA, is loaned by the United States Air Force. Pre-operational testing of the machine was completed and solutions of four problems have been made. The ORACLE (Oak Ridge Automatic Computer and Logical Machine), a general purpose computer capable of performing a wide variety of problems, is being completed at Argonne by both Argonne and ORNL personnel. The necessary engineering is being performed for installation of the machine in the ORNL Computer Room next Spring.

Neutron Velocity Selector (AEC Activity 5261)

A broad resonance was observed at 3700 electron volts in the measurement of the total cross section of nickel-62.

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PROGRAM 5000 - PHYSICAL RESEARCH Continued

Neutron Diffraction (AEC Activity 5211)

Resistivity measurements made at Ames Laboratory on the rare earth metals gadolinium, dysprosium, and erbium suggested that erbium might undergo a ferromagnetic transition analogous to that known to exist in gadolinium. Ames provided a sample of erbium metal for neutron diffraction measurements in ORNL facilities. Preliminary results indicate that a ferromagnetic transition exists in the neighborhood of 60°K and the moments are probably oriented parallel to the C axis of the hexagonal unit cell. An interesting anomaly appears in the pattern at 63°K; this is being further studied. The intensities of the forward peaks are enhanced by a factor of four in the ferromagnetic as compared to the paramagnetic state. The coherent enhancement is accompanied by a marked reduction in the diffuse scattering.

The 86-Inch Cyclotron (AEC Activity 5261)

A new high current record of three milliamperes at 22 Mev was established on the 86" cyclotron; the pertinent data is as follows:

Beam (μ a)	Input to Osc (kw)	Beam Power (kw)	Stray Ion Load (kw)	Efficiencies (%) A	B
2,318	314.2	51.0	43.8	16.2	53.8
3,000	270.2	66.1	54.0	17.9	55.0

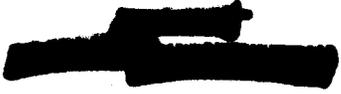
where: Eff. A = Beam power/dc power input to oscillator
Eff. B = Beam power/stray ion load \div beam power

The beam power to the 6" x 10" water-cooled aluminum target was determined calorimetrically. The previous record had been 1.85 milliamperes at 22.5 Mev, or a beam power of 41.7 kw.

A method using "half coil" windings on the cyclotron pole pieces has proven effective in shifting the beam orbits off center. The beam energy can be changed from 18 to 23 Mev by different excitations of the "half coils". This method of controlling the position of the beam may prove very useful in connection with the beam deflector now being designed.

The 63-Inch Cyclotron (AEC Activity 5261)

A range-energy curve for nitrogen ions in emulsions exposed to the internal 63" cyclotron beam has been determined by the following method. Nitrogen-proton scatter events can be readily identified in the emulsion since the nitrogens are practically undeflected. From the known range-energy relations of protons in emulsions and the angle between the nitrogen and proton tracks, an energy can be assigned to the residual nitrogen track length. Approximately 100 such events have been measured to date.


PROGRAM 5000 - PHYSICAL RESEARCH Continued

The ratio of the cross sections of two nitrogen-induced reactions in carbon has been measured as a function of incident energy. At low energies the reaction $N^{14} + C^{12} \rightarrow Na^{24} + 2H^1$ is favored over the one going to $F^{18} + 2He^4$ (or $+ Be^8$). Relative cross sections of some nitrogen-induced reactions in Be, B, C, N, and O are also being determined.

Isotope Analysis Methods Laboratory (AEC Activity 5261)

Modifications in microwave equipment have contributed to the measurement of an excited bending mode of the $J = 3 \rightarrow 4$ hyperfine pattern for vinylacetylene, an asymmetric rotor molecule. The unusual molecular distortion effects observed in the ground state bending mode occur also in the excited states.

A high resolution echelle spectrograph has been tested to determine its sensitivity for analyzing rare earths in uranium and uranium isotopes. Less than 50 parts per million of Gd, La, and Yb in uranium were detected in direct sampling. Further tests showed that 0.84% of U^{236} in a mixture of U^{234} and U^{238} was readily detectable.

An investigation of random uranium salvage samples using X-ray absorption direct analysis gave good agreement with the slower gravimetric chemical analysis method.

Mass Spectrometer Laboratory (AEC Activity 5261)

Investigations were made on the cause and cure of the grid deposits formed during the separation of lithium isotopes. Both mass spectrometer and chemical analyses confirmed that the deposit consisted of lithium and copper with much smaller amounts of zinc, silver, tin, and iron. When untreated lithium chloride was studied in the mass spectrometer, considerable evidence was found of free chlorine. Lithium chloride which was mixed with lithium metal showed almost no free chlorine.

In the course of investigating lithium chloride in the mass spectrometer, large currents due to Li_2Cl^+ ions were observed. The most prominent ion peaks appear at e/m values of 48 and 51. A sensitive method of isotopic analysis of lithium has been developed using these ions. There was also noted some evidence for the existence of $Li_3Cl_2^+$ ions.

Techniques are being investigated for performing hydrogen-deuterium analyses on the General Electric Mass Spectrometer. The fabrication of the H/D machines are now more than 90% complete.


PROGRAM 5000 - PHYSICAL RESEARCH Continued

CHEMISTRY

Radiation Chemistry (AEC Activity 5311)

A Van de Graaff generator has been obtained from High Voltage Engineering Corporation for radiation chemistry studies. This machine provides an external electron beam at energies up to 2 Mv and currents up to 100 microamps. With an internal gold target, X-ray intensities up to about 25,000 r per minute are obtainable.

The reduction of ceric sulfate in 0.8 N. sulfuric acid solution has been suggested as a radiation actinometer. The rate of reduction by cobalt gamma-rays is stoichiometrically equivalent to the rate of hydrogen peroxide formation in solutions containing oxygen or a hydrogen-oxygen mixture. It is concluded that ceric sulfate reduction takes place through the intermediate formation of hydrogen peroxide.

The mechanism of the gamma-ray induced oxidation of U^{4+} in sulfuric acid solutions is being studied. U^{4+} is oxidized completely to U^{6+} at rates ranging from 1.6 ions oxidized per 100 ev. in degassed solutions to 7.8 ions per 100 ev with oxygen present.

Studies of bubble nucleation by fission recoils in superheated uranyl sulfate solutions have been extended to 250°C where the maximum superheating possible in the presence of fissions is about 2°C. Fast neutrons have been shown to cause nucleation in superheated pure water.

Thorex (AEC Activity 5361)

Laboratory scale counter current batch runs indicate that ruthenium decontamination in the first (A) column is not adequate. Amsco 125-90W was found to be a satisfactory diluent for the solvent. The pilot plant is designed to reduce radiation hazards to personnel by relocation of process equipment containing radioactive material into areas according to the amount of maintenance or operation required. According to present plans a new sampling gallery will be added to the 3019 pilot plant building.

Chemistry of Corrosion (AEC Activity 5361)

Theoretical considerations led to the expectation that pertechnetate ion might have corrosion inhibiting properties similar to the chromate ion. Preliminary experiments have demonstrated that this is true for water containing 10 ppm of chloride with electrolytic iron and mild steel at temperatures up to 250°C. Experiments with 347 stainless steel and uranyl sulfate (40 g U/l and 300 g U/l) at 250°C in the presence of the pertechnetate ion are underway.



[REDACTED]

PROGRAM 5000 - PHYSICAL RESEARCH Continued

Chemistry of Uranium Raw Materials (AEC Activity 5361)

Uranium ²³⁸ is reduced appreciably by ferrous iron in ca. 2 M phosphoric acid solution and is completely reduced in 6M phosphoric acid. The extent of reduction is proportional to approximately the eighth power of the acid concentration.

Tri(2-ethylhexyl) phosphine oxide, butyl dibutyl-phosphinate, di(2-ethylhexyl) phosphinic acid, and dioctyl pyrophosphoric acid have given good extractions of uranium from a high phosphate-nitrate liquor as obtained in processing the Florida Leached Zone materials.

When mineral acids of the same percent concentration are used to strip uranium from organophosphorus acids, the coefficients decrease in the order HF, HCl, H₃PO₄, H₂SO₄. The ammonium salts of di(2-ethylhexyl) phosphoric and phosphinic acids are kerosene soluble; hence, uranium can be stripped from solution by bases as well as acids.

Using radioactive tracer methods the solubility and distribution of di(2-ethylhexyl) phosphinic acid in water and various acid solutions have been determined to be no higher than a few parts per million.

METALLURGY

Physical Metallurgy of Reactor Materials (AEC Activity 5411)

A breeder type solid fuel element consisting of a uranium-thorium alloy core clad in aluminum has been fabricated. The uranium content is between 1% and 2%. The objective is to develop a long life MTR type fuel element. In-pile tests of this single fuel element are scheduled for irradiation in the MTR during December.

Fundamental Investigations of Radiation Damage in Solids (AEC Activity 5411)

The magnetic susceptibility balance apparatus for measuring susceptibility of germanium as a function of bombardment is completed. The apparatus has been calibrated and is capable of detecting one tenth of one microgram change in weight. Preliminary measurements on unirradiated germanium has been made over a range between room temperature and liquid nitrogen temperature. The sensitivity appears to be adequate for measurements on irradiated material. The study is to determine the nature of the electron trapping process associated with bombardment.

[REDACTED]


PROGRAM 5000 - PHYSICAL RESEARCH Continued

The effect of neutron bombardment on the electrical properties of a large number of germanium samples has been studied between temperatures of -160°C and -100°C in a low temperature facility located within the X-10 graphite reactor. The effects on the electrical conductivity are complicated in contrast to observations at room temperature. In addition the annealing behavior of the disorder induced during low temperature bombardment is being investigated. The low temperature facility is also being used to extend the information on the bombardment of Cu-Be alloys to low temperature regions. A 2% Be-98% Cu solution quenched alloy increased in resistance by 0.8% at -150°C after bombardment of 5×10^{16} nvt.


PROGRAM 6000 - BIOLOGY AND MEDICINE

BIOLOGY

Cytogenetics (AEC Activity 6400)

It was found that the egg yolk is essential for recovery of the grasshopper neuroblast after exposure to X-rays. An analysis of the factors which are responsible for this recovery in egg yolk is being made.

It had been found previously that infrared sensitizes Tradescantia to the action of X-rays. The maximum temperature at which the infrared radiation can be given is 20°C.

Radiation Protection (AEC Activity 6400)

Careful studies were made of the response of bacteria to X-rays at low temperatures both in the presence and the absence of oxygen. It was found that E. coli increases slightly in sensitivity with increasing temperatures in the absence of oxygen. Similar behavior was observed in E. coli in the presence of oxygen up to about -70°C. At higher temperatures, the sensitivity in the presence of oxygen increases rapidly. It appears that the protection afforded by irradiation at extremely low temperatures will protect approximately 80% of the organisms.


PROGRAM 9000 - RESEARCH FACILITIES

Central Shops Building #7012

The contractors portion of the work is 33% complete. Erection of structural steel is 80% complete.

Iodine-131 Plant Building #3028

The contractors portion of the work is 5% complete. Process drainage lines are being laid prior to pouring concrete floors. Foundation concrete pouring is underway.

Additions to the Metal Recovery Plant Building #3505

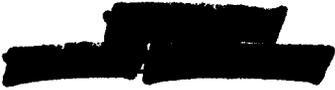
The sampling and pumping area addition is essentially completed. The project was finished somewhat behind the original schedule because of the delayed delivery of metal siding for enclosing the area.

Cooling System for the LITR

The air cooler for the LITR has been completed. This structure will conserve water in that the water from the heat exchanger system can now be recycled.

Gas Decontamination Facilities for Buildings #4500 and #4501

All tie-ins have been made at the Radioisotope Processing Area stack. Tie-ins are yet to be made at the buildings.



RADIOISOTOPE SALES

<u>Sales</u>	<u>September</u>	<u>October</u>
Transfers within AEC	\$ 2,532.25	\$ 27.80
Cash Sales	10,241.25	7,485.00
Foreign	1,322.70	1,530.65
Cancer Program (Free)	16,849.56	18,371.82
Technical Cooperation Plan	-0-	-0-
Total Sales and Transfers FY 1953 to Date	227,385.17	313,129.35
Total Cancer Program (Free) to Date	1,470,195.84	1,488,567.66
Technical Cooperation Plan (Shipment to Date)	15,152.55	15,152.55

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

(a) Actual Cost for October, 1952	2,579,102	
Actual Plant and Equipment Cost	518,973	
Construction Program "H"	36,051	
Total Operating and Construction Cost for October, 1952		<u>3,134,126</u>
(b) Estimated Operating Cost for November, 1952		3,100,000
(c) Actual Accumulative FY 1953 Operating Cost through October, 1952	9,602,264	
Actual Accumulative FY 1953 Plant and Equipment Cost through October, 1952	1,553,828	
Actual Accumulative FY 1953 Construction Program "H" Cost through October, 1952	104,447	
Total Accumulative FY 1953 Operating, Construction, and Plant and Equipment Cost through October, 1952		<u>11,260,539</u>
(d) Estimated Operating Cost FY 1953 through November, 1952		14,360,539





PERSONNEL SUMMARY

	<u>Number of Employees</u> <u>November, 1952</u>	<u>New Hires</u> <u>November</u>	<u>Terminations</u> <u>November</u>
Administration	73	1	3
Operations*	120	2	0
Engineering, Shops and Mechanical	930	22	1
Laboratory and Research	1480	11	18
Protection	177	0	3
Service	391	2	4
Total	3171	38	29

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

