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AEC RESEARCH AND DEVELOPMENT REPORT

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

FEBRUARY, 1951

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

FEBRUARY, 1951

W. E. Thompson

Date Issued: MAR 8 1951

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PROGRAM 1000 - RESEARCH FACILITIES

Research Laboratory Building

Work on this building is approximately 8% complete. Concrete footings, columns, foundation walls and grade beam walls are approximately 90% complete. Approximately 10% of the structural steel has been erected in Wings 3 and 4.

Isotope Research and Semi-Works Building

Work on this building is approximately 14.8% complete. Footings, columns, walls and grade beams are approximately complete. Concrete cell structure in Semi-Works area is being erected. Structural steel is being erected on southeast corner of building.

High Voltage Laboratory Building

Plans and specifications are complete. Bids have been received.

Health Physics Waste Research Building

Contract awarded to V. L. Nicholson Company. Work has been started on excavation and form building.

Chemical Isolation Laboratory Building

Phase I drawings and specifications have been approved, and the Architect-Engineer has been authorized to proceed with Phase II engineering.

Aircraft Reactor Experiment Building

The Austin Company is working on Phase I design.

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PROGRAM 2000 - SOURCE AND FISSIONABLE MATERIALS

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

The installation of the process equipment in the ORNL Metal Recovery Building was continued, with 30% of the process equipment installed and all the connections made to the Tank Farm. The processing program for the building has been expanded to include three jobs other than the metal recovery job for which it was originally designed. These jobs are (1) the processing of old Hanford material for the recovery of Strontium-90 for the radioisotopes group, (2) the processing of production material from the Chalk River Reactor for the recovery of plutonium, and (3) the processing of the uranium from the X Reactor for the recovery of the plutonium. When these three programs are completed, the recovery of the uranium from the ORNL metal waste will be initiated.

Purex Process (AEC Activity 2802-3)

The pilot plant development of the Purex Process was continued with runs made in both pulse and packed columns to determine their maximum capacity. In addition, piping alterations were made in the Pilot Plant, converting it from the No. 2 flowsheet to the No. 1 flowsheet on the basis of laboratory tests. The Pilot Plant program through May will be limited now to the No. 1 flowsheet with runs starting at 10% ORNL level about March 15, and the final run in May at 30% Hanford level.

In the course of the laboratory study on the Purex No. 2 flowsheet, it was found that the separation of plutonium from uranium in one cycle, as was required in this flowsheet was not satisfactory. Therefore, the results of this work recommended that the No. 1 flowsheet, with 2 uranium cycles available for plutonium separation, be the number one effort of the Pilot Plant. Major laboratory studies are now concerned with the recovery of nitric acid from the extraction waste and evaluation of the fumes given off during the metal solution step.

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PROGRAM 3000 - WEAPONS

RaLa Development (AEC Activity 3670)

In the ORNL RaLa Plant, the installation of the ion exchange cubicle for the final barium purification was continued. The present production schedule calls for a small trial shipment in March and full-scale shipments in May and July.

Sufficient progress has been made in the laboratory stage of the MTR RaLa Process that the design of the pilot plant equipment will be started during the coming month.

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PROGRAM 4000 - REACTOR DEVELOPMENT

MATERIALS TESTING REACTOR

Mockup Conversion (AEC Activity 9543)

Full power operation was achieved during the month of February. It is expected that continuous operation will be started during March. Arrangements are now being made for the training of Phillips Petroleum personnel to start early in April or possibly the end of March.

Pre-Installation Assembly of MTR Components (AEC Activity 9543)

The objective of the pre-installation assembly of MTR components is to insure the compatability and operability of the various parts supplied by different vendors and to gain experience which will hold the field assembly and installation time to a minimum. The completed assembly will include the reactor tank and its attendant castings, the beryllium reflector, the top plug and control element drives and the bottom plug. All components will be tested for fit and tolerance; necessary alterations will be made in the shops, so that the final assembly at Arco can be performed without any last-minute changes.

25 Process Design (AEC Activity 9541)

The final approved engineering flowsheet for the main line process was transmitted to Foster Wheeler on February 9, 1951. The vessel arrangement drawings are essentially complete. The design of 80% of the process vessels has been approved. Approximately 20% of the drawings for the fabrication of these vessels were approved for fabrication, which is scheduled to begin about March 1. Special equipment required for charging the hot material for the filters, the samplers, and the laboratory specific gravity dilution and storage areas is being fabricated.

The two major process problems related to this program were (1) dissolution of the P-10 slug and (2) the development of a fumeless dissolving procedure. Preliminary results of full-scale P-10 dissolving tests have been very satisfactory. In the fumeless dissolver problem, an AEC contract has been initiated with Linde to allow adequate demonstration of the process before June 1, 1951.

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HOMOGENEOUS REACTOR EXPERIMENT

Experimental and Design Engineering for HRE (AEC Activity 4264)

Although minor jobs remain to be done before the HRE building is accepted from the contractor, the building will be occupied by ORNL personnel about the first of March. Construction of the reactor proper will be started during March.

The use of hard stellite bearings in the Westinghouse 100-gpm fuel solution pump has been quite encouraging in the tests to date.

Reactor Chemistry (AEC Activity 4263)

A concerted effort has been undertaken to explore the fundamental chemistry of corrosion inhibiting films in the HRE components. It is hoped that these fundamental studies will lead to the establishment of a set of chemical requirements for pretreatment and operation of the system so that by following the proper steps one can be sure that a system treated in this manner will operate satisfactorily.

The work to date has indicated that under certain conditions a system can be set up and operated satisfactorily for long periods of time. Fundamental research should establish exactly what these conditions are.

Continuous Fuel Processing (AEC Activity 4268)

Alternate processes for application to the HRE were considered. With the presently available information and experience, the solvent extraction process would be the most feasible and would require relatively minor development effort. However, two processes appeared to be attractive alternates; ion exchange process and an electrochemical process. A memo is being prepared concerning the development program required by the alternate processes to be considered for homogeneous type reactors.

Recombination of Hydrogen and Oxygen (AEC Activity 4263)

Development of a recombiner employing a platinum on alumina catalyst for the oxidation of hydrogen is nearing completion. It has been found that the catalyst operates effectively over a wide span of temperature and space velocity. Catalyst temperatures as high as 900°C have been employed with no harmful effects. Space velocities from 6,000 hr^{-1} to 95,000 hr^{-1} have been

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used. Poisoning of the catalyst by iodine is appreciable in the neighborhood of 200°C, but of little consequence at 500°C. A volume of 250 cc of catalyst is capable of converting 0.5 cfm of a stoichiometric hydrogen-oxygen mixture with only 0.2% of the electrolytic gas passing the catalyst without reacting.

The preliminary burning tests with the HRE burning chamber were made and completed with the pilot plant equipment.

The flashback and quenching tests with maximum and decreased gas and steam flows were completed. The minimum gas and steam flow tests were also completed. This work was done with the burner orifice in the open. At the present time alterations are being made to continue the experimental runs in the burner chamber under simulated plant conditions.

AIRCRAFT NUCLEAR PROPULSION PROJECT

ANP Central Design (AEC Activity 4271)

The design of the 1 megawatt ARE reactor has been developed from the final version of the 200 megawatt ANP reactor. Although it appeared desirable that this prototype reproduce the temperature pattern and control characteristics of the larger reactor, as would be effected by reducing the fuel elements proportionally to the power reduction, such an arrangement possesses insufficient fuel volume to achieve criticality and a compromise in the direction of more and larger fuel elements was necessary. The reactor design incorporates a nuclear sensing control device as well as the thermal sensing control device proposed for the ANP reactor. The primary coolant is sodium and the heat will ultimately (through an intermediate circuit) be expended in water.

The building facility for the ARE will consist of a high and low wing of equal area in which adequate provision has been made for the associated equipment and operations necessary in the testing and development of the ARE. The Austin Company has been designated to complete the detailed design and to order the structural steel as soon as possible. The building will be located 2000 feet east of the HRE building.

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ANP Critical Experiments (AEC Activity 4272)

The first critical assembly was arranged early in February, consisting of uranium discs moderated and reflected with beryllium. The first arrangement contained no simulated coolant or other poison. Preliminary foil measurements were made to determine power and neutron spectrum. Currently, tests are being made to assure that there are no spurious reflections from the floor and structural materials. Other activities involve general "shakedown" operations, the evaluation of safety devices and the measurement of the adequacy of personnel shields.

Mechanical Design and Experimental Engineering (AEC Activity 4271)

Analysis of the crystalline mass which plugged the harps in which lead was being circulated showed it to be a high-melting alloy of iron, chromium, nickel and lead.

The use of flanges in circulating liquid metal systems now appears feasible. During the month, four pairs of flanges were replaced without removing the liquid metal from the system.

Test runs of a heat exchanger mock-up in which air flow was used to study the dynamics indicate that the pressure drop across the exchanger was somewhat greater than calculated. Further tests are being conducted.

To date, 33 harps fabricated from 11 structural materials have been tested in the range 1100 - 1500°F with three coolants: lead, lithium, and sodium. Of these, 13 operated for 1000 hours. To test systems of particular interest for the ARE, two harps, each of four types of stainless steel and nickel, were fabricated and tested with sodium at 1500°F. Only three harps lasted the full 1000 hours.

Liquid Metals Research (AEC Activity 4275)

Additional data are being gathered concerning the resistance of various metals and alloys to liquid metal corrosion under static and dynamic conditions. The coolants - lead, sodium, lithium and bismuth - which contain two atomic percent uranium have been investigated with regard to their interactions with certain solid metals under static test conditions at 1000°C. Some work has been completed on the effect of sodium on construction materials in thermal convection loops.

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An extensive summary of the corrosive behavior of many metals in molten lead under static conditions has been completed. Results of similar tests in other liquid media are also completed.

The fabrication of solid fuel elements is being studied by three methods. They are as follows: 1) filling the holes in a perforated metal plate with UO_2 and cladding, 2) sintering a loose powder compact of UO_2 and stainless steel to a plate, and 3) using a powder compact of UO_2 and stainless steel and cladding this by a technique similar to that used in producing MTR fuel elements.

The majority of the welding equipment and associated apparatus has been delivered and is in use in the welding laboratory. Preliminary experiments have been conducted to determine techniques of spot welding strap supports for fuel tube clusters. Other work is being conducted to find a suitable means of joining thin-walled tubing to header plates.

ANP Metallurgy (AEC Activity 4275)

Work on corrosion resistance of 26 metals and alloys to liquid fluorides was started. At the month's end, half of the materials have been tested. Of promise are Nickel A, which shows 2 to 3 mils penetration in 100 hours, and Monel, which shows less than one mil penetration over the same length of time. A full report on details of the testing to date will be found in the ANP Quarterly Report which is at present under preparation.

Radiation Damage (AEC Activity 4274)

Copper targets have been bombarded in the 86-inch cyclotron with proton currents up to 12 μa at energies between 3 and 19 Mev. Only small changes in hardness of the copper were observed.

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

Low Melting Fluoride Systems. Study of the ternary systems $NaF-KF-UF_4$ has progressed so that it is possible to draw isotherms in some detail on the triangular diagram. Separation, by filtration, of the phases at appropriate temperatures has yielded information in excellent agreement with that obtained by thermal analysis. It appears that 520°C (980°F) is the lowest melting point available in this system.

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Chemical analyses indicate that oxygen-free BeF_2 has been prepared by thermal decomposition of ammonium beryllium fluoride. This material is being prepared in quantity to substitute for the commercial BeF_2 previously used in these investigations.

Preliminary data indicate that the previous statements concerning the NaF-BeF_2-UF_4 system will need only minor modifications.

Suspensions of Uranium Compounds in NaOH. Attempts to prepare substantial quantities of sodium monouranate by heating Na_2CO_3 and UO_3 to 1700°C have been unsuccessful due to lack of a container for this mixture in the induction furnace.

Attempts of stabilization of suspensions by addition of a third component to the mixture have been made using a wide variety of materials. To date no additive has afforded a marked improvement, although addition of sodium vanadate in high concentrations is definitely beneficial. It is possible that this beneficial effect is due to increased viscosity of the melt.

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PROGRAM 5000 - PHYSICAL RESEARCH

PRODUCTION OF RADIOISOTOPES

Radioisotope Production, Development and Operations (AEC Activity 5111)

The total accumulated KWH for pile operation during February was 2,426,390 averaging 3990 KW per operating hour. Pile down time was 9.5% as compared with 10.4% during January. One ruptured slug was located and discharged without difficulty.

The total number of radioisotope shipments during February was 793.

STABLE ISOTOPE SEPARATIONS

Calutron Operation and Process Development (AEC Activity 5121)

During the month of February, 1951, the Isotope Operations and Process Development Groups directed their principal efforts toward the development of a Beta Type filament changer, development of a method for electrodepositing lithium, the reconversion of the charge evaluation laboratory, and to collections of carbon, calcium, and tellurium isotopes. The electrodeposition of lithium metal from a solution of lithium iodide in the organic solvent, ethylene diamine, was aimed at the determination of the particular electrode processes involved. The development of the filament changer has embodied some of the features of the Alpha-1 type filament changer. Carbon and tellurium collections begun in January were completed during the month. A voltage and magnetic scan was made of the tellurium charge material ($TeCl_4$) to determine the impurities present. Estimated total collections of carbon were 24.6 grams and for tellurium 20.1 grams. By the end of the month an estimated 39.6 grams of calcium were collected.

Isotope Chemistry (AEC Activity 5121)

Sample Summary

Chemical Refinement Completed	15
Isotope Samples in Process, Feb. 28	12
Samples in Backlog, Feb. 28	0
Mass Assay Samples Submitted	21
Mass Assays Reported	14
Mass Assay Sample Backlog	69
Isotope Shipments Made	57

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Chemical charge materials were supplied for calutron operations with calcium and tellurium. Investigations were continued on the preparation of a suitable ruthenium compound for charge material.

Chemical refinement was done on the isotopes of potassium, carbon and iron. Repurification of rubidium and neodymium is being done to meet the purity requirements for neutron cross-section measurements.

Progress was made on the separation of rare earths for charge material, and research was continued on new methods of separation. Research is also in progress on the solubility of zirconium tetrafluoride in aqueous solutions.

PHYSICS

Neutron Decay Experiment (AEC Activity 5211)

Improvements in geometry have resulted in increasing the counting rate to about 1.5 beta-proton coincidences per minute above a relatively small background. Potential rings serve to define the ends of the collecting volume. It is believed that these modifications will permit determination of the neutron half-life in a fairly straightforward manner.

High Voltage Program (AEC Activity 5211)

The 5-MV electrostatic generator has arrived in Oak Ridge in its entirety and is being assembled in a temporary location at Y-12.

Nuclear Alignment (AEC Activity 5211)

The intensities available have been increased by a factor of three and the size of the effect to be observed from nuclear alignment has also been increased by a factor of two. A series of runs under these improved conditions will be started in March.

Theory (AEC Activity 5211)

The question of what information can be obtained concerning nuclear energy levels by studying the gamma rays emitted when polarized neutrons are captured has been studied. It was considered that the radiation would be detected with polarization sensitive devices and that these

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polarization sensitive detectors could measure only linear polarization. It was concluded that the effects observed with slow polarized neutrons would be exactly the same as with unpolarized neutrons. This conclusion holds whether the radiation is a pure multipole or an arbitrary mixture of multipoles.

Scintillation Spectrometry (AEC Activity 5211)

A means has been found for getting a good beta ray spectrum while counting only a small fraction of the beta rays emitted by a sample. This overcomes some of the objections imposed by earlier scintillation counters which counted 100% of the beta rays emitted. In essence the new technique consists of counting the beta rays falling inside a cone-shaped hole in the anthracene crystal. By varying the solid angle, one can control the percentage of beta rays counted.

The 86" Cyclotron (AEC Activity 5261)

A proton beam current of over one milliampere has been obtained at 15 Mev. Measurements of beam energies greater than 20 Mev have been substantiated by $C^{12}(p, pn)\ C^{11}$ reaction experiments.

Control of the position of the beam is now obtained by the use of auxiliary magnet coils placed on both sides of the gap and energized to about 1200-ampere-turns. The beam previously was found to shift away from the median plane at high energies.

The 63" Cyclotron (AEC Activity 5261)

A Beta tank has been modified and additional pole pieces installed to give a 14,000 oersted field in an 8" gap. The magnetic field has been mapped and shims are being machined. The model for rf testing is under construction. The cyclotron ion source for the production of N^{+++} is being tested.

The 22" Cyclotron (AEC Activity 5261)

A deflector arrangement has been developed which deflects 33% of the internal proton beam. The cyclotron is being modified to operate with biased dees.

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Isotope Physics and Spectroscopy (AEC Activity 5261)

Microwave Spectroscopy. Two compounds, iodo-acetylene (HCCI) and lithium carbonyl (LiCO), have been prepared and purified for possible microwave studies. LiCO was found to have negligible vapor pressure up to 200°C and hence will probably not be used for microwave studies with present equipment.

X-Ray Spectroscopy. A target assembly has been sent to the Mound Laboratory for loading with polonium in order to obtain the L spectra of this element.

A series of solutions containing varying amounts of uranium have been analyzed by use of the L III critical absorption edge of uranium. Precision of ± 40 ppm was obtained at concentrations below 300 ppm while above 300 ppm the precision is usually better than 1 per cent of the amount reported.

Atomic Spectroscopy. The isotope displacements in the resonance line of lithium have been used to evaluate the possibility of doing assay of lithium samples on a routine basis. An unknown sample submitted by the Materials Chemistry Division was analyzed and results on the 4.0% Li-6 sample reported to ± 10%. Improvements in this technic are still being made. The source of excitation has been a water-cooled aluminum hollow cathode containing approximately 250 micrograms of the element as the sulphate.

Spectrographic Analysis. Additional data have been obtained supporting the choice of vanadium rather than platinum as the internal standard in the analysis of sodium solutions.

A total of 250 samples have been analyzed for more than 2500 element determinations during this month.

Nuclear Resonance. The reproducibility on the Li-7 resonance signal amplitude using a 100 mg LiCl sample is now 3 per cent. In addition, the amplitude of the Li-6 signal in a saturated solution of LiCl was measured to 3.5 per cent reproducibility. The magnetic catalyst used has been 0.1 molar $MnSO_4$.

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Mass Spectrometer and Vacuum Laboratories (AEC Activity 5261)

Mass Spectrometer. Investigations of the dissociation products of MoO_3 have revealed that the instrument was badly contaminated by diffusion pump oil and copper chloride. The instrument was taken apart, thoroughly cleaned and reassembled. All copper parts have been replaced by nichrome. An instrument has been developed and installed to keep the liquid nitrogen trap filled.

Vacuum Laboratory. Some measurements have been made on the conductance of ducts at low pressures, but instrument changes will be required for obtaining reliable results.

CHEMISTRY

Nuclear and Chemical Properties of the Fission Products (AEC Activity 5311)

The solubility curves for fission product sulfates at high temperatures and pressures have been completed for a number of species, notably, yttrium, cesium, lanthanium, cadmium, and zinc in water. Solubilities of the sulfates in UO_2SO_4 (30gU/l) solution have been determined for yttrium, lanthanium, cadmium and zinc.

Chemical Physics (AEC Activity 5311)

Calorimetric determinations of the heat liberated by weighed samples of $C^{14}O_2$ and gas density and mass spectroscopic measurements are under way for determining the isotopic composition of the sample. The results of these measurements will be used to compute the half-life of C^{14}, or, using a known value for the half-life, to compute a value of the average energy per disintegration which can be compared with the result from beta ray spectroscopy.

Resonance absorption lines due to nuclear quadrupole splittings have been observed in five chlorine compounds: $SOCl_2$, $POCl_3$, $CHCl_2$, $CHCl_3$, and C_6H_5Cl. The nuclear quadrupole moment ratio of Cl^{35} to Cl^{37} given by these measurements is: $Q(Cl^{35})/Q(Cl^{37}) = 1.26878 \pm 0.00015$.

Lithium Isotope Separation (AEC Activity 5361)

Experimental data now show that rate of exchange, rate of back reaction of lithium amalgam and water, and equilibrium holding current are all

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a similar function of agitation rate and markedly affected by it. Studies on Li^7 refluxer characteristics show that lithium can be completely stripped from the aqueous phase with an energy consumption of 220 watt-hrs/mol. The lowest values obtained to date on single stage processing time (3.5 minutes/stage) were achieved in an open trough type countercurrent cell equipped with agitators but no compartmenting partitions. With this design high rates of throughput are possible.

Chemical Separation of Isotopes (AEC Activity 5361)

Equipment has been designed and assembled to facilitate a Rayleigh distillation of the ferrous nitroso complex for the separation of nitrogen isotopes. Additional equipment for the preparation of samples for isotopic assay is practically complete. Under the conditions studied, the reaction

$$FeSO_4 + NO \rightleftharpoons FeNOSO_4$$

was found to be reversible.

Evaluation of the molybdenum thiocyanate system awaits the preparation of suitable samples for isotopic assay. The several compounds prepared thus far have not proved suitable for isotopic assay. Currently, the use of molybdenum hexafluoride as a suitable sample material is being studied.

Chemistry of Uranium Raw Materials (AEC Activity 5361)

Precipitation of uranous phosphate has been shown to be suitable for recovery of uranium from sulfuric acid leach liquors of Marysvale ore; tests are being continued to establish optimum conditions.

The spectrophotometric study of uranyl fluoride solutions at pH 0.5 has shown only a complex with F:U = 1 (acidity adjusted with nitric acid). At pH 6 a complex with F:U = 4 was found, together with some evidence for small amounts of a complex with F:U = 2, but no evidence for any ratio above 4.

It has been shown that uranium and vanadium can be removed from high-lime carnotite ores by several methods. Data necessary for the calculation of comparative processing costs are being obtained.

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

FEBRUARY, 1951

METALLURGY

Thorium Research (AEC Activity 5411)

Successful welds have been made between thorium and thorium and betweem thorium and zirconium using a protective atmosphere and a Heliarc in a dry box. Edge button lap welds were made.

On the basis of preliminary data an apparent anomaly exists in the recrystallization characteristics of thorium and its alloys. Namely, pure iodide thorium apparently has a higher recrystallization temperature than some of its alloys.

Preferred Orientation in Uranium (AEC Activity 5411)

In the case of the preferred orientation developed by α-extruded U rod in the as-extruded condition, the texture was essentially a duplex fiber consisting of a $[\bar{4}10]$ component which increased in strength with increasing degree of recrystallization, and a $[\bar{0}10]$ component which decreased in strength with increasing degree of recrystallization and nearly disappeared at complete recrystallization. There were detected also several minor components $[\bar{3}21]$ and $[\bar{0}31]$, the former increasing and the latter decreasing in strength with increasing degree of recrystallization. Increasing degrees of recrystallization, however, resulted from increasing the extrusion ratio, and therefore the differences in texture could not be attributed conclusively to the effect of recrystallization.

To determine the influence of recrystallization per se a sample which in the as-extruded condition exhibited a deformed structure and a duplex $[\bar{0}10]$ $[\bar{4}10]$ texture with minor $[\bar{0}31]$ $[\bar{3}21]$ components was completely recrystallized by annealing 1 hour at 550°C and then examined. The examination is now complete, and results indicate $[\bar{3}21]$ texture to be predominant.

It would appear from this that the recrystallization texture of α-extruded uranium rod is a duplex $[\bar{4}10]$ $[\bar{3}21]$ fiber, high extrusion ratios favoring $[\bar{4}10]$ and low extrusion ratios favoring $[\bar{3}21]$.

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

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PROGRAM 6000 - BIOLOGY AND MEDICINE

BIOLOGY

Cytogenetics (AEC Activity 6400)

Two further groups of compounds have been found to protect significantly against radiation damage. One of these groups consists of different metabolites, some of which occur normally in the human body and are non-toxic even when given in significant quantities. Some of these are: sodium formate, succinate, and pyruvate. These compounds are not effective at $0^{o}C$ but become highly effective at body temperature.

Another compound which has been the most successful to date in protecting against radiation damage is $Na_2S_2O_4$. This will protect significantly in concentrations as low as 0.00005 molar. This compound is not toxic at these very low concentrations.

Interesting results have been obtained in relation to radiation protection using alpha rays to produce chromosome breaks in the presence and absence of oxygen.

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

FEBRUARY, 1951

PERSONNEL SUMMARY

	Number of Employees February 28, 1951	New Hires February	Terminations February
Admininstration	82	4	2
Operations*	114	5	1
Engineering, Shops, and Mechanical	937	7	5
Laboratory and Research	1165	22	12
Protection	176	1	2
Service	353	5	1
TOTAL	2827	44	23

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

RADIOISOTOPE SALES

Sales	December, 1950	January, 1951
Transfer within AEC	$ 505.00	$ 850.00
Cash Sales	31,156.05	40,780.38
Foreign	514.25	1,138.80
Cancer Program (Free)	29,281.88	37,264.90
Technical Cooperation Plan	-0-	-0-
Total Sales and Transfers to Date	1,413,071.91	1,413,071.91
Total Cancer Program (Free) to Date	683,625.45	720,890.35
Technical Cooperation Plan (Shipments to date)	6,993.04	6,993.04

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

FEBRUARY, 1951

GROSS OPERATING COSTS

(Including X-10 and Y-12)

(a)	Actual Cost for January, 1951	2,268,335	
	Construction - Program "H"	61,369	
	Total Operating & Const. Cost		2,329,704
(b)	Estimated Operating Costs for Feb., 1951		2,000,000
(c)	Actual Accumulative FY 1951 Operating Cost through Jan., 1951	13,022,084	
	Actual Accumulative FY 1951 Const. Cost through Jan., 1951	407,421	
	Total Accumulative FY 1951 Operating and Const. Cost through Jan., 1951		13,429,505
(d)	Estimated Operating Cost FY 1951 through Feb., 1951		15,429,505

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