SECRET

MARTIN MARIETTA ENERGY SYSTEMS LIBRARIES
3 4456 0360845 1

ORNL 953
Series A
PROGRESS

DECLASSIFIED
Classification Cancelled To:
By Authority Of
By:

LABORATORY RECORDS
1954

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

AEC RESEARCH AND DEVELOPMENT REPORT

OAK RIDGE NATIONAL LABORATORY
CENTRAL RESEARCH LIBRARY
CIRCULATION SECTION
4500N ROOM 175
LIBRARY LOAN COPY
DO NOT TRANSFER TO ANOTHER PERSON
If you wish someone else to see this report, send in name with report and the library will arrange a loan.
UCN-7969 (3 9-77)

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

CLASSIFICATION CANCELLED
ADD Signature
Date 12/4/2009
Single review of CCRP-declassified documents was authorized by DOE Office of Declassification memo of August 22, 1994.

SECRET

[redacted]

ORNL 953
This document consists
of 24 pages. Copy 49
of 53, Series A

Contract No. W-7405, eng 26

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

W. E. Thompson

Date Issued: FEB 9 1951

OAK RIDGE NATIONAL LABORATORY
operated by
CARBIDE AND CARBON CHEMICALS DIVISION
Union Carbide and Carbon Corporation
Post Office Box P
Oak Ridge, Tennessee

[redacted]

[redacted]

MARTIN MARIETTA ENERGY SYSTEMS LIBRARIES
3 4456 0360845 1

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

Distribution

Offices of Directed Operations

1-3.	J. H. Roberson	Oak Ridge, Tennessee
4.	Technical Information Div.	Oak Ridge, Tennessee
5.	C. A. Nelson	Wilmington, Delaware

AEC Installations

6.	H. A. Blair	University of Rochester
7.	N. E. Bradbury	Los Alamos Scientific Laboratory
8.	C. E. Center	Carbide and Carbon Chemicals Div.
9.	G. T. Felbeck	Carbide and Carbon Chemicals Div.
10.	A. B. Greninger	Hanford Works
11.	L. J. Haworth	Brookhaven National Laboratory
12.	A. R. Kaufman	M.I.T. Metallurgical Laboratory
13.	K. H. Kingdon	Knolls Atomic Power Laboratory
14.	H. D. Kinsey	Carbide and Carbon Chemicals Div.
15.	E. O. Lawrence	Univ. of Calif. Radiation Laboratory
16.	F. L. Mohler	National Bureau of Standards
17.	H. W. Russell	Battelle Memorial Institute
18.	F. H. Spedding	Ames Laboratory
19.	W. H. Zinn	Argonne National Laboratory

Oak Ridge National Laboratory

20.	E. P. Blizard	36.	M. M. Mann
21.	G. E. Boyd	37.	H. J. McAlduff
22.	R. C. Briant	38.	K. Z. Morgan
23.	G. H. Clewett	39.	M. E. Ramsey
24.	W. K. Eister	40.	E. D. Shipley
25.	C. B. Ellis	41.	A. H. Snell
26.	J. H. Frye, Jr.	42.	F. L. Steahly
27.	W. M. Hawkins	43.	A. Swartout
28.	A. Hollaender	44.	E. H. Taylor
29.	J. T. Lowe	45.	W. E. Thompson
30.	C. P. Keim	46.	A. M. Weinberg
31.	J. A. Lane	47.	C. E. Winters
32.	C. E. Larson	48.	F. C. VanderLage
33.	W. D. Lavers	49-53.	Central Files
34.	R. W. Livingston		
35.	R. N. Lyon		

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

TABLE OF CONTENTS

	Page
PROGRAM 1000 - RESEARCH FACILITIES	6
Instrument Laboratory Building #3500	6
Research Laboratory Building #4500	6
Isotope Research and Semi-Works Building #4501	6
High Voltage Laboratory Building #4503	6
Health Physics Waste Research Building #3504	6
PROGRAM 2000 - SOURCE AND FISSIONABLE MATERIALS	7
TBP Process for Waste Metal Recovery	7
Purex Process	7
PROGRAM 3000 - WEAPONS	8
RaLa Development	8
Special Separations	8
Target Damage	8
PROGRAM 4000 - REACTOR DEVELOPMENT	9
MATERIALS TESTING REACTOR	9
Mockup Conversion	9
MTR Metallurgy	9
Reactor Controls Development	9
25 Process Design	9
HOMOGENEOUS REACTOR EXPERIMENT	10
Experimental and Design Engineering for HRE	10
Homogeneous Reactor Experiment	10
Slurry Fuel Media Study	10
Continuous Fuel Processing	11
Recombination of Hydrogen and Oxygen	11
Pilot Tests of Primary Recombiner	11
AIRCRAFT NUCLEAR PROPULSION PROJECT	12
ANP Central Design	12
ANP Critical Experiments	12
Induced Activities in ANP Pile Coolant	12
Mechanical Design and Experimental Engineering	13
Radiation Damage	13
Liquid Metals Research	13
Shielding	13

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

Page

Liquid Fuel System for High Temperature Reactor..... 14
Low Melting Fluoride Systems..... 14
Suspensions of Uranium Compounds in NaOH..... 14

PROGRAM 5000 - PHYSICAL RESEARCH..... 15

PRODUCTION OF RADIOISOTOPES..... 15
Radioisotope Production, Development & Operations..... 15

STABLE ISOTOPE SEPARATIONS..... 15
Calutron Operation and Process Development 15
Isotope Chemistry..... 15

PHYSICS..... 16
Neutron Diffraction..... 16
Instrument Development..... 16
The 86" Cyclotron..... 16
Isotope Physics and Spectroscopy..... 17
Atomic Spectra..... 17
Spectrochemical Analysis..... 17
Nuclear Resonance..... 17
X-Ray Spectroscopy..... 17
Source and Vacuum Laboratory..... 17

CHEMISTRY..... 18
Radio-Organic Chemistry.....18
Chemical Physics..... 18
Chemistry of Uranium Raw Materials..... 18

METALLURGY..... 19
Thorium Research..... 19
Materials Laboratory..... 19
Zirconium Reduction..... 19
Hafnium Reduction and Research..... 19

PROGRAM 6000 - BIOLOGY AND MEDICINE..... 20

BIOLOGY..... 20
Cytogenetics..... 20

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

Page

Biochemistry..... 20
Mammaliam Genetics..... 20

APPLIED BIOPHYSICS..... 20
Instrument Development..... 20
Radioactive Waste Disposal Research & Development..... 21
Continuous Water Monitor..... 21

PERSONNEL SUMMARY..... 23

RADIOISOTOPE SALES..... 23

GROSS OPERATING COSTS..... 24

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

PROGRAM 1000 - RESEARCH FACILITIES

Instrument Laboratory Building #3500

Work on this building is 99%+ completed. Completion report F-2 (with exceptions) was processed and signed on January 3, 1951, and building was released to ORNL as of that date. Several items of furniture and equipment have not been received at building.

Research Laboratory Building #4500

Work on this building is approximately 8% complete. Concrete footings, columns, foundation walls and grade beam walls are approximately 90% complete.

Isotope Research and Semi-Works Building #4501

Work on this building is approximately 14% complete. Footings, columns, walls and grade beams are approximately complete. Concrete cell structure in Semi-Works area is being erected.

High Voltage Laboratory Building #4503

Plans and specifications are complete for advertisement for bids.

Health Physics Waste Research Building #3504

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

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

PROGRAM 2000 - SOURCE AND FISSIONABLE MATERIALS

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

A laboratory study was initiated to determine the feasibility of extracting uranium from unclarified metal waste solution. Preliminary runs in a one-inch laboratory column with unclarified feeds were not successful. Therefore, the laboratory study will be continued to determine the degree of clarification that will be required.

The installation of the process equipment in the ORNL metal recovery building was continued.

Purex Process (AEC Activity 2802-3)

The satisfactory operability of the Purex Process was demonstrated in the Pilot Plant in both packed and pulse type countercurrent solvent extraction columns. The high uranium loss previously reported in the packed stripping column was corrected by increasing its height. The packed heights of the extraction, partition and strip columns are now the same. All runs to date have been made with inactive chemical solution.

Chemical studies in the laboratory were concerned primarily with the uranium loss in stripping and the use of hydrofluoric acid as the plutonium-uranium partitioning agent. Results of the laboratory studies indicated that the most direct solution to the high uranium strip loss was to increase the height of the column. The use of hydrofluoric acid as the plutonium-uranium partitioning agent was tested in the semi-works equipment with satisfactorily low uranium losses. No plutonium was present in this run.

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

PROGRAM 3000 - WEAPONS

RaLa Development (AEC Activity 3670)

Satisfactory operation of the RaLa plant equipment was demonstrated using inactive chemical solutions. The improved operation was accomplished by increasing the filter area, using a filter aid in the crud filter and removing some of the slug bonding material by a one molar nitric acid treatment.

The optimum procedure for extraction of barium from MTR fuel assemblies now appears to be caustic dissolution followed by barium sulfate precipitation.

Special Separations (AEC Activity 3670)

In experiments to determine the lower limit of charge weight, the Beta calutron has been operated satisfactorily with charges of less than 10 grams. From a one-gram UCl_4 charge 4 milliampere-hours of operation were obtained with 5% process efficiency.

Target Damage (AEC Activity 9543)

In initial tests of equipment for determining the effects of high-flux thermal cycling by resistance heating, an average power density of 20 kw/in^3 has been obtained in a 1/4" uranium rod 6" long at a pulse rate of 8 cps and a duty cycle of 1 to 5.

In tests using a pulsed proton beam from a calutron ion source it appears that localized surface effects previously reported are due to deposits formed on the inside of the tube by the action of 0.05% $CuSO_4$ in the cooling water.

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

PROGRAM 4000 - REACTOR DEVELOPMENT

MATERIALS TESTING REACTOR

Mockup Conversion (AEC Activity 4229)

Conversion of the full-scale MTR mockup to a Low Intensity Training Reactor has been completed and start-up operations have been carried out. The LITR will be turned over to the Operations Division on February 1 and full power operation will be started during the month.

MTR Metallurgy (AEC Activity 9541)

The beryllium machining at Y-12 has been completed. Fitting of the finished beryllium pieces into the "D" tank of the reactor will be started early in February.

Machining of the graphite is over half completed.

Reactor Controls Development (AEC Activity 4226)

Construction of the electronic instrumentation for the MTR is now about 90% complete.

25 Process Design (AEC Activity 4582)

A meeting of the major contractors concerned with the construction of the Idaho Chemical Process area was held at the Laboratory this month to review overall program. The need for completion of the process area by October, 1951, was firmly emphasized by representatives of the AEC.

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

HOMOGENEOUS REACTOR EXPERIMENT

Experimental and Design Engineering for HRE (AEC Activity 4264)

The HRE building was not finished on February 1, but has been further delayed by vendors failing to meet their delivery promises and a walk-out of the painters. Provided the vendors meet their revised delivery promises, the building should be available by February 10 or 15. The Laboratory is prepared to start erection of the reactor immediately upon receipt of the building. The design of the installation is completed except for a few remaining details. Ninety percent of the materials are either on hand or have been placed with vendors on "firm" delivery dates. Completion of shop fabrication of a number of the important components has been delayed by revised delivery schedules from vendors.

The large forged steel pressure vessel has been received, and has been sent to the shop for the installation of the liner. The experimental steam generator is virtually completed at the A. O. Smith Company, and should be ready for pressure and leak testing within a few days. The bearings of the Westinghouse pumps continue to cause trouble. During the month of January there has been no important change in the conclusions that can be drawn from the experimental programs.

Homogeneous Reactor Experiment (AEC Activity 4261)

The electronic instrumentation for the HRE is about 40% complete. Design of instrumentation for process controls is about 90% complete.

An electronic homogeneous reactor simulator is now in use. Phase I of the simulator includes temperature coefficient (without circulation effect) and six delayed neutron groups corrected for flow effect. Phase II includes addition of gas coefficient with delayed evolution time. Phase I is complete; runs for several values of the temperature coefficient under numerous simulated conditions have been completed. The results obtained agree quite well with theoretically calculated values.

Slurry Fuel Media Study (AEC Activity 4263)

Slurries of uranium oxide and thorium oxide stabilized with bentonite have been tested under the conditions of temperature and pressure expected in the homogeneous reactor experiment. It appears that these slurries may be sufficiently stable to use in the homogeneous type reactors; however, further work must be done to demonstrate their radiation stability.

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

Continuous Fuel Processing (AEC Activity 4268)

The use of an ion exchange process for the decontamination of a homogeneous reactor solution now appears more feasible. This was the result of further study of the radiation stability of the Dowex-50 ion exchange resin which indicated that the radiation stability of the resin is significantly increased by the exclusion of air. Preliminary tests with inorganic ion exchange materials have indicated that they are not satisfactory as the Dowex-50 resin.

Recombination of Hydrogen and Oxygen (AEC Activity 4263)

A catalyst prepared by J. Bishop Platinum Works and containing 0.3% Pt on Al_2O_3 has been found to give excellent recombination of hydrogen and oxygen in steam at space velocities of about 10,000 hr^{-1} and at temperatures as high as 540°C. When poisoned with iodine at 520°C, the reaction efficiency dropped from 99.7% to 96%. After poisoning at 200°C, the catalyst had only 5% efficiency at the same space velocity as above. However, simply heating this poisoned catalyst to 400°C restored the conversion efficiency to 99% at 400°C and 94% at 200°C.

A battery of electrolytic cells for producing hydrogen and oxygen at low pressure has been constructed. The capacity of this gas generator is about 0.5 cfm of electrolytic gas mixture. The fabrication of a large, high-pressure gas generator is now about 80% complete.

Pilot Tests of Primary Recombiner (AEC Activity 4263)

Calibration and installation of instruments are virtually complete. Flashback tests at maximum gas and steam flows are in progress with low gas and steam flows to be checked. The burning chamber from the mockup is being connected in the present pilot plant in order to check it for performance.

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

AIRCRAFT NUCLEAR PROPULSION PROJECT

ANP Central Design (AEC Activity 4271)

Of the five quiescent liquid-fuel reactors which have been under consideration since last fall, the hair-pin core arrangement, in which three tubular hair-pins (fuel tubes) are immersed in each coolant tube, was selected for the ANP reactor. A recent modification of the core design will surround each coolant tube with beryllium oxide moderator in such a manner as to provide support for the coolant tubes and to leave no voids in the core matrix. This reactor design employs sodium in both the primary and secondary coolant circuits and incorporates the divided shield. The design of the 1 megawatt ARE reactor will be developed from this version of the 200 megawatt reactor.

The H. K. Ferguson Company, Inc., has completed a design study of a modified B-52 aircraft to cruise at 0.8 Mach at 35,000 feet and to be powered by a circulating fuel reactor. Their design embodies a sodium hydroxide-uranium fuel in a 3 foot core, NaK coolant and a divided shield. It appears that all other design specifications are readily attainable, if a suitable fuel (NaOH-U suspensions) can be found.

ANP Critical Experiments (AEC Activity 4272)

All instruments have been installed and tested; the assembly is complete and has been tested in mock runs using beryllium only. About 30% of the fuel discs are now on hand, as well as supplies of beryllium, graphite and high-density (2.2) graphite.

Induced Activities in ANP Pile Coolant (AEC Activity 4275)

Tests of the electromagnetic pump and flowmeter for liquid lithium indicated that both perform satisfactorily; the pump gives flow rates of 20 ft/sec through 3/16 inch diameter pipe and the flowmeter gives a signal of 1/3 millivolt per foot per second of flow. The test assembly has been operated continuously for 10 days with lithium at 1000°F and is now being dismantled for inspection.

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

Mechanical Design and Experimental Engineering (AEC Activity 4271)

Liquid sodium has been circulated in nickel harps at 1500°F; one harp lasted the duration of the 1000-hour test, three others failed at welds. Lead has been circulated in seven harps, of which four plugged after short periods of operation. The harps were found to be plugged with a hard, porous, crystalline mass which is being analyzed.

Sodium is now being pumped through the "figure 8" loop. A pressure type self-welding rig, an oscillating type self-welding rig, sleeve bearing test rig, and seal testers have been received and set up for operation.

Designs are being considered for models of heat exchanger and fuel element configurations to be used for air flow tests of flow patterns and turbulence.

Radiation Damage (AEC Activity 4274)

A high temperature rotating target cooled with sodium has been designed. A model of the sodium pump has been tested and found to pump eight gallons per minute.

Liquid Metals Research (AEC Activity 4275)

The liquid metals corrosion work has shown that any of the iron-base, cobalt-base or nickel-base alloys will be suitable structural materials in contact with liquid sodium. Additional work will be needed to find materials that will be usable with lithium, lead, and sodium hydroxide.

Fuel elements for the ANP reactor can be fabricated so a modified MTR type element can be made. This will be done by mixing uranium oxide and stainless steel powders and bonding this to a stainless steel plate by pressing and sintering.

The stress-rupture lab will be in operation within four to six weeks. At present, high temperature stress cycling tests have been conducted to determine the amount of elastic strain existing in the material at the test temperature.

Shielding (AEC Activity 4277)

The Lid Tank crew has spent the past month in determining the activation

[redacted]

to be expected in a sodium-bearing coolant which is separated from a reactor by either water or B_4C neutron shield. The work is also directly applicable to the KAPL submarine project, which utilizes a secondary circuit or either Na or NaK coolant.

The Shield Testing Reactor has been run at low power continually throughout the month, during which time the flux at interior points of the reactor has been mapped by means of gold foils. A number of instruments are still under development for use with this facility, including a Compton recoil gamma spectrometer, fast neutron dosimeter, a tritium neutron spectrometer, and several other more standard devices. Preparations are being made to measure the power of the reactor from temperature rise of the water coolant.

Liquid metal duct tests have been extended to include measurements with the coolant in place. In the first leg of the duct the intensity is so low it becomes evident that a new detection technique will have to be employed to extend this work through the full duct length.

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

Low Melting Fluoride Systems. It has been demonstrated that a fuel which will contain about 75 pounds of uranium per cubic foot and which will be completely molten below 525°C can be realized in either the $NaF-BeF_2-UF_4$ or the $NaF-KF-UF_4$ ternary system. Of these systems the former offers a somewhat wider range of acceptable compositions and, therefore, appears considerably more flexible. The latter system, on the other hand, probably has the advantage of lower vapor pressure and certainly would be easier to work with safely on an engineering development scale.

Suspensions of Uranium Compounds in NaOH. A compound of uranium, prepared by ignition at about 1500°C of an equimolar mixture of Na_2CO_3 and UO_3, yields an X-ray diffraction spectrum identical with that of the compound produced by addition of UO_3 to a large excess of NaOH. Since the temperature used is sufficiently high to decompose Na_2CO_3 it seems likely that the preparation consists of sodium monouranate (Na_2UO_4). This material, which does not seem to have been described previously, appears moderately stable to laboratory air, but has not yet been characterized by chemical analysis.

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

PROGRAM 5000 - PHYSICAL RESEARCH

PRODUCTION OF RADIOISOTOPES

Radioisotope Production, Development and Operations (AEC Activity 5111)

The total accumulated KWH for pile operation during January was 2,711,088 averaging 4066 KW per operating hour. Pile down time was 10.4% as compared with 10.2% during December. One ruptured slug was located and discharged without difficulty.

On January 29, the pile building had to be evacuated for about two hours because of high air activity resulting from a leak in the bomb being used in hole 12 for radiation damage studies on molten UF_4-NaF salt. The highest activity noted was 100 mr/hour on top of the pile.

The total number of radioisotope shipments during January was 836, an increase of about 30% over the previous month. This establishes a new record number of shipments for a single month, being about 5% above the previous record established in May 1950.

STABLE ISOTOPE SEPARATIONS

Calutron Operation and Process Development (AEC Activity 5121)

In the Isotope Operations and Process Development Groups, for the month of January, 1951, primary attention was given to development of a filament changer, a method for electrodepositing lithium, the development of a d-d source, and to collections of carbon, iron and tellurium isotopes. The development of a method to electrodeposit lithium led to tests of several organic solvents for lithium halide salts; tests were carried out using ethylene diamine and pyridine as solvents and lithium iodide as the salt. These tests were made in an anhydrous helium atmosphere. A literature survey has been made of linear accelerators. Iron collections begun in December, 1950 were completed during the month. Estimated total collections of iron were 107.8 grams. By the end of the month an estimated 21.0 grams of C^{12} were collected.

Isotope Chemistry (AEC Activity 5121)

Sample Summary

Chemical Refinement Completed	23
Isotope Samples in Process, Jan. 31	9

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

Isotope Samples in Backlog, Jan. 31	6
Mass Assay Samples Submitted	17
Mass Assays Reported	14
Mass Assay Sample Backlog	78
Isotope Shipments Made	23

Charge materials were supplied for calutron operations with carbon, iron, and tellurium. The recovery and purification of samarium, carbon, vanadium, potassium, and indium isotopes, and the repurification of rubidium, lead and neodymium isotopes to meet special requirements were all carried out. Research was continued on the radiochemistry of isotopes of neodymium, samarium and potassium.

PHYSICS

Neutron Diffraction (AEC Activity 5211)

Two paramagnetic materials, MnF_2 and NiF_2, have been studied at very low temperatures down to liquid hydrogen temperature and found to become anti-ferromagnetic. A preliminary study of the neutron diffraction patterns has indicated the suspected magnetic structure to be correct.

Instrument Development (AEC Activity 5211)

The ten-channel pulse analyzer has been improved by increasing the speed of the window amplifier, making the instrument less critical as to the shape of the pulses. The single-channel pulse analyzer has been improved to where the window width is constant to within 1% using a two megacycle bandwidth of the A-1 amplifier with RC differentiation.

The 86" Cyclotron (AEC Activity 5261)

With a water-cooled grid structure installed between the dees and liner, the cyclotron has been operated at energies up to 20 Mev. The focal pattern of the beam at energies above 15 Mev is being investigated. Beam current has been limited to 10 μa to avoid melting the targets.

A water-cooled target has been fabricated which can be used for direct or grazing incidence bombardment with beam currents up to 50 μa at 26 Mev. The target design facilitates removal and handling radio-active materials.

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

Isotope Physics and Spectroscopy (AEC Activity 5261)

Atomic Spectra. Spectra of the separated stable isotopes, Sm 144 and Sm 154, have been re-photographed on the 21-foot Paschen mount spectrograph using water-cooled hollow cathode sources. Tests with these sources on a two-milligram sample show that upwards of 2000 milliampere hours (at 270 milliamperes) of exposure time is available with apparently undiminished samarium intensity.

Spectrochemical Analysis. Scrutiny of data on reproducibility of the porous-cup solution method for NEPA samples shows conclusively that platinum does not satisfy the homologous line criterion for the impurities Fe, Cr, Ni, Mn. The standard deviations for the Fe/Pt line intensity ratios for 32 identical samples were calculated to be 14.7% while the ratio Fe/Cr gave only 6.8%. Similar but not as large improvements were evidenced for the other impurity elements.

The following table summarizes the spectrochemical load for the month of January:

Type Sample	Number Samples
ANP	51
NEPA	81
Misc. (incl. isotope)	80
Total	212

Nuclear Resonance. Final measurements were made on the long-lived radioactive iodine 129 obtaining a magnetic moment of 2.6173 ± 0.0003 n.m.

Work on the use of nuclear resonance for quantitative analysis has continued with a series runs in progress to determine the reproducibility of results on a Li 7 resonance. Runs have been made with varied leakage balance, with reduced modulating field amplitudes, and with various modulating field frequencies. A series of samples of various concentrations have indicated the ability to detect 1.5 mg of Li 7 at approximately 7 mc with a 0.1 molar solution of $MnSO_4$ as a magnetic catalyst. A signal to noise ratio of 2 was found for the 1.5 mg sample.

X-Ray Spectroscopy. The Bragg spectrograph recorded the L spectrum of lead in preparation for recording the L spectrum of material from Mound Laboratory.

Source and Vacuum Laboratory (AEC Activity 5261)

Ionization and dissociation data have been obtained on $SmBr_3$, SmI_3,

[redacted]

$TiCl_4$, $SiCl_4$, $MoCl_5$, and $Fe(CO)_5$. Several more Silastic rubber samples including Sr 1060 and Sr 1080, have been tested for relative vapor pressure.

CHEMISTRY

Radio-Organic Chemistry (AEC Activity 5311)

In the decomposition of formic acid containing both carbon 12 and carbon 14, it has been observed that the carbon 12 formate decomposes more readily than the carbon 14 formate. The method used was to decompose formic acid in the presence of sulfuric acid and bleed off carbon monoxide through an ion chamber. The activity recorded by the ion chamber increased as the reaction progressed. At 25°C the rate of decomposition of carbon 12 formate was 8% higher than that of carbon 14 formate. At 0°C the difference was 11%, indicating that the isotope effect is temperature dependent.

Chemical Physics (AEC Activity 5311)

The nuclear resonance of long-lived radioactive I^{129}, formed by fission, has been observed in a nuclear induction apparatus. Frequency measurements at fixed magnetic fields were made on the I^{129} as well as I^{127} and deuterium giving:

$$\mu(I^{129})/\mu(D) = 0.86744 \pm 0.0001$$

and

$$\mu(I^{127})/\mu(D) = 1.30337 \pm 0.0002$$

The calculated nuclear magnetic moments, in units of the nuclear magneton are:

$$\mu(I^{129}) = +2.6173 \pm 0.0003$$

$$\mu(I^{127}) = +2.8090 \pm 0.0004$$

The I^{129} moment is within the experimental limits of the older published value of 2.74 ± 0.14 nuclear magnetons. The I^{127} moment agrees satisfactorily with published values.

Chemistry of Uranium Raw Materials (AEC Activity 5361)

Continued tests of uranium recovery from acid leach liquor of Marysvale ore have showed improved reduction of uranium in solution and hence improved recovery on the addition of as little as 0.01% vanadium. Cation and anion

exchange tests are being made on the uranous phosphate filtrate.

Interference of excess ligand with the anion exchange sorption of uranium complexes has been measured for chloride, sulfate, phosphate, fluoride, acetate, and carbonate.

High pressure tests have been started in the phase equilibrium study of the uranyl carbonate-sodium bicarbonate system.

Several samples of high lime and limestone carnotite ores have been received for study of uranium and vanadium recovery.

METALLURGY

Thorium Research (AEC Activity 5411)

Thorium has been successfully extruded into rods and tubing. The flow pattern for thorium during extrusion appears to be somewhat different from that of other face-centered cubic metals. High-carbon steel dies were found to be unsatisfactory for the extrusion since there was evidence of erosion by thorium in the throat of the die, causing appreciable enlargement in the diameter of the die. Flat-faced dies of high-temperature alloy steel were necessary for satisfactory extrusions.

Thorium tubing, 3/8 inch inside diameter, and outside diameter of about one inch, was extruded using pierced billets and a floating mandrel.

Materials Laboratory (AEC Activity 5461)

Zirconium Reduction. The reduction shelter was completed during the month, and two large reductions, each yielding about four pounds of zirconium metal, were successfully run. A three-inch diameter zirconium mortar was cast. These mortars are for analytical grinding of uranium.

Hafnium Reduction and Research. Three hafnium reductions were made. This completed the Westinghouse Atomic Power Division order for 25 pounds of hafnium metal. Studies of carbonization and oxidation rates of hafnium versus zirconium were under way.

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

PROGRAM 6000 - BIOLOGY AND MEDICINE

BIOLOGY

Cytogenetics (AEC Activity 6400)

The investigation on the effects of sulfur-containing compounds in protecting against radiation damage has been reported previously. Two groups of compounds have proved very promising. One group is the furfuryls. In general, these are toxic; but if protected with side chains, they become non-toxic. The other group of compounds includes glycerine, propylene glycol, triethylene glycol and the alcohols (methyl, ethyl and propyl). The latter compounds are non-toxic in modest concentration.

It appears now that these different groups of compounds protect by different mechanisms. Unfortunately, this laboratory is not well set up to do the mammalian work on this problem. For this reason a cooperative project has been set up with the Argonne National Laboratory for the testing of these compounds on mice.

Biochemistry (AEC Activity 6400)

The ion exchange method continues to be an excellent tool for the analysis of nucleic acid breakdown products. Several new and extremely interesting breakdown products of nucleic acids have been found.

Mammalian Genetics (AEC Activity 6400)

More than 30 mutations produced by X-rays have been isolated in the mouse genetics experiment. These mutations appear at a rate ten times as large as the rate one would expect on the basis of data obtained with drosophila. These findings are of greatest importance in connection with the problem of setting tolerance dosages.

APPLIED BIOPHYSICS

Instrument Development (AEC Activity 6542)

One of a series of fast neutron detection instruments resulting from a long range program of development of neutron proportional counters of specialized designs is a neutron dosimeter designed to give a count rate response proportional to tissue dose in an energy range from 0.2 Mev to

[redacted]

10 Mev. While the accurate use of the instrument is limited to neutrons moving parallel to the axis of the counter, for this purpose it has many advantages over existing instrumentation. Design of the counter is described in ORNL-930. A working model of an appropriate power supply and package with desirable characteristics of convenience and reliability has been constructed as a preliminary step to discussions of possible commercial production engineering.

Radioactive Waste Disposal Research and Development (AEC Activity 6532)

A contract for construction of the Health Physics Waste Research Building was awarded in December to the V. L. Nicholson Company of Knoxville and the contractor began work on this project early in January. This new facility, to be completed about October 1, 1951, will provide more adequate laboratory facilities and also pilot plant space for an expanded program of research on methods for water and liquid waste decontamination. This program has been established and is being developed as a cooperative project of ORNL, the U. S. Public Health Service and Military agencies. Health Physics workers and on-loan personnel, assigned by the cooperating agencies, make up the project staff. Two sanitary engineers of the Public Health Service have been on assignment to the Health Physics Division since the initiation of the Waste Disposal Research program during 1948 and it is expected that the service will assign additional personnel beginning in February.

Continuous Water Monitor (AEC Activity 6542)

Development work is in progress to provide an instrument that will monitor drinking water for radiation (primarily beta-gamma) and record the information on a safe-unsafe scale.

Preliminary work to date suggests a lower limit of activity detected to be about 5 disintegrations per minute (or 2×10^{-6} uc)/cc.

The detector is a thin wall cylindrical (0.0005 in. aluminum) G. M. counter using a continuous counting gas flow, at atmospheric pressure. This G. M. counter has a beta window area of 4.8 in.^{2} and a (shielded) background count rate of 10 to 12 c/m.

To utilize all of the beta window area, the water to be monitored is formed into a thick vertical cylinder enclosing but not touching the counter. The radial depth of the water wall is greater than the average range of the beta to be monitored. The water wall is present without an absorber between the water wall and the beta counter other than the air gap. By rotating the water at a sufficient velocity within a confining shell, one can form a layer of water held away from the counter by centrifugal action only.

Tests of this apparatus prove there is no measurable carry-over of activity to the beta counter. While intended for beta-gamma detection, the counter wall mass is such as to admit alpha particles and thus the device measures to some extent the three common radiations.

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

PERSONNEL SUMMARY

	Number of Employees January 31, 1951	New Hires January	Terminations January
Administration	80	3	1
Operations*	110	1	1
Engineering, Shops, and Mechanical	935	30	0
Laboratory and Research	1155	31	3
Protection	177	2	1
Service	349	6	1
TOTAL	2806	73	7

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

RADIOISOTOPE SALES

Sales	November, 1950	December, 1950
Transfer within AEC	-0-	505.00
Cash Sales	31,351.78	31,156.05
Foreign	1,211.20	514.25
Cancer Program (Free)	31,095.89	29,281.88
Technical Cooperation Plan	253.78	-0-
Total Sales and Transfers to Date	1,374,702.61	1,413,071.91
Total Cancer Program (Free) to Date	654,343.57	683,625.45
Technical Cooperation Plan (Shipments to Date)	6,993.04	6,993.04

[redacted]

[redacted]

OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

JANUARY, 1951

GROSS OPERATING COSTS

(Including X-10 and Y-12)

(a)	Actual Cost for December, 1950	1,930,832	
	Construction - Program "H"	49,977	
	Total Operating & Constr. Costs		1,980,809
(b)	Estimated Operating Costs for Jan., 1951		2,000,000
(c)	Actual Accumulative FY 1951 Operating Cost through December, 1950	10,724,562	
	Actual Accumulative FY 1951 Constr. Cost through December, 1950	346,052	
	Total Accumulative FY 1951 Constr. & Operating Cost through Dec., 1950		11,070,614
(d)	Estimated Operating Cost FY 1951 through January, 1951		13,070,614

[redacted]