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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

MARCH, 1950

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

MARCH, 1950

W. E. Thompson

Date Issued APR 7 1950

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

MARCH, 1950

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

MARCH, 1950

PREFACE

The Oak Ridge National Laboratory Monthly Status and Progress Report has customarily covered the program of the Laboratory on the basis of the project headings used in the budget description submitted to the Atomic Energy Commission. This report describes only those projects in which significant progress has been made during the month; the omission of a particular project does not mean that no progress has been made, but simply that the work has not developed to a point where significant results can be reported.

With this report the project outline has been revised to conform with the Preliminary Program and Budget Estimate for Fiscal Year 1951, submitted to the Atomic Energy Commission in March. Since there have been numerous changes in project headings and since some projects have been shifted to different AEC programs, the complete outline is given in the table of contents. The projects which are described in this report are given page numbers; others are not. The portion of the Laboratory's program which is carried out by the three research divisions in Y-12 is included in the outline; however, this work is covered in a separate Status and Progress Report issued at Y-12. The Y-12 projects are listed in this report only for the purpose of giving a complete picture of the overall program.

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PROGRAM 2000 - SOURCE AND FISSIONABLE MATERIALS

TBP Process for Waste Metal Recovery

The pilot plant runs for metal recovery by the TBP process using the sludge from the Hanford metal waste are in progress and satisfactory results are indicated.

The laboratory-scale studies showed that special pretreatment of the ORNL metal waste would be required for plutonium recovery. A successful procedure was developed and pilot plant runs using ORNL metal waste have demonstrated the feasibility of plutonium recovery as well as uranium recovery from the waste.

The general building layout for the ORNL Metal Recovery plant has been fixed and is ready for construction design.

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OAK RIDGE NATIONAL LABORATORY

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PROGRAM 3000 - WEAPONS

RaLa Development

The pilot plant and laboratory development studies were continued for the RaLa Process and progress reports (ORNL-620, 621, and 622) are being issued. Several studies remain to be completed before the final process is fixed. In the meantime the design of the alterations to the present production facilities is in progress.

RaLa Production

Run Number 40 was completed and the product shipped March 18 without operational difficulty. The cell ventilation, tied into the new isotope area stack, was considerably improved, as shown by the fact that no air contamination was experienced during the final product sampling which had previously been a troublesome operation.

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OAK RIDGE NATIONAL LABORATORY

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MARCH, 1950

PROGRAM 4000 - REACTOR DEVELOPMENT

MATERIALS TESTING REACTOR PROJECT (AND MODIFIED MTR)

Design and Evaluation

MTR Analysis and Engineering Design

Design of the reactor tank and its contents has progressed to the point where a design completion date has been set (May 15, 1950).

A report, ORNL Central Files Number 50-3-102, has been issued on the air requirements for cooling of the graphite moderator. A compilation of water flow requirements through the reflector and through the active section has been issued (CF 50-3-69) and recommended for incorporation into the design of internals of the tank system.

The cooling requirements of the various pieces in the beryllium reflector have been calculated and a hole pattern has been made.

A few Blaw-Knox drawings of the reactor structure have been received and are being reviewed. The details of the graphite design are nearing completion. A detailed report covering graphite procurement has been written and steps are being taken to assure timely delivery to the shop designated to perform the final machining.

Thirty-five drawings covering the design of the beryllium reflector were sent to the Brush Beryllium Company. Rough blanks of QMV beryllium will be made from these drawings and sent to Y-12 shops for final machining. Chemical and metallurgical specifications for the Be reflector written by the Metallurgy and Engineering Divisions have been approved.

Preliminary tests (2 SF aluminum and 35677 aluminum weldments) have been made on standard test bars for the MTR flange mock-up. Results indicate the welded joint will withstand the calculated stresses in tank Section "D."

Reactor Physics and Critical Assembly Work

MTR Critical Experiments

The critical assembly in the MTR mock-up has been operating at 100 watts; in the first phase of traverse investigations gamma and neutron

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flux measurements have been completed. A plot of gamma and neutron flux distribution has been made on the midplane from the core center to the outer edge of the graphite and along vertical lines from top to bottom in the graphite. The neutron traverse for the entire lattice within the tank has been mapped; other traverses will be made under different conditions. From these measurements the heat distribution in the reflector for full power operation (MTR) is now being calculated.

Moderator, Structural Materials and Reflector

MTR Test and Development other than Critical Experiments

The design of the full scale flange mock-up has been completed and necessary purchase requisitions and work orders have been written and approved. Two of the tank sections used in this test will be used ultimately in the MTR.

The necessary authority and appropriation for purchasing the tank system (less Tanks A and E) has been received. Purchase orders have been written for the necessary aluminum and stainless steel plate.

Instrumentation and Control

MTR Reactor Controls

A prototype fission chamber has been designed and built and is now being tested in the mock-up. A study of the tie-ins between the various warnings of abnormal reactor operating conditions and corresponding automatic or manual action is under way.

A simple solution has been found for the problem of reducing the flux to the fission chamber in the withdrawn position. This is accomplished by putting a neutron absorbing plate on the lower end of the chamber in such a way that when the chamber is "in," it monitors the flux from all sides but when it is "out," the absorber stops the beam streaming through the hole before it reaches the chamber proper. This greatly simplifies the withdrawing mechanism as well.

Chemical Processing

25 Process Design

A tentative time schedule has been established for the construction and start-up of the chemical processing plant for the MTR fuel assemblies at

[redacted]

Arco. Discussions are now in progress to choose an architect-engineering firm for the design of the plant. The tentative completion date for the plant is now October, 1951.

AIRCRAFT NUCLEAR PROPULSION PROJECT

Design and Evaluation

ANP Central Design Group; ANP Design Subcontracts

Contract negotiations with the H. K. Ferguson Company for ANP design and engineering work have been completed and signed by Ferguson and Carbide and are awaiting AEC approval. Negotiation of a contract with North American Aviation, Incorporated, for similar ANP work has been started.

Cooling, Heat Transfer and Power Generation

Liquid Metals Research

The static corrosion sorting tests involving the exposures of some 15 elements and a variety of high-temperature alloys to liquid lithium, bismuth and lead for various time intervals at 1000°C are being performed. An active program is in progress to insure maximum purity of lithium and other potential coolants used in the tests. Several thermal convection loops are being fabricated from promising high-temperature materials for dynamic corrosion testing. The fabrication of bimetallic structural components for reactor and heat exchanger systems is under way.

Shield Development

Shielding Materials Development

Tests on the naval reactor shield have been completed; neutrons and gammas throughout the entire shield mock-up have been measured as well as the ionization (and therefore the heating effect) within the iron of the thermal shield and pressure shell and the reduction of capture gamma rays by the addition of boron at various points throughout the shield.

A series of measurements was made to determine the flux depression due to the insertion of neutron detectors in the water.

AEC approval has been granted for the construction of the bulk shield testing facility, a 10-KW, water-moderated critical assembly. Preliminary

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notices have been issued to prospective bidders.

HOMOGENEOUS REACTOR EXPERIMENT

Experimental Engineering

Experimental and Design Engineering for the Homogeneous Reactor

A reactor safeguards report for the homogeneous reactor is nearing completion and will be issued in April.

Fuel Elements

Phase Relationships of Fuel Media

Preliminary studies of the phase and thermal stability of the UO_2CrO_4 - H_2O system indicate that it is not suitable as a homogeneous reactor fluid at elevated temperatures unless the mole ratio of CrO_3 to UO_3 is at least about 1.8. With smaller amounts of CrO_3, precipitation is encountered at temperatures well below 250°C, the exact temperature being dependent on the amount of CrO_3.

GENERAL REACTOR DEVELOPMENT (INCLUDING CHEMICAL TECHNOLOGY)

Chemical Processing

23 Process and Recovery of Thorium

The pilot plant development of the 23 Process using the methyl isobutyl ketone flowsheet was satisfactorily completed, and several runs are being made to demonstrate the operational feasibility of the diisopropyl ether flowsheet.

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OAK RIDGE NATIONAL LABORATORY

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PROGRAM 5000 - PHYSICAL RESEARCH

PRODUCTION OF RADIOISOTOPES AND RADIO-ORGANIC COMPOUNDS

Radioisotope Production, Development and Operations

The total accumulated KWH for pile operation during the month of March was 2,487,173 averaging 3612.63 KW per operating hour. The pile down time was 7.5%, as compared to 8.3% in February. Two ruptured slugs were located by visual inspection and discharged without difficulty.

During March 662 radioisotope shipments were made. This is the largest number of shipments for any single month to date.

The University of Wisconsin complaint about the quality of carbon 14 labeled alanine and glycine distributed by the Laboratory was investigated and found to be without foundation, resulting from an experimental error at Wisconsin.

The first requests for service irradiation of biological specimens in the reactor under the new Biological Irradiation Program have been received. It is also planned to offer gamma irradiation services.

Requests for three shipments of irradiated potassium bromide ranging from one to ten curies in activity have been received from Brookhaven National Laboratory. These shipments, intended for use in connection with the Civilian Defense Training program, will be the largest ever sent by air.

In processing the rare earth fraction of the fission products from Hanford slugs which had been irradiated for one year and allowed to cool for three years, it was noted that the yields of europium 155 and samarium 151 were considerably less than the theoretical prediction from fission yield curves.

Elemental sulfur 35 with a specific activity of six curies per gram has been prepared to fill a special order.

PHYSICS

Nucleon Bombardment of Semiconductors

The number of conducting centers (hole-type) induced by pile irradiation of semiconductors and measured by means of the Hall effect is found

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to agree within rather wide limits of experimental error with the number of atoms displaced by scattering collisions as computed by simple theory.

High Voltage Program

The Cockroft-Walton machine constructed at ORNL is operating at 300 Kev, giving an unresolved beam of about one milliampere of positive ions.

Neutron Diffraction

A sample of unmagnetized, metallic cobalt has been examined by neutron diffraction and found to show ferromagnetic scattering as well as nuclear scattering. Nickel 62 has been shown to scatter neutrons with a negative scattering amplitude. Of some 60 elements studied, only five show this effect.

CHEMISTRY

Instrument Development for Chemical Research

Results of studies for the elucidation of decay schemes of the radioactive isotopes are to be published in the near future. The proportional counter spectrometer used in these studies is particularly useful for determining energies of x-rays and beta particles below 200 Kev which are difficult to measure with conventional magnetic lens spectrometers. This proportional counter spectrometer, developed at ORNL, has resolution sufficiently good to distinguish the K x-rays of adjoining elements in the periodic table. It is currently being used to measure the beta-ray spectra of such low-energy beta emitters as nickel 63 and thulium 171.

Purex Process

The laboratory development of the Purex Process for the recovery and decontamination of plutonium and uranium from Hanford production metal was continued. The radiation stability of the system was indicated to be satisfactory, and the volumetric efficiency was improved. Then studies are being continued.

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PROGRAM 6000 - BIOLOGY AND MEDICINE

BIOLOGY

Pathological Effects of Radiation

The damaging effect of slow neutrons in causing chromosomal aberrations is much greater than would be expected on the basis of calculated physical radiation dosage and in addition, it has been shown that micro amounts of boron further increase this damage four to five times.

APPLIED BIOPHYSICS

Waste Disposal Research

Continuous, recording water monitoring equipment is being installed at the White Oak Lake discharge. Beta and gamma activity plus flow rates will be recorded at the dam and telemetered to the local area monitoring office in the plant.

HEALTH PHYSICS TRAINING AND RESEARCH PARTICIPATION

Special Training

In cooperation with the Civilian Defense Program of the AEC, a "Manual on Radiological Protection for Civilian Defense" has been prepared and will be issued in April. Also in this connection the "Lecture Notes; Health Physics Training Lectures" and health physics "Instrument Manual" are being made available to the Technical Information Branch for reproduction and distribution.

The Laboratory, jointly with the Oak Ridge Institute of Nuclear Studies, is conducting a training program to provide a background of information for Civilian Defense representatives from various states. The twenty students now in training will return to their respective states to train instructors for local radiological units.

A group of five army medical officers has started a brief, intensive training program in applied health physics following the completion of the 4-week ORINS training course in radioisotope techniques.

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OAK RIDGE NATIONAL LABORATORY

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PROGRAM 1000 - PLANT AND EQUIPMENT

RESEARCH FACILITIES

Separations Building #205

The erection of structural steel is approximately 60% completed. Foundation excavation, pouring of foundations and backfill are approximately 80% complete. The entire remodeling and permanentization is approximately 20% complete.

Research Laboratory

Bids will be opened on May 4, 1950. An addendum, covering corrections to the original drawings and specifications and including Alternate No. 6 (extending the 2nd floor to full width of building, interior not finished) will be sent to A.E.C. April 3rd for inclusion in the bids.

Physics of Solids Building

All drawings not yet issued are practically ready for approval. Construction work by J. A. Jones is continuing and consists of form building and pouring concrete.

Cafeteria Building

Masons have started on interior tile. Hangers and channels to receive metal lath are approximately 100% complete. Laboratory-furnished equipment is being delivered to Jones. The job is approximately 45% complete.

Instrument Laboratory

Concrete grade beams have been erected; backfilling with stone for concrete floor slab is under way. Plumbers are installing soil lines and drain lines. Total completion, 6%.

Health Physics Calibration Building #104-A

Brick work (outside walls) is 80% complete; rough plumbing has been completed and tested.

Isotope Research and Semi-Works Building

Phase II design is continuing. Drawings and specifications will be sent out for lump sum bids on Monday, May 1, 1950.

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Fan House #115

Construction was started on March 22 by J. A. Jones Co. North and East foundation walls have been poured. All plans and specifications have received final approval except Instrumentation, which is delayed pending receipt of detailed information from fan manufacturer.

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OAK RIDGE NATIONAL LABORATORY

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PERSONNEL SUMMARY

	Number of Employees March 31, 1950	New Hires March	Terminations March
Administration	90	2	0
Operations*	101	2	4
Engineering, Shops, and Mechanical	691	32	0
Laboratory and Research	776	108	96
Protection	171	1	0
Service	301	1	1
TOTAL	2130	146	101

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

RADIOISOTOPE SALES

Sales	January, 1950	February, 1950
Transfers within AEC	$10,251.45	$ 8,557.40
Off Project	15,572.46	13,927.55
Foreign	1,851.00	2,062.20
Cancer Program (Free)	31,103.80	27,384.10
Technical Cooperation Plan	-0-	-0-
Total Sales and Transfers to Date		$979,339.46
Total Cancer Program (free) to Date		$408,699.41
Technical Cooperation Plan		$400.00

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GROSS OPERATING COSTS

(a)	Actual ORNL operating cost for Feb., 1950	$1,119,696	
	Construction - ORNL portion of Program "H"	11,882	
	Total ORNL operating and construction costs		$1,131,578
(b)	Estimated ORNL operating cost for March, 1950		$1,350,000
(c)	Actual accumulative FY 50 ORNL operating cost through Feb., 1950	$8,329,200	
	Actual accumulative FY 50 ORNL construction costs (Program "H") through Feb., 1950	$196,060	
	Total actual accumulative FY 50 operating and construction costs through Feb., 1950		$8,525,260
(d)	Estimated ORNL operating cost FY 50 through March, 1950		$9,875,260

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