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Progress Report
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AEC RESEARCH AND DEVELOPMENT REPORT

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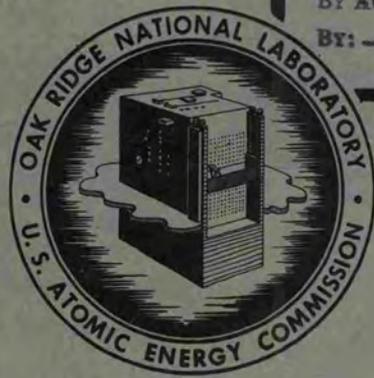
OAK RIDGE NATIONAL LABORATORY
STATUS AND PROGRESS REPORT
MAY, 1950

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OAK RIDGE NATIONAL LABORATORY

ORNL-735

STATUS AND PROGRESS REPORT

MAY, 1950

W. E. Thompson

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OAK RIDGE NATIONAL LABORATORY

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

MAY, 1950

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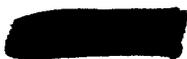
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STATUS AND PROGRESS REPORT

MAY, 1950

PROGRAM 2000 - SOURCE AND FISSIONABLE MATERIALS

TBP Process for Waste Metal Recovery

The laboratory and hot pilot plant program for the evaluation of the TBP Process on Hanford waste metal recovery was continued with the dissolving of the second sample of Hanford metal sludge. The effect of increasing the column flow rate was studied.

Design work on the ORNL Metal Recovery Plant was continued.

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OAK RIDGE NATIONAL LABORATORY

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MAY, 1950

PROGRAM 3000 - WEAPONS

Chalk River Separations

The processing of the Chalk River material through the 205 equipment for primary separation of uranium, plutonium, and fission products is about 50% complete. The facilities for the final isolation of the plutonium are now complete, and the plutonium is scheduled for final processing next month.

RaLa Development

The pilot plant study of the improved RaLa Process for the ORNL Plant was essentially completed. The Process was satisfactorily demonstrated using sulfate precipitation for separating the barium from the metal solution followed by metathesis and ion exchange for the purification of the product. The design of required alteration of the ORNL Plant was continued and the construction is scheduled to start in June.

Chemical studies are to be continued to adapt the RaLa Process to the spent fuel units from the Materials Testing Reactor. The design of the Idaho Chemical Processing Plant will include an area for this process.

RaLa Production

Run No. 42 was scheduled to start on June 12. Following completion of this run, the cells will be decontaminated to allow construction of facilities for the improved RaLa Process.

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

MAY, 1950

PROGRAM 4000 - REACTOR DEVELOPMENT

MATERIALS TESTING REACTOR PROJECT

Design and Evaluation

MTR Project Engineering

Procurement of the parts to be supplied by ORNL is moving more slowly than planned; however, of the funds allocated by the Idaho Office, 75% is either committed by vendor contract or by requisition for vendor contract. Within the next eight weeks substantially all of the funds will be committed.

MTR Analysis and Engineering Design

Design work has progressed satisfactorily toward completion of the reactor tank parts to be supplied by ORNL. With the exception of the shim rod magnetic couplings and the shim rod active sections, all major items are either completed or are in the checking stage. Numerous small parts such as the various handling tools, the monitoring tubes, etc. have yet to be detailed. It is expected that this plus other detail design work will continue for sixty to ninety days.

Reactor Physics and Critical Assembly Work

MTR Critical Experiments

All gamma and neutron flux measurements in the mock-up are complete except those in the water above the active section. The automatic regulating rod control servo system was installed and found to operate satisfactorily even with full water flow.

Fuel Elements

MTR Metallurgy Development

Studies of the process for fabricating MTR fuel assemblies have indicated some simplifications which can be made, cutting down handling.

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Complete Fuel Assembly for Chalk River Reactor Irradiation

The assembly for this experiment has been fabricated and will be shipped to Argonne early in June.

Moderator, Structural Materials and Reflector

MTR Corrosion Studies

ORNL autoclave tests of beryllium from the first Brush production batch show excellent corrosion resistance in the beryllium. These tests will be performed at ORNL until July 1, when the Brush autoclaves are expected to be ready.

MTR Test and Development other than Critical Experiments

Design of a mock-up test of the reactor tank flanged joints has been completed and the required materials are on order. It is expected that the various parts will be delivered in time to allow tests to be made early in August.

Instrumentation and Control

MTR Reactor Controls

A model II, compensated, four-inch ionization chamber has been received from Eastman Kodak for use with the period meter. It has not proved entirely satisfactory and modifications will be made.

Chemical Processing

25 Process Design

The scope of the Idaho Chemical Processing Plant was further increased this month to include an area for the separation of barium from the spent MTR fuel units. The preliminary design studies were continued.

AIRCRAFT NUCLEAR PROPULSION PROJECT

Design and Evaluation

ANP Central Design Group; ANP Design Subcontracts

The summer meeting of the Technical Advisory Board, under the direction of Dr. Wheeler Loomis, is scheduled to start on June 5. Eighteen consultants, not counting H. K. Ferguson, North American Aviation, or Nuclear Development Associates personnel, will participate in the summer program.

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STATUS AND PROGRESS REPORT

MAY, 1950

Current effort of the Central Design Group is centered on establishing basic criteria for the Aircraft Reactor Experiment (ARE). It is hoped that the over-all plans for type of reactor, cycle, coolant, and other basic features can be decided upon during the month of June.

Negotiations have been completed for the prime contracts between AEC and North American Aviation and Nuclear Development Associates for ANP work.

Reactor Physics and Critical Assembly Work

ANP Reactor Critical Experiments

The critical experiment building is expected to be completed in July. A request for fissionable material for the critical experiments is being initiated.

Cooling, Heat Transfer and Power Generation

ANP Heat Transfer and Liquid Metals

Equipment for the general heat transfer studies with lithium is essentially complete. Heater tracings on the lines and lagging remain to be installed.

The Liquid Metals Handbook will be sent to the printer on June 17.

Shield Development

The past month has been spent in recalibrating both gamma and neutron instruments, so no new shields have been measured. A fast neutron spectrometer has been calibrated at Bartol and MIT and has been used for preliminary runs in the lid tank. No data are available yet, but it is hoped that this instrument will serve better to correlate thermal neutron measurements with fast spectra.

A new monitor has been installed which has sufficient power to run a Brown recorder directly, eliminating the necessity for an electrometer. This should prove much more satisfactory in that it will be a more accurate indication of power level and will require less servicing.

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STATUS AND PROGRESS REPORT

MAY, 1950

HOMOGENEOUS REACTOR EXPERIMENT PROJECT

Experimental Engineering

Experimental and Design Engineering for Homogeneous Reactor

The Homogeneous Reactor Feasibility and Safeguard reports are essentially complete and will be issued in June. The Homogeneous Reactor will be discussed at the next meeting of the Reactor Safeguard Committee at the end of June.

GENERAL REACTOR DEVELOPMENT

Chemical Processing

23 Process and Recovery of Thorium

The uranium 233 separated from Hanford irradiated thorium metal is now being purified and concentrated in the new isolation facility.

Waste Processing

Monitoring of the radiochemical liquid waste evaporator condensate by electric conductivity was found to be satisfactory in preliminary tests for the detection of excessive entrainment which caused low decontamination from radioactivity.

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

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PROGRAM 5000 - PHYSICAL RESEARCH

PRODUCTION OF RADIOISOTOPES

Radioisotope Production, Development and Operation

2048 200
The total accumulated KWH for pile operation during May was 2,267,161, averaging 3431 KW per operating hour. Pile down time was 11.2%, as compared with 10.1% during April. One ruptured slug was located by visual inspection and discharged without difficulty.

A total of 791 radioisotope shipments was made during the month of May. This represents an increase of 20% over the previous record set in March 1950.

During the past month large orders for strontium 90 for use in thickness gauges have been received. Firm orders for 18,200 millicuries of Sr⁹⁰ have been received and further large orders are expected in the near future.

PHYSICS

Neutron Diffraction

It has been found that the Bragg reflected intensities from a sample of magnetite (ferromagnetic Fe₃O₄) are extremely sensitive to the application of an external magnetic field. This opens up the possibility of using a crystal of this substance as a fast neutron shutter and also as a source of very highly polarized neutrons.

Scintillation Spectrometry and Instrument Development

A ten-channel pulse spectrum analyzer has been completed for use with scintillation spectrometers or proportional counters and is now in use with the scintillation spectrometer. The spectrum analyzer reduces the time required to plot the spectrum of a low activity specimen by a factor of ten.

Short Period Activities

A proportional counter has been set up and is being used for the measurement of X rays emitted by short lived fission products.

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STATUS AND PROGRESS REPORT

MAY, 1950

Short-Lived Isomers

A metastable level with a half-life of 5.7×10^{-9} seconds has been found in iridium 191. The energy of the isomeric transition has been measured with the delayed coincidence scintillation spectrometer and found to be 65 ± 5 Kev.

Theory

Calculations have shown that a long-standing puzzle presented by the shape of the beta ray spectrum of radium E may be resolved by taking into account the effect of the finite size of the nucleus.

CHEMISTRY

Chemistry of Separations Processes

Different resins are being investigated for the ion exchange separation of lithium isotopes. Somewhat better enrichment of lithium 7 has been obtained with standard Dowex 50 resin under more closely controlled conditions. Mass assays on runs with other resins are not yet available.

Chalk River Separations

The installation of equipment for the separation and purification of fission products from the Building 205 process waste (from Chalk River fuel processing) has been completed and cold test runs are now being made. It is expected that chemical operations on the waste will be started in June.

Purex Process

The laboratory development was continued for the Purex Process for the separation of uranium, plutonium, and fission products from Hanford Metal. The evaluation of the present flowsheet using ORNL irradiated uranium in laboratory columns is in progress.

Analytical Chemistry

On May 19 it was announced that the Analytical Service Groups of the X-10 Chemistry Division and the Technical Services Group of the Y-12 Chemistry Division would be transferred from those Divisions and combined to form the Analytical Chemistry Division. M. T. Kelley and C. D. Susano will assume the duties of Division Director and Associate Division Director, respectively.

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STATUS AND PROGRESS REPORT

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METALLURGY

Thorium Research

Additions of beryllium, silicon, and aluminum to thorium have been found to form intermetallic compounds which make the alloys hard and brittle. Additions of titanium, zirconium, and niobium to the thorium form alloys which are soft and may be fabricated by cold working. Improvement in the quality of the alloys has resulted from use of the vacuum casting technique with the tilting vacuum furnace.

Special Services

The 140 fuel rods for the Argonne CP-3 reactor were completed and shipped to Argonne during May.

Ten J slugs from Hanford have been encased in a Chalk River fuel rod sheath. Following welding closure at the ends and leak testing, this assembly will be shipped to Chalk River for irradiation to determine dimensional stability of the J slugs.

Physical Metallurgy of U-Al Alloys

Analysis of the gas under blisters formed in the fabrication of MTR fuel elements showed the gas to be predominantly hydrogen. This evidence helps to substantiate the theory that blisters are caused by the adsorption of water on the surface of the components prior to cladding. During annealing, the water reacts with aluminum to liberate hydrogen which causes the blisters.

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OAK RIDGE NATIONAL LABORATORY

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PROGRAM 6000 - BIOLOGY AND MEDICINE

BIOLOGY

Cytogenetics

Studies of the effects of oxygen upon sensitivity to X radiation were extended to include effects upon sensitivity to alpha rays. It was found that, in contrast to X-ray sensitivity, alpha ray sensitivity was not affected by changes in oxygen concentration.

Pathological Effects of Radiation

It has been reported earlier that certain dosages of slow neutrons cause high percentages of cataracts. It has been found that mice which received equivalent doses of X rays or slow neutrons develop similar percentages of cataracts.

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

MAY, 1950

PROGRAM 1000 - PLANT AND EQUIPMENT

File Building #102 and Change House Addition

Work on File Control and Instrumentation has been started and is now approximately 40% completed. The new laboratory on first floor and relocation of Door #104 is completed. Site work on the Air Intake Filter is postponed pending arrival of materials, with shipping dates promised for June 15. A deficiency in air conditioning on the third south platform is being studied, and it is thought that corrections can be made with equipment now in place by slight duct changes. Two per cent of the items on the punch list are uncompleted. The entire job is estimated as 99% complete this date. The original scheduled completion date was May 1, 1950; the work has been rescheduled to be completed by June 30, 1950.

Research Laboratory

Bids were received on May 4, 1950, and the general contract has been awarded to the John A. Johnson Contracting Corporation. As awarded, the contract includes Wing No. 1 at full length, and the Second Floor at front extended to full width of the building. The second floor extensions are to be unfinished at present; however, The Austin Company is preparing plans for finishing these spaces, including office layouts, so that the work can be done at any time.

Physics of Solids Building

All plans and specifications for the building and extension are in the hands of J. A. Jones Company, the contractor. Per cent completion of construction items are as follows: structural steel framing, 98%; roughing plumbing, 65%; roughing hot drains, 65%; total building, 40%. The concrete floor for cells 1, 2, and 3 has been poured. Original scheduled completion date of June 30, 1950, was rescheduled to July 31, 1950. With the extension made necessary by NEPA participation a new date for the entire building has been established at October 30, 1950.

Isotope Research and Semi-Works Building

The drawings and specifications are now in the hands of bidders. Corrections and clarifications, in the form of addenda, are being issued and will be included in bids to be received on June 15, 1950.

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STATUS AND PROGRESS REPORT

MAY, 1950

Fan House, Building #115

Production schedule of the B. F. Sturtevant Company has fixed June 26 as shipping date for both of the new compressors (fans) for this building. The concrete block walls for the driver room are 40% completed, making the building 35% completed. No other construction work is being done. The foundation drawing for the compressors was submitted on May 26 and is being reviewed by ORNL. Approval of this drawing will permit The Austin Company to complete the work sequence program they have been asked to prepare covering the installation of the compressors. Scheduled completion date is October 31, 1950.

Separations Building #205

The exterior concrete dock slab, with the exception of miscellaneous concrete work, has been completed. Erection of steel roof deck and exterior concrete block walls is in progress. The total job is approximately 45% completed. Scheduled completion date is September 30, 1950.

Cafeteria Building

The plastering and partition tile work is scheduled to be completed May 31, 1950. New equipment and toilet fixtures are being installed. Carpenters are hanging doors and trimming. The building is expected to be completed for release to operators by June 10, 1950, excepting the painting of plastered walls. The scheduled completion date is May 31, 1950; the probable completion date is June 10, 1950.

Instrument Laboratory

Exterior masonry walls are being erected; metal roofing is being put in place; and supply lines and electrical conduit are being installed. Sheet metal workers are installing duct work. Total completion is 35%; scheduled completion date is November 1, 1950.

Health Physics Calibration Building #104-A

Masonry work in connection with exterior wall has been completed with the exception of stone copings. Interior utility tile walls have been completed. Interior painting of concrete block walls is in progress. Metal furring for suspended ceilings is complete. The total job is approximately 95% complete; the original scheduled completion date of April 15, 1950, was re-scheduled to May 31, 1950.

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OAK RIDGE NATIONAL LABORATORY

STATUS AND PROGRESS REPORT

MAY, 1950

PERSONNEL SUMMARY

	Number of Employees <u>May 31, 1950</u>	New Hires <u>May</u>	Terminations <u>May</u>
Administration	92	2	1
Operations*	102	1	0
Engineering, Shops, and Mechanical	761	39	0
Laboratory and Research	806	16	1
Protection	168	0	2
Service	<u>309</u>	<u>5</u>	<u>1</u>
TOTAL	2238	63	5

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

RADIOISOTOPE SALES

<u>Sales</u>	<u>March, 1950</u>	<u>April, 1950</u>
Transfers within AEC	\$18,195.09	\$ 9,981.64
Off Project	18,311.68	17,270.28
Foreign	2,251.30	838.60
Cancer Program (Free)	23,053.55	28,032.62
Technical Cooperation Plan	<u>2,442.90</u>	<u>-0-</u>
Total Sales and Transfers to Date		\$1,046,188.05
Total Cancer Program (Free) to Date		\$459,785.58
Technical Cooperation Plan		\$2,842.90

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STATUS AND PROGRESS REPORT

MAY, 1950

GROSS OPERATING COSTS

(a) Actual cost for April, 1950	\$1,226,052	
Construction - Program "H"	\$99,552	
Total Operating & Construction Costs		\$1,325,604
(b) Estimated operating costs for May, 1950		\$1,400,000
(c) Actual accumulative FY 50 operating cost through April, 1950	\$10,732,830	
Actual accumulative FY 50 construction costs through April, 1950		334,580
Total accumulative FY 50 construction and operating cost through April, 1950		\$11,067,410
(d) Estimated operating cost FY 50 through May, 1950		\$12,467,410