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Messrs. McCarthy and Burrows
Brig. Gen. K. E. Fields
Mr. Cook
Mr. Snapp ✓

The attached abstract was prepared at Mr. Strauss' request, for use in briefing the President; a copy was delivered to Mr. Strauss on July 2.

Philip Mullenbach
7/3/53

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# Abstract of the AEC ~~Progress~~ Report to the Joint Committee December 1952 through May 1953*

Key developments in the atomic energy program during the six months ended May 31, 1953, are these:

1) Weapon tests held this last spring at Nevada have helped Los Alamos greatly in proceeding toward design of deliverable thermonuclear weapons. The experiments provided increased assurance of the successful test of a deliverable thermonuclear weapon, currently scheduled for the Pacific early in 1954.

2) Production of fission weapons is proceeding satisfactorily. On May 31, 1953, there were ____ nuclear assemblies in the stockpile, compared with ____ on December 31, 1952. [redacted]

3) Technical advances in the operation of the plutonium production reactors have made it possible to raise by one-fourth the projected steady-state output of plutonium originally planned under the authorized expansion program in 1952.

4) The rate of fissionable material production is sharply higher than six months ago, primarily because new facilities have come into initial or full-scale use. In May 1953, plutonium formation was 27 percent higher than in November 1952, while the rate of U 235 production was 50 percent greater than six months earlier.

5) Receipts of uranium ($U_3O_8$) from all sources during this period were 21 percent less than in the preceding six months period. Productivity of the Shinkolobwe mine in the Belgian Congo continued to decline. First receipts of $U_3O_8$ came in from South Africa in April. Important new ore discoveries have been made on the Colorado Plateau and in Canada. The Commission feels more assured that the goal of procuring 12,500 short tons of $U_3O_8$ annually will be achieved by 1960.

* This odd reporting interval is based on the fact that the Joint Committee asked the Commission in 1950 to furnish the progress reports in June and in December so as to be available just before Congress convenes and adjourns.

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6) Major policy decisions were at the forefront of the reactor development program for both military and civilian purposes: The NSC actions on development of the aircraft carrier reactor, the aircraft reactor, the sodium-graphite power reactor, and the Commission's policy statement on civilian power, were all being worked into a reoriented reactor development program. In March 1953 the first experimental submarine reactor (STR) was brought to criticality at the Reactor Testing Station in Idaho.

Raw Materials (Part I, pp. 11-24)

During 1952, total receipts of uranium concentrates available to the Combined Development Agency (representing the United States, United Kingdom, and Canada) were 3,173 short tons, or 577 tons less than the amount projected at the beginning of the year. During the six-months period ended May 31, 1953, total receipts declined to 1,294 short tons, 21 percent less than in the preceding period. Shipments from the Shinkolobwe mine in the Belgian Congo have dropped sharply since July 1952, mainly because open-pit operations came to an end and the grade of ore has continued to decline. The Belgian Congo is still projected to provide 1,700 tons annually for some years; this is roughly one-fourth less than the average rate during 1946-51.

Recent favorable developments in Canada, the United States, and South Africa provide increased assurance, however, that the Commission's projection of 13,100 tons annually (including 600 tons tentatively allocated to the United Kingdom) will be achieved by 1960. Actual and projected receipts are shown below (for detail, see table on p. 13):

| Calendar year | | Short tons $U_3O_8$ | Percent from-- North America | Belgian Congo | South Africa | Other |
|---|---|---|---|---|---|---|
| Actual | 1952 | 3,173 | 34.8% | 61.7% | -- % | 3.5% |
| Projected | 1953 | 3,970 | 34.5 | 42.8 | 20.2 | 2.5 |
| | 1954 | 5,600 | 33.9 | 30.4 | 32.1 | 3.6 |
| | 1955 | 7,500 | 33.3 | 22.7 | 37.3 | 6.7 |
| | 1956 | 8,900 | 38.2 | 19.1 | 37.1 | 5.6 |
| | 1957 | 10,600 | 36.8 | 16.0 | 37.7 | 9.5 |
| | 1958 | 11,100 | 35.1 | 15.3 | 36.1 | 13.5 |
| | 1959 | 12,500 | 32.0 | 13.6 | 32.0 | 22.4 |
| | 1960 | 13,100 | 30.5 | 13.0 | 30.5 | 26.0 |

The first three uranium recovery plants in South Africa are now operating and nine more are expected to come into production over the next two years. First deliveries from this source were received in the United States in April 1953.

Important new ore bodies have been discovered in Canada (at Gunnar Lake, in the Athabaska area) and in southeastern Utah on the Colorado Plateau. Domestic uranium operations (exploration, mining, milling) are proceeding satisfactorily. During this six-months period, ore deliveries and mill output have continued to rise (see charts on pp. 18 and 19). Moreover, the recovery of uranium as a by-product of phosphate chemical production which began in 1952, has proceeded smoothly at the first plant; unit costs have been below expectations. Two more plants will start up this year. Important research and development are being directed toward methods of recovering uranium from low-grade material such as the Florida phosphates and Florida leached zone material discarded in commercial phosphate operations.

<u>Fissionable Materials</u> (Part II, pp. 25-37)

Actual and projected output of U 235 and plutonium are as follows, based on 1952 = 100 (see charts on p. 26):

| Calendar Year | | U 235 | Plutonium |
|---|---|---|---|
| Actual | 1946 | 15 | 27 |
| | 1947 | 22 | 19 |
| | 1948 | 22 | 23 |
| | 1949 | 25 | 29 |
| | 1950 | 27 | 49 |
| | 1951 | 43 | 69 |
| | 1952 | 100 | 100 |
| Projected | 1953 | 144 | 128 |
| | 1954 | 216 | 166 |
| | 1955 | 284 | 270 |
| | 1956 | 361 | 395 |
| | 1957 | 438 | 420 |
| | 1958 | 506 | 423 |
| | 1959 | 516 | 423 |
| | 1960 | 516 | 423 |

The projected output of plutonium for 1957 and thereafter is 24 percent greater than indicated in previous progress reports. The increase is based upon confidence that Hanford and Savannah River reactors can perform at higher power levels than were previously assumed.

<u>Hanford operations</u>. Successively higher power levels are being achieved in the Hanford piles each quarter (see Chart II-F, p. 32). Lost operating time caused by the failure of uranium slugs in the piles fell to 1.3 percent in the first quarter of 1953 compared with the peak of 8.4 percent in the third quarter of 1951. These factors and outstanding

performance of the sixth pile (C pile), which started up in November 1952, are expected to raise 1953 production of plutonium 13 percent above the estimate of six months ago.

Construction of plutonium facilities. On May 31, 1953, the five heavy water reactors and related facilities at Savannah River were 60 percent complete. Following several weeks of preoperational testing, production operation of the first reactor is expected to begin in September. All five Savannah River reactors are scheduled to be completed by January 1, 1955.

Construction of the jumbo-size seventh and eighth Hanford graphite reactors was 13 percent complete on May 31. These are scheduled to be completed in October 1954 and April 1955.

Gaseous-diffusion operations. The sharp rise now occurring in the output of weapon-level U 235 at Oak Ridge is based on the successive start-up of new units at Paducah, beginning last November and continuing throughout 1953. Operating efficiency of the plants has been maintained at a high level, despite occasional equipment failures associated with the start-up of new plants and with continuing efforts to increase operating pressures to the highest practicable limits.

Construction of uranium 235 facilities. The two Paducah plants started in 1951 were 90 percent complete on May 31. The additional gaseous diffusion plants authorized in the 1952 expansion program are all under construction and scheduled to be completed in 1955 and 1956. On May 31 the two additional plants at Paducah were 6 percent complete, the additional plant at Oak Ridge was 8 percent complete, and the new plant at Portsmouth was 1 percent complete.

Feed materials. Stocks of uranium feed materials prepared from ore have fallen below the levels of recent years (see Chart II-C, p. 20). Operation of growing plant capacity has been made possible by the recovery at Hanford of large tonnages of uranium depleted in the uranium 235 isotope. Only depleted uranium is now fed to the gaseous diffusion cascades. All uranium of normal isotopic content is required as metal feed for the production of plutonium in the Hanford and Savannah River reactors.

Special products for thermonuclear program. The ADP plant at Oak Ridge is scheduled to begin producing lithium 6 during the summer. Production schedules are aimed at meeting the requirements of the thermonuclear weapon tests next spring. Tritium is being produced as a by-product of regular Hanford operations, and the excess neutrons from Savannah River reactors will be similarly used. Larger quantities of tritium will be produced as necessary by use of special reactor loadings which involve a sacrifice of plutonium production. The special loading of one Hanford reactor was begun in April.

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Weapons (Part III, separate document)

Thermonuclear program. Since the full-scale test of a thermonuclear device at Eniwetok in November 1952, the immediate and primary objective of the Commission's weapon program has been to achieve as soon as possible emergency capability in a deliverable thermonuclear weapon. Los Alamos Scientific Laboratory is engaged in a "crash" program to secure such a deliverable weapon through simultaneous development of three potential designs. Production of prototypes will parallel development so as to provide an emergency capability if one or more of the prototypes is proved by full-scale test to be successful. Each of the three is scheduled to be tested at Eniwetok early in 1954.

[redacted] DOE 6.1(a)

The full-scale weapon tests this spring in Nevada included 11 devices and were among the most important ever held, having provided data needed for further thermonuclear development and for a variety of fission weapon problems. (For detail, see Table 1, page 10, Part III.)

Stockpile. During 1952 the stockpile of nuclear assemblies grew rapidly because larger quantities of fissionable material became available and the inventory of material in the production pipeline was sharply reduced to augment weapon fabrication. (The growth of the stockpile over the last few years, its composition, and the rate of production, as measured by numbers, are shown in the charts on page 12.)

[redacted] DOE 6.1(a)

Production by DOD. A step has been taken toward DOD participation in the production of nonnuclear weapon components. The President in February 1953 approved the AEC-DOD recommendation that he direct the Commission to authorize the DOD to assume primary responsibility for the production of such nonnuclear components of gun-assembly-type weapons as may be agreed to by the two agencies. The Commission has granted this authorization for the artillery-fired projectile and for an advanced design of a gun-assembly bomb for subsurface detonation (p. 15, Part III).

Reactor Development (Part IV, pp. 39-50)

Emphasis in reactor development is concentrated on reactors for the propulsion of submarines and military aircraft and for the generation of electric power.

Submarine reactors. The land-based prototype of the Submarine Thermal Reactor is being tested by Westinghouse at the Reactor Testing Station in Idaho. The shipboard model will be tested in 1954 in dock trials of the USS NAUTILUS, under construction at Groton, Conn.

The land-based prototype of the Submarine Intermediate Reactor, developed by General Electric Co., is under construction at West Milton, N. Y. The shipboard model will be installed in the USS SEA WOLF, scheduled for completion in 1955.

Reactor designs for higher submerged speeds are being studied.

Aircraft reactors. Development work will continue on the three reactor types considered most promising for aircraft propulsion. Earlier plans for prompt construction of a direct-cycle, air-cooled prototype by General Electric have been deferred in favor of continued analysis and research. Emphasis will now be directed toward improved component systems for a direct-cycle plant, of which the most promising uses the drawn-wire fuel element. Work on liquid-fuel reactor systems, centered at Oak Ridge National Laboratory, will continue essentially as previously planned. Pratt and Whitney will continue work on a reactor system in which supercritical water serves as the moderator and coolant.

Reactors for civilian power. The policy statement on nuclear power development adopted by the National Security Council recognizes that early development of nuclear power by the United States is a prerequisite to maintaining our lead in the atomic field. The statement emphasizes the part industry should play in this achievement and recommends that steps be taken for legislation to expand the role of industry. The Commission has submitted draft legislation to the Bureau of the Budget for review by the executive agencies.

The Commission's earlier plans for constructing pilot models of the most promising reactor types for civilian power have been curtailed, and development during the coming year will consist mainly of exploratory laboratory work. Proposed construction of the Sodium-Graphite Reactor was deferred when the National Security Council approved use of available funds only for architect-engineer work.

The National Security Council adopted the recommendation of the Department of Defense that the previously existing program for a large ship reactor be eliminated, as not required from the viewpoint of national security. Subsequently, the Council adopted the Commission's recommendation that the reactor portion of the program be continued for the purpose of constructing a pressurized-light-water reactor for civilian power. Work in the coming year will be concentrated on the most difficult design problems, including the development of the pressure vessel, steam generator, and long-lived fuel elements.

Previously planned work on the fast-breeder reactor concept is being curtailed. Exploratory investigations will be continued by Argonne National Laboratory, including operation of the Experimental Breeder Reactor (EBR) at the Reactor Testing Station. Recent Argonne measurements confirm a net gain in fissionable material during operation of the EBR. The fast-breeder concept is necessarily a long-range approach to economic nuclear power because of inherent technical problems. The potential advantages of breeding, however, give special significance to this work.

Physical Research (Part V, pp. 51-56)

In physical research, scientists have further developed a new design principle which now promises to reduce the cost and increase the efficiency of particle accelerators. The result may be more powerful accelerators for Commission laboratories and a greater number of small accelerators for private research institutions. A number of universities have also expressed an interest in acquiring low-power research reactors. The first of these reactors will be placed in operation in July 1953 at North Carolina State College.

Biology and Medicine (Part VI, pp. 57-62)

An important part of the Commission's work in biology and medicine has been the monitoring of radioactive fall-out from recent weapons tests. Fall-out from the Eniwetok tests in November 1952 was very low outside the target area. The recent spring tests in Nevada produced greater fall-out than those of previous continental series. The highest possible radiation doses of gamma rays measured in eight communities in the Nevada-Utah area were above or nearly equal to the Commission's standard of 3.9 roentgens as a maximum dose for a 13-week period. (See pp. 57-58.) These calculations were based on the assumption of the most extreme exposure conditions; actual doses received by residents of the area were undoubtedly much less. Measured air and water concentrations of radioactivity were all within safe limits. The only unusual fall-out recorded in more distant parts of the nation occurred in the Troy-Albany, N. Y., area, where the dose over a 13-week period did not exceed 0.1 roentgen.

Since July 1952, the Commission has renewed 240 projects and granted 78 new contracts for research in biology and medicine in private institutions throughout the nation. In addition, a large amount of information on both the harmful and beneficial effects of radiation on humans, animals, and plants comes from the Commission's own installations. The newest of these, the Argonne Cancer Research Hospital in Chicago, is the largest facility ever built specifically for the application of atomic energy to the study, diagnosis, and treatment of cancer.

Technical Cooperation Program (Appendix A, pp. 65-71)

The Technical Cooperation Program is the principal medium for the mutual exchange of classified technical information and assistance between the United States, the United Kingdom, and Canada. In addition to providing the usual forms of mutual assistance, the Program has permitted close cooperation between United States and Canadian scientists in repairing the Chalk River NRX reactor, which was damaged by an accidental surge of power on December 12, 1952. Breakdown of the reactor has caused the postponement or cancellation of a number of irradiations of importance to the Commission's research and reactor development programs. [redacted]

DOE 6.1(a)