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THE AEC AND THE GRANTS MINERAL BELT

By

M. CLIFFORD SMITH, JR.

U.S. Atomic Energy Commission, Grand Junction, Colorado*

THE AEC AND THE DEVELOPMENT OF THE URANIUM INDUSTRY

With the passage of the Atomic Energy Act of 1946, the Congress of the United States placed the responsibility for the control and development of nuclear energy in a civilian agency, the Atomic Energy Commission. The atomic bomb, whose power was so awesomely demonstrated at Hiroshima and Nagasaki, had been developed in remarkable wartime secrecy by the Manhattan Project, a division of the Army. While recognizing the paramount importance of the new energy source to national defense, the Act enjoined the Commission to develop atomic power for the promotion of world peace, improvement of the general welfare, and strengthening of free competition in private enterprise. These objectives were retained in the revised Atomic Energy Act of 1954, which relaxed certain restrictions of the earlier act to permit easier participation in nuclear power development and international cooperation for peaceful purposes.

The most critical situation facing the Commission in 1946 was the pitifully small amount of atomic fuel available. It seems incredible now, but the bombs which ended the war with Japan were made possible only by the fortuitous presence on a Manhattan dock of 2500 tons of high grade uranium ore from the Belgian Congo.

The Webber report of Union Mines Development, compiled for the Manhattan Project, estimated the known and indicated minable uranium ore reserves of the United States in 1947 at less than 1,000,000 tons, containing about 2,000 tons of U_3O_8 . The total domestic mine production in fiscal year 1948, two years after establishment of the Commission, was only 54,000 tons of ore, from which the Commission obtained but 110 tons of U_3O_8 . The responsibility for alleviating this condition was placed in the AEC's Division of Raw Materials, which had to be organized and staffed from scratch.

The first contract for purchase of U_3O_8 concentrate was executed with the Vanadium Corporation of America in May 1947 for its Naturita, Colorado plant. A few months later the second contract was signed with the U. S. Vanadium Co., a subsidiary of Union Carbide, for the Rifle mill. Both of these plants had been vanadium producers and the first deliveries to the AEC took place in late 1947. In view of the fact that all of the domestic uranium reserves known at the time were located in southwestern Colorado and southeastern Utah, the Colorado Raw Materials Office was established in December of 1947 at Grand Junction, Colorado.

In considering the most effective means of relieving the

critical shortage of U_3O_8 , the AEC early decided to leave the mining and processing of uranium ores almost entirely to private enterprise, the wisdom of which was later to be amply demonstrated. The basic requirement for this purpose was to provide a market for ores and concentrates at prices which would encourage the prospector, miner, and miller to put in the tremendous effort and investment needed to build up the industry. To this end, the AEC issued a number of offers for uranium ores culminating in the well-known Domestic Uranium Program Circular 5, Revised, of March, 1951, which has remained the basic ore buying schedule to this day. Aside from the Government-owned mill at Monticello, Utah, which was shut down in late 1959, all processing plants were built by private operators under negotiated contracts with the Commission.

In addition to the fundamental requirement of a market, the AEC instituted a large number of other incentives and stimulants to uranium production. Approximately \$17,000,000 was paid out, chiefly to small miners, as a bonus for initial and certain other production of uranium ores.

Between 1948 and 1956, over 5.5 million feet of drilling was done by the USGS and the AEC and extensive geological studies were made and published. Over 1,200 miles of access roads were built and improved in Arizona, Colorado, New Mexico, South Dakota, Utah, and Wyoming at a cost of \$17,000,000. Sixteen ore buying stations were established in promising districts, before mills were built, and were operated for the AEC by its contractors, principally the American Smelting and Refining Co. and Lucius Pitkin. Forty nine leases were issued to private firms and individuals between 1949 and 1954 on withdrawn lands.

Many other assisting programs were carried out such as airborne reconnaissance and posting of anomalies, development of geophysical instruments and techniques, improvement of ore sampling practices, and free examination and assay of radioactive minerals for prospectors.

Less known than the help given to prospectors and miners was the extensive research performed and initiated by the Commission in the then primitive art of extracting uranium from its ores. Uranium extractive metallurgy in 1947 was confined to a crude separation of yellow cake, primarily as a byproduct, from the vanadate ores of the Uravan Mineral Belt. Recoveries were poor and costs were high. With American Cyanamide and National Lead as the principal contractors, the AEC established the Raw Materials Development Laboratory at Winchester, Massachusetts and, in 1953, the pilot plant at Grand Junction.

Numerous research contracts were concluded with

* Publication authorized by the Atomic Energy Commission.

universities, companies, and such organizations as the Bureau of Mines, the Battelle Memorial Institute, and the Oak Ridge National Laboratory. Approximately \$27,000,000 was spent in this work but the improvement to uranium ore processing was tremendous.

The results of all this were successful beyond the fondest hopes and are a credit to the energy and competence of the American mining industry. Between 1948 and 1961, uranium ore production soared from 54,000 to 8,000,000 tons, concentrate production from 110 to 17,600 tons, and minable reserves from less than 1,000,000 to over 74,000,000 tons. From the carnotite rim deposits of the Uruan Mineral Belt and adjoining Utah areas, uranium discoveries spread to the Black Hills, Big Indian Wash, the Jackpile and Ambrosia Lake, the Gas Hills and Shirley Basin, the Colorado Front Range, the Texas Gulf Coast, and even to the Spokane Indian Reservation and Prince of Wales Island in Alaska.

By 1956 it was becoming evident that the AEC might be faced with an embarrassment of riches. In October, 1957, the AEC announced that it was "no longer in the interest of the Government to expand the production of uranium concentrate" and on November 24, 1958, modified the procurement program by limiting concentrate purchases in the 1962-1966 period to those derived from reserves developed prior to that date.

However, the Commission became increasingly concerned with the necessity of maintaining a viable uranium industry during the period following expiration of the procurement program in 1966, and up to the time a significant private market for nuclear power fuel might develop. Consequently, a stretchout program was announced on November 17, 1962 whereby mill operators could defer delivery of part of the concentrates contracted for purchase by the AEC in the 1963-1966 period until 1967 and 1968. In return, the AEC offered to purchase during 1969 and 1970 a quantity of U_3O_8 equal to the amount deferred, thus providing the industry with an assured, albeit reduced, market for four more years.

At the time the stretchout program was offered, it was estimated that a sizable private market for U_3O_8 would not develop much before 1975. However, the spectacular success of power reactor technology in lowering delivered power costs has accelerated the utility industry's trend to nuclear power plant construction, and consequently the estimates of nuclear fuel requirements are constantly being revised upwards and earlier. It now appears that, far from facing a few lean years, the uranium industry will have to make an unprecedented effort to meet future needs for raw materials.

In retrospect, the AEC's primary function during the first decade of its existence, from 1947 to 1957, might be described as creating and stimulating with every possible means the production of a new element from the earth's crust. The second decade, from 1957 to 1967, was one of restraining the snowballing growth of the new industry while keeping it in a healthy condition for the needs of the future. The third decade begins with the expectation

that the industry faces a new and greater expansion if man's ever-increasing needs for energy are to be satisfied.

THE AEC AT GRANTS

Who first recognized the presence of uranium in what was to become the world's most productive district is unrecorded, but for practical purposes the story starts with the discovery of tyuyamunite near the base of Haystack Butte by a Navajo Indian, Paddy Martinez, in the spring of 1950. A few years before, his find would have elicited nothing but idle curiosity, but the uranium rush had started and the land on which the discovery was made belonged to the Santa Fe Railway Co. Exploration work was started that summer by the Santa Fe, and by fall most of the open Todilto Limestone bench around Haystack Butte had been staked by local individuals. The first major mining company, the Anaconda Copper Mining Company—later called simply—"The Anaconda Company," set up an office in Grants in January of 1951, leased extensive tracts, and started trenching and wagon drilling on the Todilto bench east of the San Mateo road.

News of the new discovery was of particular interest to the AEC's Colorado Raw Materials Office at Grand Junction; first, because of its location outside of the known productive districts of the Colorado Plateau, and second, because it was the first known occurrence of commercial uranium ore in limestone. AEC and USGS geologists examined the occurrences in November of 1950 and the first AEC office was established in the railway station at Prewitt in January, 1951, staffed by two geologists of the Denver Exploration Branch. In view of the almost complete lack of local geological information on the area, early efforts were directed to geologic mapping and detailed stratigraphic studies of the ore-bearing region. The first report incorporating the results of this work, "The Jurassic Rocks of the Zuni Uplift," was published in March, 1952.

During the same period, ore occurrences were evaluated, geologic advice was given to prospectors and miners, and free examination and assay of radioactive samples was offered.

In August, 1951, a Supai Indian brought some ore samples to the office that came from the Lucero Uplift in the Laguna Indian Reservation, and field examination disclosed uranium mineralization. The locality was approximately 25 miles east of the previously known occurrences. An agreement for prospecting and leasing was concluded shortly after between the Laguna Tribal Council and Anaconda, and in November, 1951 the outcrop of the famed Jackpile deposit was found by ground checking of an airborne radiometric anomaly.

Probably the AEC's greatest contribution to the early development of the Grants district was the establishment of an ore buying station. Most of the known ore showings in 1951 were owned by individuals or small companies and income from sale of ore was vital to the development of their properties. At the time there was no market for the Todilto limestone ores and the newly discovered sandstone deposits faced a haul of 250 miles to Monticello, Utah.

In December, 1951, the AEC signed a contract with Anaconda for the construction of a mill at Bluewater to treat Todilto limestone ores with a carbonate leach. As an addendum to the contract, Anaconda's sampling plant, the first mill unit to be built, was utilized by AEC as an ore buying station, and a buying schedule was announced in June, 1952. In addition to the customary provisions for carnotite-type ores to be purchased under Domestic Uranium Program Circular 5, Revised, the schedule announced that limestone gangue ores would be purchased without penalty for lime content. Anaconda operated the station as AEC contractor.

The bulk of the early ore reserves at Grants were in the Todilto Limestone. The original Anaconda mill was designed primarily for these ores and the mill feed was predicted chiefly on the developed Haystack Butte deposits of the Santa Fe Pacific Railway Co. in sec. 19, T. 13 N., R. 10 W. However, it was natural that the Morrison Formation would be investigated in view of its reputation as the host rock for the Colorado Plateau deposits. In early 1951 the first sandstone discovery was made in the Morrison Formation in Poison Canyon in sec. 19, T. 13 N., R. 9 W. The Blue Peak deposit, to the west, was found shortly after and developed into the first underground mine in the Grants district. As more Morrison discoveries were made and realization of the size of the Jackpile deposit developed from Anaconda's drilling, the relative importance of the limestone ores began to diminish.

As the Grants district developed, the Exploration Branch of the AEC expanded its geologic studies to encompass the entire northern flank of the Zuni Uplift from northeast of Gallup to west of Mt. Taylor. Trailer camps were set up to facilitate the field work, the last and most permanent being at Smith Lake. In 1953, two access roads were built under the AEC program, the first being six miles from the Bluewater mill east to the San Mateo road and the second seven miles northeast from U.S. 66 near Laguna to the vicinity of the Jackpile deposit. In the same year, an office was established in downtown Grants for a representative of the Mining Division to maintain liaison with mining operators and give as much assistance to the burgeoning industry as possible.

The Grants office became the most permanent AEC installation in the Grants district, one representative having a continuous record of service from 1954 to the present. In the meantime, the increasing development of sandstone ore reserves resulted in the execution of contracts between the AEC and Anaconda for the addition of an acid circuit to the Bluewater mill and a major increase in capacity, both in 1954.

In April, 1955, an independent wildcatter, Louis Lothman, drilled two holes in the Mancos shale about six miles northeast of the Dakota rim and the known deposits of the Poison Canyon trend. Location of the holes in sec. 11, T. 14 N., R. 10 W was reportedly influenced by the shallow depth to the Morrison as revealed in an oil test near the crest of Ambrosia Lake dome. The second hole struck ore in the Westwater Canyon member of the Morrison at about 300 feet and the great Ambrosia Lake trend

was discovered. The first major underground mine in the Grants district, the Stella Dysart #1, was developed on the site of the discovery.

Within a year over 50 drilling rigs were operating in the Ambrosia Lake area and the tremendous scope of the deposits was being realized. The AEC's truck-mounted logging units were swamped with requests to log drill holes and the engineers and geologists calculating ore reserves were flooded with data. State Highway 53, the old San Mateo road, was improved and the nine-mile branch to Ambrosia Lake was built under the AEC's access road program. In 1956, the Commission contractor, Lucius Pitkin, built a new ore buying station near the junction of the San Mateo road and U. S. 66 which began receiving ore in July.

The AEC executed a contract in December, 1956 with Homestake-New Mexico Partners for the first processing plant to treat Ambrosia Lake ores and the second plant in the Grants district. In 1957, three additional mills were authorized, one for Homestake-Sapin Partners adjoining the Homestake-New Mexico Partners site, one for Phillips Petroleum, and one with Kermac Nuclear Fuels which has the largest capacity in the United States.

The discoveries at Ambrosia Lake, together with those in the Gas Hills of Wyoming, filled the cup of domestic raw materials to overflowing, at least so far as requirements at the time were concerned. The growth of the uranium industry, particularly at Grants, had developed to a point where many incentives or stimuli were no longer needed. Government exploration was terminated in 1956 and in the following two years most of the lands withdrawn by the AEC for this purpose were restored to the public domain. The access road program was terminated in 1957 and the Grants ore buying station was shut down in the fall of 1958.

In January, 1958 the Grand Junction Operations Office had been reorganized to reflect the retrenchment of procurement activities. The Exploration and Mining Divisions were combined into a Production Evaluation Division and the Grants office became a Field Branch of the Division. The consolidated Branch was moved to larger quarters at the present location in Milan during the summer of 1958.

Although the AEC was no longer interested in increasing the production of uranium, the industry continued to grow for some time because of pre-existing commitments obligatory on the AEC. The peak of both uranium ore and concentrate production occurred in 1961, of which the Grants district contributed the lion's share.

The AEC in 1961 modified the contract with Homestake-Sapin Partners to replace the prior contracts with Sapin and Homestake-New Mexico Partners, and the latter mill was shut down in April, 1962. The Phillips mill was closed in March, 1963 after transfer of its contract to United Nuclear. United Nuclear ores were subsequently tolled through the Homestake-Sapin plant. All of the remaining mills in the Grants area executed stretch-out contracts with the Commission, thus assuring a government market through 1970.

Now, in mid-1967, the pendulum of uranium demand is again changing direction and the function of the AEC is changing with it. The size and complexity attained by the industry, particularly as affected by the inevitable new growth, require a greater effort than before on the part of the Commission to keep abreast of developments and, figuratively speaking, its finger on the industry's pulse.

The continuing determination of mine and mill productive capability and of uranium ore reserves is vital to any planning for nuclear power and will need the full cooperation of the industry from whom the basic data must come. A recent reorganization of the Grand Junction and Grants offices is designed to aid these objectives in addition to placing new emphasis on the exploration and development of potential uranium bearing areas. As the only comprehensive source of information on the uranium industry, deposits, and technology, the AEC must con-

tinue to supply the answers for nuclear development as well as assist the industry to meet the greater goals of the future.

The immediate factor that is stimulating the rejuvenation of the Grants district, along with the rest of the uranium producing areas, is the rapid rise in estimates of fuel requirements for nuclear power plants. The Grants mills have already contracted the sale of substantial amounts of U_3O_8 concentrates through commercial channels, aside from their continuing sales to the AEC, and this outlet is expected to grow as demand increases.

Exploration and development drilling, a good yardstick of the industry's future plans, is rising rapidly and land acquisition activity is reaching a high level. This healthy condition of the uranium industry is very gratifying to the AEC and is reassuring evidence that the infant was not nourished to maturity in vain.