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GRAND JUNCTION OFFICE

SUMMARY AND CHRONOLOGY

OF

THE DOMESTIC URANIUM PROGRAM

by

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SUMMARY

THE DOMESTIC URANIUM PROGRAM

1946-1966

The New Power.....1

Need For Raw Materials.....l

The Search Begins.....2

The Measure of Success.....3

The Incentives.....4

Additional Stimulants.....7

Ore-Buying Stations.....7

AEC Exploration Program.....8

Access Roads.....12

Concentrate Procurement Contracts.....13

Program Changes.....17

Uranium Producing Areas.....21

Vanadium.....23

Research and Process Development.....26

Sampling and Assaying.....28

Table I--AEC U306 Purchases.....33

(Note:--This. historical summary of the domestic raw materials program prepared by Neilsen B. O'Rear, Public Information Officer, Grand Junction Office,USAEC. Final draft completed in August, 1966, after thorough review by GJO technical and administrative staff).

SUMMARY

THE DOMESTIC URANIUM PROGRAM

1946-1966

The New Power

Man first initiated a self-sustaining nuclear reaction and controlled it on December 2, 1942. Beneath the west stands of Stagg Field in Chicago, Enrico Fermi and a small group of scientists witnessed the event and ushered in a new era of science.

The power of the atom had been unleashed. It was to result first in new weapons of war, and later, in a host of peacetime servants of mankind, such as the generation of electric power, diagnosis and treatment of disease, use of radioisotopes in agriculture and industry, and many others.

Since the United States was involved in World War II in 1942, early efforts in the nuclear energy field naturally were directed toward the development of weapons. It was not until four years later that Congress passed the Atomic Energy Act of 1946 and the Nation's leaders could take a long look at the new power and plan for its development and use.

Need For Raw Materials

The newly-created Atomic Energy Commission immediately recognized the need for a domestic source of raw materials, and inaugurated a nationwide program for the discovery and acquisition of uranium ores and concentrates. Meantime, to take care of immediate needs, the Government contracted to buy uranium ores and concentrates from the Belgian Congo and other foreign countries where the material was more readily available.

Uranium-vanadium bearing ores were first discovered in the Uravan Mineral Belt of Colorado and Utah in 1881. Some high-grade ores were mined for their radium content in the years 1898-1923. The same ores were mined in 1936-1944 for their vanadium. The uranium in the ore went into the tailings piles. In the early days of the Manhattan Project, some of these tailings were reprocessed to obtain the uranium values.

Nevertheless, in 1946, the known minable reserves of uranium in the United States amounted to only one million tons of ore containing about 2,500 tons of U_3O_8. This was considered a trifling amount in the light of future estimated needs of the Nation.

Since the bulk of this one million tons of ore was known to be in the Uravan Mineral Belt of western Colorado and eastern Utah, it was logical that the Government would launch it's search in this geographical area.

In early 1947 the Commission, through it's Raw Materials Division, executed the first uranium concentrate procurement contract with Vanadium Corporation of America for a processing mill at Naturita, Colorado. Later that same year, another contract was signed with U. S. Vanadium (later Union Carbide) for a mill at Rifle, Colorado. Both of these plants were vanadium mills which were converted to uranium production.

The Search Begins

Then, in December of 1947, the AEC established the Colorado Raw Materials Office at Grand Junction, Colorado, in the western part of the State and near the Uravan Mineral Belt. This office was to spearhead the ore and concentrate procurement programs. An exploration branch also was established

at Grand Junction, operating at that time under the New York Operations Office but later integrated with other Grand Junction activities to become the Grand Junction Operations Office.

Staffing of the Grand Junction office with geologists, mining engineers, mineralogists, administrators and others began, and by the Spring of 1948 this organization launched a search for domestic uranium that was to prove successful far beyond the most optimistic dreams.

Before outlining the methods employed by the AEC in sparking this uranium discovery and production cycle which was carried to fruition by a combination of Government and private industry in less than a decade, take a look at some figures which indicate the full measure of success.

The Measure of Success

1. Minable reserves of uranium ore in the western United States climbed from the estimated one million tons in 1948 to 89,000,000 tons in 1959.

2. The annual mining rate of uranium ore in the West started with 54,000 tons in 1948, jumped to $4\frac{1}{2}$ million tons by 1958, and reached the peak of 8 million tons in 1961.

3. In 1948, the AEC bought 110 tons of (U_3O_8) domestic uranium concentrates for which it paid 19 million dollars. In 1954, the AEC bought 1,450 tons for 105 million dollars. Production continued to climb to the peak year of 1961, when AEC purchased 17,671 tons of U_3O_8 at a cost of 299 million dollars.

4. A steady decline in the price per pound the Government paid for uranium over the years also attests to rapid advances in uranium metallurgy and the overall success of the program. In the early 1950s the average cost ran as high as $12.51 per pound of U_3O_8, but it declined rapidly after that time. In 1958 it was $9.57; in 1960, $8.75; and in 1961--the peak year--it was $8.47. All concentrates bought in 1962-1966 were pegged at $8 per pound of contained U_3O_8, and this was extended under the stretch-out program through 1967 and 1968. It is estimated that U_3O_8 in concentrates bought in 1969 and 1970 will cost about $5.50 to $6 a pound.

5. In 1952, there were only six uranium processing mills in operation, including five privately-owned mills and one Government-owned mill. In late 1961, a total of 27 privately-owned mills were processing about 22,000 tons of uranium ore a day. Each of these mills had a unit price contract with AEC, individually negotiated at the Grand Junction office.

6. As early as October of 1957, the Commission gave notice to the public and the industry that "it is no longer in the interest of the Government to expand the production of uranium concentrate". This was followed by a formal announcement on November 24, 1958, to the effect that U_3O_8 purchased in the 1962-1966 period would have to be derived from ore reserves developed prior to November 24, 1958. Existing contractual commitments caused the AEC purchases to continue to increase up to 1961, after which they declined.

The Incentives

On April 8, 1948, the Commission approved a broad plan for expanding uranium production in the Colorado Plateau region, including the acquisition

and operation of a Government-owned processing mill at Monticello, Utah. Immediately thereafter, the AEC promulgated a series of Domestic Uranium Program Circulars establishing wide-ranging financial incentives for the discovery and production of uranium. Several of these Circular were revised and extended from time to time, and the last one--covering guaranteed ore prices among other things--terminated on March 31, 1962.

Circular 1 (April 11, 1948) guaranteed for 10 years a minimum price for certain high grade uranium ores.

Circular 2 (April 11, 1948) offered a bonus of $10,000 for delivery of 20 short tons of uranium-bearing ores or mechanical concentrates assaying 20 percent or more U_3O_8 from any single mining location, lode, or placer which had not been previously worked for uranium. (It was collected once).

Circular 3 (April 11, 1948) provided for minimum prices, specifications and conditions under which AEC would purchase carnotite and roscoelite type ores at Monticello, Utah. It also established payment of 31 cents a pound for the vanadium content (V_2O_5) of the ores.

Circular 4 (June 1, 1948) provided for payment of haulage and development allowances for uranium ore producers.

Circular 5 (February 1, 1949) consolidated Circulars 3 and 4, increased the price of U_3O_8 in ore, established premium prices for higher grade ore, and contained other provisions. This Circular was revised and broadened again on March 1, 1951.

Circular 6 (June 29, 1951) offered bonus payments for initial and certain other production of uranium ores to assist in the development of new sources. (Approximately $17,000,000 was paid out in the bonus program over the years).

Circular 7 (February 9, 1954) provided for the issuances of leases by the AEC to make available for uranium mining purposes lands which were not otherwise open to location by reason of Federal mining leasing laws. Public Law 250 of August 12, 1953, and Public Law 585 of August 13, 1954, eliminated the requirement for this Circular by opening such lands to mining location. Circular 7 was terminated December 12, 1954, without prejudice to the rights of leaseholders established under their Circular 7 leases.

Circular 8 (July 13, 1956) set forth regulations covering the issuance of leases for mining deposits of uranium in public lands withdrawn from entry and location under the general mining laws for the use of the Commission and in certain other lands under Commission control.

Circular 9 (March 4, 1957):--Section 67 of the Atomic Energy Act of 1954 authorized the AEC, to the extent it deemed necessary, to issue leases or permits for prospecting for, exploration for, mining of, or removal of deposits of source material in certain lands belonging to the United States. Circular 9 provided for the issuance by AEC of uranium prospecting permits and mining leases covering lands not open to the location of mining claims and which are not subject to lease by the Federal agencies administering such lands or by the Department of the Interior.

The foregoing circulars constituted the basic procedures and regulations upon which the Commission's domestic uranium procurement program has been administered.

Additional Stimulants

As the newly-promulgated Circulars were being studied and assimilated by prospectors, miners and mill operators prior to descending upon the Colorado Plateau en masse, the AEC in 1948 and 1949 was starting several other major projects designed to stimulate the discovery and production of uranium. Some of these projects continued for several years, and all played major roles in the ultimate success of the Government-industry effort. They were guided and directed out of the Grand Junction office under the supervision of the Division of Raw Materials at Headquarters. Brief descriptions of some of them follow.

Ore Buying Stations

Obviously, the first thing to do was to provide a place where a uranium miner could sell his ore after he had found it and dug it out of the ground. The first Government-operated buying station was set up at Monticello, Utah, under the terms of Circulars 3 and 5, and it was buying ore prior to the start of operations of the AEC processing mill in late 1949. It was also the last Government station to close---on March 31, 1962, with the expiration of Circular 5, Revised.

During the next several years the AEC established ore-buying stations in the new uranium producing areas where it appeared that ore production from the area would be sufficient to support a mill. If and when a mill

was built to provide the necessary market for the ores, the AEC would withdraw and the stockpiles of ore accumulated by the AEC would be sold later to the mill for processing.

AEC ore-buying stations were established and operated for varying periods at the following places: Marysvale, White Canyon, Moab, and Monticello, all in Utah; Shiprock and Grants, New Mexico; Globe and Tuba City, Arizona; Riverton and Crooks Gap, in Wyoming; and at Edgemont, South Dakota. In addition, the Commission made arrangements for mill contractors and for the AEC ore-buying agent to purchase uranium ore at Bluewater and the Ambrosia Lake area in New Mexico; Salt Lake City and Mexican Hat, Utah; the Shirley Basin area in Wyoming; and in Karnes County, Texas. These arrangements were for limited periods of time, and usually while mills were under construction.

Government Exploration Program

Between 1948 and 1956, the Atomic Energy Commission pursued a broad program of exploration for uranium, beginning in the Colorado Plateau area and spreading northward to Wyoming, southward to the Grants, New Mexico, region, and to other parts of several western states. The AEC was assisted by the Geological Survey of the U. S. Department of the Interior, an agency that assigned more than a hundred geologists and other experts to work with AEC in searching for uranium deposits. For several years the USGS people had offices at the AEC compound in Grand Junction and worked with AEC geologists and mining engineers.

The concentrated exploration program included the withdrawal of thousands of acres of public domain land for exploration purposes; geological

studies of the area; physical exploration by means of drilling projects and examination of samples; development and use of gamma ray logging methods; airborne reconnaissance; establishment of exploration "camps" throughout the region to conduct the various programs; and the regular publication of reports and papers so the burgeoning industry would have quick access to the accumulated knowledge.

Drilling--In 1948-1956, the AEC and the USGS drilled a total of 5,575,000 feet of exploratory and development holes in the hunt for uranium in the western states. Commercial drillers under contract to AEC and USGS performed this service on the basis of competitive bids. As many as a dozen AEC and USGS drilling projects were under way at one time in the Plateau region. By the middle 1950s, private industry had picked up the ball and in one year drilled an estimated 9 million feet. The AEC terminated the Government drilling program in late 1956 when it was apparent there was no further need for it.

Withdrawn Lands and Mineral Leasing--An integral part of AEC's early exploration program (1949-1955) was the withdrawal of public domain lands for AEC prospecting, geologic studies, and drilling. This was to demonstrate that uranium could be found in areas where private industry was reluctant to enter at that time. The land was withdrawn to protect ore reserves developed at Government expense, and a system of mineral leasing was conducted between 1949 and 1962. Ore discovered on AEC-controlled land was leased to private firms for mining on a royalty payment basis. A total of 49 such leases were executed over the years, each one operating for varying lengths of time. Ore production from these leases totaled

$1\frac{1}{4}$ million tons which yielded 7,261,000 pounds of U_3O_8 and 40,824,000 pounds of vanadium. Royalties paid to the Government under the program totaled $5,890,391. Between 1949 and 1954, the AEC withdrew a total of about 500,000 acres of public domain land in several Western states for uranium exploration purposes. Where substantial ore bodies were found, the land was retained by AEC and mineral leases executed. If nothing was found, the land was promptly returned to the public domain. Hence, numerous separate withdrawals and restorations were made over the years. At the present time, the AEC retains control of about 32,000 acres of withdrawn land. Ore reserves on these lands in Colorado, Utah, and New Mexico are estimated at 914,000 tons of ore averaging 0.34 percent U_3O_8 and containing 6,300,000 pounds of U_3O_8. At $8 a pound, this is worth over $50,000,000.

Geologic Investigations--Between 1948 and 1958, AEC geologists and mining engineers made over 7,500 preliminary examinations of radioactive occurrences in 42 states and prepared brief reports on each. Some of these occurrences were later developed as paying ore bodies, while hundreds of others did not. In 1966, the AEC reproduced these preliminary reports on microfilm and donated complete sets to seventeen State mining and mineral agencies and universities where they were made available for public inspection. The reports also were placed on open file by the AEC in Washington, D.C., and Grand Junction, Colorado.

Airborne Surveys--The AEC's airborne reconnaissance program was started in 1949 by a contract with an oil company to perform a detailed survey over a small area by heliocopter. This was followed in 1951 by

another contract with the same company for operation of a fixed wing plane to be used in "rim flying." The method proved to be not only feasible but by far the best and cheapest method for prospecting the many hundreds of square miles of rugged and remote country throughout the West. In July, 1953, the AEC Airborne Section was formed and from then until September 1956, a total of 81,000 square miles of potentially favorable uranium territory was radiometrically scanned. To accomplish this, ten Piper Supercub airplanes were used, each equipped with a scintillation counter and manned by a pilot and a geologist-observer. Radiometric anomalies were posted once a month, at high noon on the 15th, at designated public places throughout the West. Crowds collected at these points to note the results and relay the information to associates in the field who would then attempt to be first to locate a claim on the ground. During the three years of the airborne program, the AEC posted 197 anomaly maps showing 1,140 anomalies covering areas in Arizona, Arkansas, California, Colorado, Montana, Nevada, New Mexico, South Dakota, Texas, Utah, and Wyoming. Duplicates of the posted maps were made available through commercial firms and the Government Printing Office. They are still available and the AEC gets requests for them occasionally. At the close of the airborne program, all of the AEC airplanes were sold or transferred to other agencies except one which now rests in the Smithsonian Institution in Washington, D.C.

Geophysical Research--As aids in the uranium exploration effort, AEC people developed many new and different techniques in the use of Geiger and scintillation counters at the electronics laboratory in Grand

Junction. Among these are quantitative methods for gamma-ray logging and interpretation, a differential face scanner for inplace assaying in mines and the gamma-only assay method to determine effective disequilibrium. These devices were being tested constantly in the field by AEC geologists and engineers. The AEC also provided industry with facilities for calibrating logging equipment. A jeep-mounted drill hole logging unit designed by AEC technicians in 1951 served as a prototype for logging equipment in wide use by the industry. Now a new generation of more sophisticated logging equipment, greatly influenced by AEC units and recently developed techniques, is now being calibrated and evaluated by geophysicists at the AEC Grand Junction Office.

Access Roads

In 1950 the uranium industry centered in the Colorado Plateau was still in its infancy. One of the major drawbacks was the inadequacy of roads in this remote canyon area. Arterial roads to processing facilities could not stand excessive ore hauling, gathering roads to mining areas were poorly constructed, dirt surfaced, and impassable in certain seasons. In new mining areas, there were no roads, or at best, a few primitive jeep trails.

The AEC felt obligated to help rectify this situation. The Bureau of Public Roads informed the AEC that under existing laws it could recommend and justify access road projects to uranium areas. Accordingly, in 1951 a plan was drawn up to investigate and recommend improvements on the most urgently needed roads. This was the beginning of an AEC access road program

which continued up through the middle of 1958 and opened up many major uranium-producing areas. The Bureau of Public Roads and various state agencies cooperated.

A summary of this program prepared in 1960 showed that a total of 1,253 miles of roads had been improved in Arizona, New Mexico, South Dakota, Wyoming, Colorado, and Utah. The total cost (in round figures) was $17,000,000, of which $14,000,000 came from the AEC, and slightly over $3,000,000 from Federal aid or state funds. The average cost per mile of improving the access roads was $13,620. The total number of projects was 90, and the type of improvement embraced everything from creating bulldozer trails to blacktop paving.

Concentrate Procurement Contracts

Finding uranium ore, opening Government ore-buying stations, and building access roads to remote mining areas were important but preliminary steps to the main objective of the AEC raw materials program--the acquisition of uranium concentrates, or "yellow cake", as it was popularly called.

Even before the Grand Junction Raw Materials office was established, the Commission in early 1947 signed the contracts with VCA for a mill at Naturita, Colorado and with U. S. Vanadium (later Union Carbide) for a mill at Rifle. In the years that followed, the number of privately-owned and operated uranium processing mills grew rapidly until in 1961 there were 27 mills operating.

All of the concentrate procurement contracts were negotiated unit price contracts under authority of the 1946 Atomic Energy Act and

supporting Commission regulations. They provided for the purchase by AEC of maximum quantities of U_3O_8 in acceptable concentrate, subject to program limitations. The contracts normally covered a period of five or more years, with provisions for amortization of plant costs.

In negotiating these unit price contracts, the Grand Junction Office applied the Commission's philosophy of "getting the most for the taxpayers dollar, while insuring the miller a fair return." The ultimate price to be paid for the U_3O_8 depended upon widely-varying factors, such as Circular 5 prices for ore, the type of processing applicable to a given ore, haulage distances, and many others.

Normal procedure in negotiating the early contracts was for the milling company to submit a detailed proposal which would meet the AEC requirements of an adequate ore supply, technical capability, and financial responsibility. After studying the proposal and at times making field investigations of the various factors involved, Grand Junction officials then would sit in conference with company officials and work out the details. Sometimes these negotiations would last for weeks and months before all acceptable conditions were agreed upon between the two parties, after which the contract would be executed with concurrence of the Raw Materials Division and the Commission.

In addition to the difficulties in negotiating these unit price contracts in the early 1950s, there was also the problem of finding companies or corporations with sufficient interest to build mills. Uranium ore production was exceeding mill capacity for a time. However, as more and more contracts were executed, it was not long before processing plant

capacity caught up with ore production. Evidence of the rapid growth of the industry follows.

The AEC rehabilitated the Monticello, Utah, mill which had been acquired from the War Assets Administration and had it in production in late 1949. Together with the Naturita and Rifle, Colorado, mills, this made a total of three mills in operation.

In 1949, the AEC signed contracts with VCA for a mill at Durango, Colorado, and a pilot plant mill at White Canyon, Utah, and with U. S. Vanadium for a mill at Uravan, Colorado. The White Canyon pilot mill operated about five years and produced about 128,000 pounds of U_3O_8.

In 1950 another contract was signed with Climax Uranium Company for a mill at Grand Junction, and in 1951 two contracts were signed--with Vitro for a mill at Salt Lake City, and with Anaconda for a mill at Bluewater, New Mexico.

There were no milling contracts in 1952, but one was executed in 1953 with Kerr-McGee Oil Industries, Inc., for a new mill at Shiprock, New Mexico. By 1954, a total of nine milling contracts had been signed (including the VCA White Canyon pilot mill). In addition, the Government-owned mill at Monticello, Utah, was operating. Several expansions of mills also were announced in 1954.

By virtue of new discoveries of uranium ore deposits in New Mexico, Wyoming, and other states, as well as expansions of known ore bodies in older areas, mill contracting took a big upswing from 1955 onward. Five contracts were executed in 1955; seven in 1956; and six in 1957. All of

these resulted in producing mills except two, which were cancelled later for various reasons at the request of the companies involved.

The 1955 contracts included Mines Development, Inc., mill at Edgemont, South Dakota; Uranium Reduction Company (later Atlas) mill at Moab, Utah; Rare Metals Corp., (later El Paso Natural Gas Co.) mill at Tuba City, Arizona; Trace Elements Corp. (later Union Carbide) mill at Maybell, Colorado; and Continental Uranium, mill at LaSal, Utah (mill never built).

The 1956 contracts were Atomic Fuel Extraction Corporation, mill at Bedrock, Colorado (never built); Texas-Zinc Minerals Co., mill at Mexican Hat, Utah; Dawn Mining Company mill at Ford, Washington; Lost Creek Oil & Uranium Company (later Western Nuclear, Inc.) mill at Jeffry City, Wyoming; Lucky Mc Uranium (later Utah Construction & Mining Company) mill in the Gas Hills area, Wyoming; Gunnison Mining Company mill at Gunnison, Colorado; and Homestake-New Mexico Partners mill at Grants, New Mexico. In the same year, AEC signed a contract with Union Carbide for a new mill to replace the old one at Rifle, Colorado.

The 1957 contracts were with Homestake-Sapin Partners, Phillips Petroleum and Kermac Nuclear Fuels for three new mills in the Ambrosia Lake area near Grants, New Mexico; Lakeview Mining Company for a mill at Lakeview, Oregon; Fremont Minerals (later Susquehanna-Western) for a mill at Riverton, Wyoming; and the Cotter Corporation, for a pilot mill at Canon City, Colorado. The Cotter pilot plant later was expanded to a full scale mill.

Two more Wyoming mill contracts were executed in 1959--Globe Mining Company (later Union Carbide) and Federal-Radorock-Gas Hills Partners. Two

contracts were signed in 1960--with Petrotomics Company for a mill in the Shirley Basin area of Wyoming, and with Susquehanna-Western for a mill in Karnes County, Texas. All of these contracts were based on ore reserves developed prior to November 24, 1958.

In summary, between 1947 and 1960, a total of 32 procurement contracts were executed, of which 28 led to the building of processing mills (including the White Canyon pilot mill) and two contracts (Continental and Atomic Fuel) were cancelled at the request of the companies. Meanwhile, the Government mill at Monticello operated for ten years in 1950-1960. Numerous revisions and extensions of the contracts were effected in the early and middle 1950s.

Program Changes

On May 24, 1956, the Commission announced a procurement program for the period 1962-1966, pointing out that although domestic uranium production had shown a remarkable expansion, a high rate of discovery was essential if substantial production were to be maintained after 1962. It was soon after this announcement that the big discoveries in Wyoming came into the picture, and the full potential of the Grants, New Mexico, are was being recognized.

Thus, 18 months later, in October of 1957, the AEC announced that "it was no longer in the interest of the Government to expand the production of uranium concentrate". Nevertheless, the AEC indicated it would fulfill existing commitments and contract for appropriate quantities of material through 1966.

In Wyoming, a system of allocations was completed prior to November 24, 1958, pursuant to the limited mill expansion authorized in April, 1958. In return for a market in pre-1962, producers agreed to post-1962 allocations based on November 1, 1957, ore reserves, although the expanded mill contracts were not signed until after November of 1958.

A formal announcement on November 24, 1958, (and publication in the Federal Register) gave notice of a modification of the procurement program. This in effect stated that all concentrates purchased by the AEC in 1962-1966 must be derived from ore reserves developed prior to November 24, 1958. This in the industry was known as "the cut-off date".

In the months that followed the November 24, 1958, announcement, a determination of eligible properties was made and an allocation system was established by AEC. Under this system, an eligible mining property was identified as a property having a market quota (allocation) established by AEC under the terms of the announcement. Allocations were based on ore reserves developed prior to November 24, 1958, or in certain areas, on the property's production history during the period of July 1, 1956, to June 30, 1960.

The AEC received requests for allocations for more than 2,500 uranium properties, but investigations of many of these showed no developed reserves. A total of 800 allocations were issued by AEC. In some cases owners applied for allocations on properties from which it was unlikely that the uranium could be mined at a profit. The AEC felt that it's obligation extended to any uranium actually mined from the property, whether the operation was profitable or not. Therefore, allocations were issued on properties on

which reserves had been developed before November 24, 1958, even though economic production might be doubtful. The allocation constituted an obligation to purchases only if the ore were actually produced from the property to which it was issued, and was not an unrestricted purchase offer.

Along with the determination of allocations under the November 24, 1958, announcement, a review was made of the situation of the small independent mining properties which indicated that many of them could not sustain an economic operation at the production levels imposed by the allocations. To assist this group of some 600 small properties, the AEC in June of 1962 issued an announcement which permitted mills to purchase, under AEC-approved contracts between the mill and mine operator, up to 20,000 pounds of U_3O_8 in ore annually from eligible small properties, subject to an overall group limitation of one million pounds per year. As part of the stretchout program announced November 17, 1962, the program for small mines which actually produced in the 1962-1966 period was extended through 1968 at $8 per pound, and a similar program was established for 1969-1970 at the $6.70 price for small mining properties not otherwise having a market.

Most of the procurement contracts were rewritten in accordance with the November 24, 1958, announcement and extended through 1966. Three or four contracts were to terminate earlier than 1966 for various reasons.

Both the assistance program for small producers described above and the stretch-out program announced on November 17, 1962, were designed to help bridge the gap between the end of the Government market in 1966 and

the expected development of a private market for uranium.

Under the stretch-out program, the mill operators were offered the option of deferring a portion of the U_3O_8 contracted for delivery to AEC in 1963-1966, and delivering it in 1967 and 1968. In return, the AEC would purchase in 1969 and 1970 an additional quantity of U_3O_8 equal to the amount deferred. The price to be paid for the deferred material in 1967 and 1968 would be $8 per pound--the same as in the 1962-66 contracts. The price to be paid in 1969 and 1970 would be based on a cost formula for the 1963-1968 period, subject to a maximum price of $6.70 per pound.

Uranium milling companies were invited to submit proposals covering the quantity of material they would be willing to defer for delivery after 1966. For the next three years the Grand Junction Office engaged in lengthy negotiations with the various companies in working out details for the stretch-out. Several firms elected not to participate in the program, but many others did.

Prior to the actual signing of the stretch-out contracts, several companies began to reduce their operations under letter agreements with AEC. Consequently, the total AEC purchases of U_3O_8 began to decline from 17,248 tons in Fiscal Year 1962 to 15,760 tons in 1963; 12,583 tons in 1964, 11,819 tons in 1965, and 10,109 in 1966.

The eleventh and final stretch-out contract modification was signed on November 26, 1965. Under these contracts--all extended through December 31, 1970--a total of approximately 15,300 tons of U_3O_8 was deferred from

1962-1966 for production and delivery in 1967 and 1968. As a result, AEC expects to purchase in 1969 and 1970 an additional 15,300 tons of U_3O_8 at a price estimated within the range of $5.50 to $6 per pound.

During the four years 1967 through 1970, the AEC estimates that it will purchase approximately 32,500 tons of U_3O_8 in concentrate from the milling contractors at a purchase price of about $450,000,000. Approximately 2,000 tons of this may come from small independent producers under the assistance program previously described.

The eleven companies participating in the stretch-out are: Vanadium Corporation of America, mill at Shiprock, New Mexico; The Anaconda Company, mill at Bluewater, New Mexico; Western Nuclear, Inc., mill in Fremont County, Wyoming; Utah Construction and Mining Co., mill in Fremont County, Wyoming; Kerr-McGee Corp., mill near Grants, New Mexico; Atlas Corporation, mill at Moab, Utah; Federal-Radorock-Gas Hills Partners, mill in Fremont County, Wyoming; Homestake-Sapin Partners, mill near Grants, New Mexico; United Nuclear Corporation, mill near Grants, New Mexico; and Union Carbide Corporation having two contracts, one for U_3O_8 production from the mill in Natrona County, Wyoming, and the other for production from the two mills at Uravan and Rifle, Colorado.

Uranium Producing Areas

From the Uravan Mineral Belt of Colorado and Utah in 1948, the production of uranium ores and concentrates spread in a decade to a dozen Western states and encompassed areas where few had ever expected to find uranium. When the ore reserve figures were added up in 1959, it was

evident that the major discoveries in New Mexico and Wyoming in the middle 1950s accounted for about 72 million of the 89 million tons of recoverable ores as estimated by the AEC.

Up until 1950, major production came from the Uravan area, the Monument Valley area on the Utah-Arizona state line, and the White Canyon area of southeastern Utah. No large mines were discovered in the Uravan area, but the collective output of numerous small mines increased steadily from 1948 to a peak in 1960. The famous Happy Jack mine, operated at first as a copper prospect and later a major uranium producer, is in the White Canyon district, along with many small mines which contributed substantially to production.

In New Mexico, interest first was focused on the uranium possibilities in the Todilto limestone by the much publicized discovery in 1950 by Paddy Martinez, the Navajo sheepherder. Production from these ores reached a peak in 1958 and declined sharply thereafter. The intensive prospecting and exploration which followed Paddy's find resulted in the discovery of the major Laguna and Ambrosia Lake districts in the Grants area. Production began in the Laguna district in 1953 (site of another famous mine, the Jackpile) and in the Ambrosia Lake area in 1956. Massive exploration programs were pursued by private indistry in both districts.

Meantime, in 1952, Charles Steen's discovery and opening of the Mi Vida mine in the Big Indian District south of Moab, Utah, sparked a rapid development of that area. Production started in 1953, followed by other important discoveries on the Lisbon Valley anticline between that time and 1957.

In Wyoming's Gas Hills district, the first discovery was made in 1953 by Neil McNiece, a Sunday prospector, who located the Lucky Mc mine. Many small near-surface deposits were staked in the 1953-54 land rush, but it was not until 1957 that exploration established the importance of the district, after which major production started. In the Crook's Gap area, the first discovery also was in 1953 by a gem dealer who found uranium while prospecting for jade. Some early drillings were disappointing and it was not until 1956-1957 that exploration by several companies established significant reserves. Peak production was reached in 1961. Although the presence of uranium was recognized in the Shirley Basin area as early as 1954, the first major discovery by Utah Construction & Mining Company did not come until 1957. Drilling by other companies established additional large reserves. Most of the mining in Wyoming is of the open-pit method.

Other areas which contributed to uranium production included the Front Range district of Colorado, site of the Schwartzwalder mine which was discovered in 1949 but not brought into production until 1956. In the Spokane area of Washington State, uranium was discovered in 1954 by Indians prospecting for tungsten. It was brought into production in 1956-57. In Texas, uranium was found in Karnes County in 1954-55, but because of the distance from markets, was not brought into production until 1960 when a small processing mill was built near Falls City.

Vanadium

As mentioned earlier in the summary, the known small deposits of domestic uranium-bearing ores in 1947-48 were the carnotite-type ores of the Colorado Plateau area, chiefly in the Uravan Mineral Belt. This type of

ore contained both uranium and vanadium, the latter being a strategic metal used primarily for alloying steel. For many years prior to the rise of the uranium industry, the carnotite-type ores had been mined for the vanadium values, with the uranium content being left in the mill tailings piles.

To encourage further the production of uranium and also to prevent possible fluctuations in the vanadium market from influencing uranium production, the AEC offered miners a price for the vanadium as well as the uranium content of the ores. Circular 3, promulgated on April 9, 1948, stated that the Government would pay 31 cents a pound for the vanadium content (V_2O_5) of ores delivered to the Commission at Monticello, Utah, and Durango, Colorado. This price would be paid up to but not exceeding 10 pounds of V_2O_5 for each pound of U_3O_8 in the ores. Vanadium payment provisions were extended into Circular 4 and finally into Circular 5, Revised, of March 1, 1951.

More significant as an incentive to uranium production, however, was the purchase by AEC of fused vanadium oxide (V_2O_5) from several mills in the Uravan area and production of V_2O_5 in the Government-owned mill at Monticello, Utah, between 1949 and 1959. Provisions for the purchase of this material were written into the 1947 contracts with VCA for the Naturita, Colorado, mill and with U. S. Vanadium (later Union Carbide) for the Rifle, Colorado, mill; in the 1949 contract with VCA for the Durango, Colorado, mill; and in the 1950 contract with Climax for the Grand Junction, Colorado, mill. Delivery of the vanadium to AEC

was optional with the miller. The Rifle, Uravan, and Naturita mills delivered V_2O_5 regularly for several years beginning in 1949. The Climax mill delivered smaller amounts in 1956-59, and the Monticello mill produced vanadium in 1951-56.

The price of $0.98475 per pound for V_2O_5 in fused vanadium oxide was paid by AEC under the terms of the uranium-vanadium procurement contracts. This figure was established by the AEC in the first mill contracts on the basis of various economic factors and considerations. This price of just under 99 cents a pound was below the then current market price of $1.20 a pound for vanadium oxide, and it also was equivalent to the price being paid by the Federal Bureau of Supply for vanadium for the permanent national stockpile in the post World War II period.

The uranium-vanadium milling contracts all provided that the AEC would limit its vanadium purchases to not more than 10 pounds of V_2O_5 for each one pound of U_3O_8 delivered by the miller in any six-months period.

In the decade 1949-1959, the Grand Junction Office of AEC purchased from privately-owned mills and produced at Monticello a total of 28,602,064 pounds of V_2O_5 in fused vanadium oxide, at a cost of $28,184,981.

Approximately 17,300,000 pounds of this material was transferred to General Services Administration between 1949 and 1956, and another 8,500,000 pounds was transferred to GSA in 1965. In 1960 and 1961, the AEC sold a total of about 2,800,000 pounds at two public sales. Lesser

amounts were donated to various state and Federal agencies and laboratories for research. Because of the recent strong market demand for vanadium, GSA has been able to sell a substantial portion of its stockpile at prices greater than the AEC purchase price.

Research and Process Development

The story of the growth of the domestic uranium industry---and especially of the rapid metallurgical advances---would not be complete without recognition of the AEC's process development program which included the operation of AEC ore-testing pilot plants at Grand Junction in 1953-1958. The pilot plants were in effect miniature processing plants (about 15 tons of ore a day capacity) where in these years approximately 30,000 tons of ore from 40 different uranium mines were tested. The first small pilot plant constructed at Grand Junction was for the express purpose of developing the resin-in-pulp process.

The large pilot plant erected in 1954 at a cost of about $2,000,000, was operated by the National Lead Company for AEC in conjunction with the Raw Materials Development Laboratory at Winchester, Mass. Fundamental research was performed at the Winchester laboratory, and the results applied to the Grand Junction pilot plant tests. The contribution of these two groups to the development of metallurgical processes in use today in uranium mills was enormous. Not only was the cost of processing the ore continuously reduced, but low-grade and refractory deposits of ore were rendered amenable through technological advances.

The pilot plant program was two-fold: (1) amenability testing of uranium ores from a wide variety of commercial deposits to obtain

metallurgical and cost data and (2) to develop and test new processes in pilot plants of sufficient size to permit accurate scale-up to commercial plants. The equipment could be rearranged and adjusted for any desired flowsheet. Actually, there were three separate pilot plants within the installation, operating 24 hours a day, seven days a week, for four years. Over 100 people were employed in this pilot plant at the peak of operations.

A typical pilot plant amenability test consisted of a six weeks to two months operation during which a 500-1000 ton representative sample of an ore body or mine was processed. Oftimes, representatives of companies owning the ore bodies were invited to be present and observe the tests. From the data obtained in these tests, it was possible to calculate costs and equipment sizes for commercial mills. In some cases where very extensive ore bodies indicated that more than one mill would be built, the ore was tested in two or more pilot plants to obtain complete metallurgical and cost data for comparing the economics of the various processes.

A major effort at the pilot plant in 1957 was the testing and development of a flow sheet for the recovery of uranium from the lignites of North and South Dakota. Nearly 2,000 tons of lignite were consumed in these tests and the results established the Dakota lignites as a reserve of uranium which could be exploited if economics warranted. (In the 1960s, at least three companies were mining and processing Dakota lignites for the uranium content.)

A broad program of research and process development was also carried on under contracts with numerous companies, universities and research organizations. This effort to improve the technology and economics of recovering uranium was terminated in 1958 after an expenditure of about $27,000,000---a cost amply justified by procurement savings to AEC and long-term benefits to the domestic industry. This is mentioned here as a matter of interest, although many of these contracts were administered from Headquarters rather than Grand Junction. One of the most important of these contracts was with the Bureau of Mines of the U. S. Department of the Interior for metallurgical research on uranium at the Bureau's experiment station at Salt Lake City, Utah. This work was carried on for several years and yielded significant results.

Sampling and Assaying

Closely related and contributing to the success of the AEC program was the development and use of accurate sampling and assaying procedures at the Grand Junction Office over the years. Concentrates produced by the mills were delivered in steel drums to Grand Junction where they were received, weighed, sampled, and assayed as the basis for payment to the mills under the terms of the contracts.

Starting with relatively crude hand sampling in 1947 when the first mill began shipping, the AEC and contractor technicians progressed to open auger, then to closed auger sampling methods, with falling stream sampling on certain concentrates. Basically, in the auger method, an electrically-operated drill or auger is run down into the open drum of concentrate in predetermined drilling positions, bringing up samples

for subsequent preparation and assaying. In the falling stream method, as applied to certain concentrates, the drum is hoisted to the top of the sampling unit and the contents allowed to flow down through sample cutters which take representative samples.

Between 1947 and early 1956, the sampling and assaying work at Grand Junction was performed under contract by the American Smelting and Refining Co. This company withdrew as of February 1, 1956, and the work was assumed by another contractor, Lucius Pitkin, Inc., a firm with headquarters in New York City.

In 1951 a new sampling plant and assay laboratory was built at Grand Junction as the flow of concentrates from the mills increased. These facilities were expanded again in 1956 when production continued to climb. All of the sampling and assaying was done at Grand Junction until 1960 when a portion was transferred to Mallinckrodt Chemical Works at Weldon Spring, Mo. In 1966, with scheduled closure of the Weldon Spring plant, all sampling and assaying was returned to Grand Junction.

The sampling and assaying of concentrates is a very precise procedure. Large sums of money exchange hands as a result of the accuracy of the work. The quality of the concentrate delivered to AEC is governed by a set of specifications included in each mill contract. These specifications were developed early in the program and have been subject to continuing review by AEC authorities. The specifications include a minimum of 75 percent of U_3O_8, and maximum limitations for some 15 impurities such as vanadium, molybdenum, chlorides, sulphate, etc.

A continuing program of evaluation and check sampling has been carried on at Grand Junction in conjunction with Mallinckrodt Chemical Works throughout the years. This encouraged the search for sampling refinements and assured that changes in characteristics of concentrates being received did not impair sampling accuracy. Consequently, analytical performance and precision, especially with respect to the U_3O_8 content of the concentrates, have improved over the years.

The National Bureau of Standards in Washington, D.C., served as the umpire laboratory for analytical work until early 1965, when it asked to withdraw. The AEC New Brunswick (N.J.) laboratory then took over the work upon agreement by the millers and AEC. In addition, the AEC in the early days advised commercial laboratories on analytical procedures and built up a program to qualify them for making acceptable umpire determinations of U_3O_8 in ore. At one time there were 12 laboratories on this list, but by 1965 the list had decreased to five. This was due primarily to the reduced volume of business available, which was caused by the high level of laboratory performance on the part of the ore buyers and the milling contractors, and the willingness of the ore sellers to accept these results.

As pointed out earlier, the U_3O_8 content of concentrates increased over the years to a figure far above the 75 percent U_3O_8 originally specified by AEC as an acceptable concentrate. For instance, in October, 1965, a total of 17 mills were producing concentrates that averaged 85 percent U_3O_8 while recovering on the average 95 percent of the U_3O_8 in nearly 12,000 tons of ore processed per day.

Epilog

This then concludes the sketch of the first two exciting decades of the domestic uranium industry, but is by no means the end of the story.

A spectacular upsurge in the construction and planning of nuclear power plants throughout the Nation in 1965 and early 1966, and the resulting concern over an adequate supply of raw materials to operate these plants in the 1970s and 1980s, has propelled uranium to the fore again.

A chart prepared by AEC in August, 1966, revealed that there were 15 nuclear power plants in operation, 8 under construction, and 20 in various stages of planning. Total reactor capacity of the 43 plants would be nearly 19,000,000 kilowatts.

Industry representatives and AEC officials in early 1966 indicated in public addresses and testimony before Congressional committees that there was a definite need to begin a new uranium exploration program. One AEC official stated:

"The nuclear power industry is developing rapidly. The capacity of plants announced to date (May, 1966) will result in nuclear capacity in 1970 of at least 10,000 MWe, six times estimated year-end 1966 capacity. If the industry is to supply domestic requirements, a uranium production capacity of 27,000 tons of U_3O_8 per year by 1980 is indicated. (AEC purchases in the peak year of 1961 were 17,671 tons of U_3O_8)....Therefore, the uranium mining industry has a growing market to serve and a major job of exploration, development, and the construction of mining and milling facilities to carry out."

Meantime, in late 1965 and early 1966, several of the uranium milling companies announced sales of large quantities of U_3O_8 to several foreign and domestic private companies for use in power plants. This is permitted under AEC regulations governing outside sales as long as the millers fulfill their contractual commitments to the Government of this country.

As a result of the foregoing developments, the Grand Junction Office of AEC reported in the opening months of 1966 a greatly revived interest in uranium exploration throughout the West. So many requests for technical information came from private industry that the Grand Junction Office started a series of technical workshops in April, 1966, where large groups could be briefed on uranium geology, exploration techniques, mining, milling, etc. By midsummer, several such workshops had been held and others were planned. Scores of industry representatives attended these briefings.

Simultaneously, the Grand Junction Office began to get letters from all over the country asking about the new "uranium boom". . . ."where can I go to prospect for uranium". . . . . "where can I sell it if I find it" . . . and similar questions.

So it appears that the domestic uranium industry---now well established and well financed---may be on the verge of a new era. It will surely rest on the solid foundation built in the two decades of 1946-1966 by those hardy pioneers in Government and industry.

The time element---how soon will a full private market develop---- is the governing factor.

TABLE I

AEC Domestic Uranium Concentrate Purchases, 1948-1966

Fiscal Year	Tons U_3O_8	Cost to AEC (dollars)	Average Price Per Lb. U_3O_8 (dollars)
1948	116	1,660,000	7.14
1949	115	1,960,000	8.53
1950	323	5,950,000	9.21
1951	639	12,800,000	10.01
1952	822	18,400,000	11.19
1953	984	24,200,000	12.30
1954	1,453	35,600,000	12.25
1955	2,142	53,600,000	12.51
1956	4,204	97,800,000	11.63
1957	7,578	159,600,000	10.53
1958	10,250	196,000,000	9.57
1959	15,160	280,500,000	9.25
1960	16,403	287,140,000	8.75
1961	17,671	299,340,000	8.47
1962	17,248	281,180,000	8.00
1963	15,760	246,210,000	8.00
1964	12,583	201,370,000	8.00
1965	11,819	181,100,000	8.00
1966	10,109	161,716,000	8.00
FY 48-66	145,379	2,546,126,000	8.76

CHRONOLOGY

Domestic Uranium Raw Materials Procurement Program

1947-1965

1947	
May 28	Concentrate purchase contract executed with Vanadium Corporation of America for Naturita, Colo., processing mill. Deliveries to AEC started late in 1947. First mill contract.
October 2	Concentrate purchase contract with U. S. Vanadium (later Union Carbide) for processing mill at Rifle, Colo. First deliveries to AEC in December, 1947.
December	Colorado Raw Materials office established in Grand Junction, Colorado, to inaugurate AEC procurement program.
1948	
April 8	Commission approves plan for expanding uranium production in Colorado Plateau region, including operation of a Government-owned processing mill at Monticello, Utah.
April 11	Domestic Uranium Program Circular 1 promulgated by AEC. Guaranteed for 10 years a minimum price for certain high grade uranium ores other than carnotite or roscoelite type ores. (Terminated April 11, 1958)
April 11	Domestic Uranium Program Circular 2 promulgated, offering a bonus of $10,000 for delivery of 20 short tons of uranium-bearing ores or mechanical concentrates assaying 20 percent or more U_3O_8 from any single mining location, lode, or placer, which had not previously been worked for uranium. Did not apply to carnotite or roscoelite type ores. Offer expired April 11, 1958. This bonus collected only once in 10 years.
April 11	Domestic Uranium Program Circular 3 promulgated. Provided minimum prices, specifications and conditions under which AEC would purchase carnotite and roscoelite type ores delivered at Monticello, Utah, buying station.
June 1	Domestic Uranium Program Circular 4 promulgated. Provided for payment of haulage and development allowances.

1948

July 1	54,000 tons of ore produced in western states in FY 1948; AEC purchased 110 tons of U_3O_8 in FY 1948 at cost of $1,700,000 an average price per pound, $7.14.
December 31	In Calendar Year 1948, U. S. Geological Survey drilled 130,000 feet of holes in AEC exploration program; estimate private industry drilled 80,000 feet.

1949

February 1	Domestic Uranium Program Circular 5 promulgated. Consolidated Circulars 3 and 4; increased price of U_3O_8 by fifty cents per pound, plus premium prices and other provisions.
February 17	Contract with Vanadium Corporation of America to purchase U_3O_8 from Durango, Colo., processing mill. (First deliveries to AEC in August, 1949).
April 13	Contract with U. S. Vanadium (later Union Carbide) to purchase concentrates from Uravan, Colo., mill.
May 17	Contract with VCA to purchase concentrates from mill at White Canyon, Utah. (Pilot Plant operation). This mill went into production in 1950 and shut down in 1953 after delivering more than 125,000 pounds of U_3O_8 to AEC.
July 1	89,000 tons of uranium ore produced in western states in FY 1949. Same period, AEC bought 120 tons of U_3O_8 at cost of $2,000,000; average cost per pound, $8.53.
July 10	AEC announces types of high-lime uranium-vanadium ores to be purchased at Monticello, Utah. (Differed from Circular 5).
August 23	AEC contracts with Galigher Company to renovate Monticello, Utah, mill (from War Assets Admn.) and operate to produce U_3O_8. Six months later the mill was producing concentrates.
December 31	In exploration program in CY 1949, AEC drilled 70,000 feet of holes and the USGS drilled 223,000 feet, for total Government drilling of 293,000 feet. Estimate private industry drilling at 120,000 feet.

1950

January	First concentrates produced by Government-owned processing mill at Monticello, Utah.
March	First concentrates received by AEC from Rifle, Colorado mill.

1950 March 12	Marysvale, Utah, AEC ore-buying station established and schedules given.
July 1	FY 1950 ore production, 230,000 tons. FY 1950 U_3O_8 purchased by AEC, 320 tons at cost of $5,800,000; average cost per pound, $8.92.
July 10	Concentrate purchase contract executed by AEC and Climax Uranium Company for mill at Grand Junction, Colo.
December 31	In exploration program in CY 1950, AEC drilled 156,000 feet of holes, USGS drilled 212,000 for Government, total of 368,000 feet. Estimate private drilling at 410,000 feet.
1951 March 1	Domestic Uranium Program Circular 5, Revised, promulgated. Extended Circular 5 to March 31, 1962, and increased the price payable for U_3O_8 in certain ores.
March 16	AEC restored 42 square miles in Colorado to public domain (through BLM) and withdrew another 86 square miles for exploration program.
March 29	AEC offers to buy copper-bearing uranium ores at Marysvale, Utah, and Monticello, Utah.
June 29	Domestic Uranium Program Circular 6 promulgated. Provided bonus payments for initial and certain other production of uranium ores to assist development of new sources. This known as "the bonus program".
June	AEC receives first concentrates from Climax Uranium mill at Grand Junction, Colo.
July 1	FY 1951 ore production, 290,000 tons. FY 1951 U_3O_8 purchased by AEC, 630 tons at cost of $12,800,000; average cost per pound, $10.01
August 22	AEC asked withdrawal of 66 square miles of public land in Grand County, Utah, for exploration program.
October 25	AEC executes contract with Vitro Corporation of America to buy concentrates from mill at Salt Lake City, Utah. (First U_3O_8 delivered to AEC later in 1951).
December 27	AEC and the Anaconda Company execute contract for concentrates to be produced at mill at Bluewater, New Mexico (Grants area).

1951

December 31	In CY 1951, AEC drilled 354,000 feet in exploration program, and USGS drilled 374,000 feet, for total Government drilling of 728,000 feet. Estimate private industry drilling at 700,000 feet.

1952

January 17	Shiprock, New Mexico, ore-buying station opened and buying schedule announced.
January 30	AEC announces over a quarter million dollars paid out in initial production bonus program in 1951. (First payments under Circular 6, promulgated June 29, 1951)
June 8	Grants, New Mexico, ore-buying station opened by AEC and buying schedules given.
July 1	In FY 1952, total of $607,232 paid by AEC in initial production bonus program.
July 1	FY 1952 ore production, 390,000 tons. FY 1952 AEC concentrate purchases: 830 tons at cost of $18,400,000, Average cost per pound, $11.19.
November 30	Grand Junction Operations Office established to consolidate AEC's exploration and procurement programs on the Colorado Plateau. Formerly known as Colorado Raw Materials Office. Operations Office status ranked it with major AEC field installations throughout U.S.
November 30	Edgemont, South Dakota, ore-buying station established by AEC and schedule published.
December 31	First report on access road program made by AEC, showing construction started on 428 miles of roads with total costs to be $1,782,802.
December	CY 1952, in exploration program AEC drilled 482,000 feet and USGS 580,000 feet, for Government total of 1,062,000 feet. Estimate private industry drilled 600,000 feet.

1953

January 11	AEC announces issuance of report on uranium sampling practices on Colorado Plateau prepared by Colorado School of Mines Research Foundation.

1953 April 12	AEC announces policy of posting results of airborne surveys of radioactivity on the 15th of each month in public places throughout the West. (This airborne program continued until 1956 when it was no longer necessary. AEC had as many as a dozen planes flying at one time.)
July 1	FY 1953 ore production, 610,000 tons. FY 1953 concentrates purchased by AEC: 990 tons at cost of $24,200,000, with average price per pound of $12.30.
August 17	AEC signs contract with Kerr-McGee Oil Industries, Inc., to buy concentrates from Shiprock, New Mexico, mill.
September	Anaconda mill at Bluewater, New Mexico, delivers first concentrate to AEC.
September 23	AEC announces extension of Circular 5, Revised, through March 31, 1962, and extension of Circular 6 (bonus) from February 24, 1954, to February 28, 1957.
November 17	AEC reports initial production bonus payments total 2½ million dollars since start March 1, 1951.
December 31	In CY 1953, AEC requested seven separate public land withdrawals for the exploration program.
December 31	In CY 1953, contracts let for 46.3 miles of roads to cost $419,299 in the AEC access road program.
December 31	In exploration program, AEC drilled 600,000 feet and USGS drilled 715,000 feet, for total Government drilling of 1,315,000 feet. Estimate private industry drilling at 2,700,000 feet.
1954 January 29	Domestic Uranium Program Circular 7 promulgated. Provided for AEC to issue mining leases on certain public lands. Terminated on December 18, 1954, with passage of Public Law 585.
February 23	AEC announces bonus payments over $3 million since the beginning on March 1, 1951. Current rate of payments at $175,000 a month.
March 30	AEC announces ore-crushing and sampling plant to be built at Moab, Utah.

1954 May 5	Contract signed for expansion of Government-owned Monticello, Utah, processing mill to treat refractory ores.
May 9	Provisional ore-buying station established by AEC at Moab, Utah.
May 18	Contract signed for expansion of Anaconda's Bluewater, New Mexico, mill to treat sandstone gangue ores.
July 1	FY 1954 ore production, 914,000 tons FY 1954 concentrate purchases by AEC: 1,450 tons costing $35,600,000; average price per pound, $12.25.
July 7	AEC announces ore-buying station to open in White Canyon, Utah, in August, 1954.
July 20	AEC announces progress in construction of ore-testing pilot plant at Grand Junction Operations Office. This plant began operations in July, 1954 and ran continuously until June of 1958. Approximately 30,000 tons of ore from 40 different mines were tested in this plant.
September 15	Another expansion of Anaconda's Bluewater, New Mexico uranium processing plant announced.
October 12	AEC announces plans to establish ore-buying station at Riverton, Wyoming. (Opened for business March 1, 1955).
October 25	Expansion of Climax Uranium Company mill at Grand Junction announced.
October 29	Shiprock, New Mexico processing mill of Kerr-McGee Oil Industries goes into operation.
November 30	Capacity increased at Naturita, Colorado processing mill operated by Vanadium Corporation of America.
December 31	In CY 1954, approximately 133,000 acres in Colorado and Utah restored to public domain at request of AEC. Had been withdrawn in exploration program.
December 31	In CY 1954, in exploration program, AEC drilled 613,000 feet of holes and the USGS drilled 497,000 feet, for Government total of 1,110,000. Estimate private industry drilled 3,500,000 feet.
December 31	In access road program in CY 1954, projects on 72½ miles of roads started at total cost of $287,732.

1955 January	First concentrate received from Shiprock, New Mexico mill of Kerr-McGee.
March 1	Announce ore-buying station to open at Globe, Arizona. (Opened July 5, 1955).
March 5	Announce ore-buying station for Green River, Utah. (cancelled later).
March 30	AEC announces plans to make tests on uranium-bearing lignite, but no buying program at that time.
April 8	AEC announces bonus payments pass $5 million mark since start of program March 1, 1951. To date, 2,889 payments totaling $5,001,019. Rate of payments per month, $195,000.
April 29	Contract executed for purchase of concentrates from Edgemont, South Dakota, mill operated by Mines Development, Inc.
June 17	AEC executed contract with Uranium Reduction Company for Moab, Utah, processing mill. (Later acquired by Atlas Corporation).
July 1	FY 1955 ore production, 1,306,000 tons. FY 1955 concentrate purchases, 2,140 tons at cost of $53,600,000; average price per pound, $12.51.
July 15	Tuba City, Arizona, mill contract signed with Rare Metals Corp. (Later, El Paso Natural Gas Company).
August 6	Announce expansion of U. S. Vanadium (later Union Carbide) processing mill at Uravan.
August 10	Executed contract with Trace Elements Corp., for mill at Maybell, Colorado. (Later, Union Carbide).
November 29	Contract with Continental Uranium Inc., for mill at LaSal, Utah. (Never built and contract cancelled).
December 31	In CY 1955, AEC requested restoration of approximately 84,000 acres of public land in Wyoming, Colorado and Utah.
December 31	In CY 1955 exploration program, AEC drilled 316,000 feet of holes and USGS drilled 213,000, for Government total of 529,000 feet. Estimate of private drilling was 5,500,000 feet.
December 31	In CY 1955, access road projects totaling 110 miles and costing $1,874,184 started under AEC auspices.

1956

January 12	AEC to open ore-buying station at Tuba City, Arizona.
January 15	AEC to open ore-buying station at Grants, New Mexico. (Began receiving ore July 5, 1956).
March 27	National Lead Company gets contract to operate Government-owned processing mill at Monticello, Utah, succeeding the Galigher Company.
May 24	AEC announces uranium procurement program for 1962-1966 period and extends initial production bonus to March 31, 1960.
June 2	Contract with Atomic Fuel Extraction Corporation for mill at Bedrock, Colorado. (Mill never built and contract cancelled).
June 8	Contract with Union Carbide Nuclear Company, for new mill at Rifle, to replace old one.
June 23	Reorganization of Division of Raw Materials to include exploration with ore and concentrate procurement.
July 1	FY ore production, 2,185,000 tons. FY concentrate purchases, 4,200 tons at cost of $97,800,000. Average cost per pound, $11.63.
July 1	Bonus payments FY 1956 total $2,237,949.
July	First concentrate received from Tuba City, Arizona, Mill operated by El Paso.
July 13	Domestic Uranium Program Circular 8 effective. Leases for mining deposits on certain withdrawn public lands.
July 17	Contract with Texas-Zinc Minerals Company for processing mill at Mexican Hat, Utah.
August	First concentrates received from mill at Edgemont, So. Dakota, operated by Mines Development, Inc.
August 8	Contract executed with Dawn Mining Company for mill at Ford, Washington.
August 15	Contract executed with Western Nuclear, Inc., for mill in Fremont County, Wyoming.
August 16	AEC revises procedures for releasing airborne survey maps.
August 22	Domestic Uranium Program Circular 5, Revised, is modified to eliminate requirements for proof of development allowance funds.

1956	
October 18	New AEC-Vitro contract increases capacity of mill and extends contract from December, 1958, to March, 1962.
October 24	Moab, Utah, ore-buying station to go on standby basis November 1, 1956.
November	First concentrate from URC mill at Moab, Utah, received by AEC.
November 11	Contract with Trace Elements Corp., for Maybell Mill (supersedes contract executed in August, 1955). Union Carbide later bought out Trace Elements.
November 15	Contract executed for Gas Hills, Wyoming, processing mill with Lucky Mc Uranium (later Utah Construction and Mining Company).
November 16	Contract with Gunnison Mining Co., for processing mill at Gunnison, Colorado.
December 14	AEC announces plans for provisional ore-buying station at Crooks Gap, Wyoming.
December 20	AEC contract with Homestake-New Mexico Partners for processing mill at Grants, New Mexico.
December 31	In CY 1956, AEC initiated 8 separate actions to restore 148,000 acres to the public domain in Colorado, Utah and New Mexico.
December 31	In CY 1956, AEC drilled 14,000 feet and USGS drilled 26,000 feet in exploration program. Estimate private industry drilled 8,750,000 feet. (The final AEC drilling contract was let in 1956; private industry had taken over and there was no need for further Government drilling.)
December 31	In CY 1956, access road program saw start of work on 48 miles of roads at total cost of $599,381.
1957	
January 1	Globe, Arizona, AEC ore-buying station to close June 30, 1957.
February 5	Marysvale, Utah, AEC ore-buying station to close March 15, 1957.
March 4	Domestic Uranium Program Circular 9 promulgated. Deals with prospecting permits on certain lands.

1957

April 2	AEC requests restoral to public domain of about 95,000 acres in Colorado.
April 24	AEC signs contract with Homestake-Sapin Partners for mill at Grants, New Mexico.
May 3	AEC signs contract with Kermac Nuclear Fuels Corporation for processing mill at Grants, New Mexico.
May 23	AEC signs contract with Cotter Corporation to purchase concentrates from pilot plant at Canon City, Colorado.
July 1	FY 1957 ore production, 3,303,000 tons. FY 1957 AEC concentrate purchases, 7,580 tons at cost of $159,600,000;average cost per pound, $10.53.
July 1	Bonus payments by AEC in Fiscal year 1957 totaled $2,982,965.
July 15	AEC announces White Canyon, Utah, buying station to close July 31, 1957.
July 19	AEC announces discontinuance of ore buying at Crooks Gap, Wyoming.
August	First concentrates received by AEC from Western Nuclear, Inc., mill in Wyoming.
September	First concentrate received by AEC from Dawn Mining Co. mill at Ford, Washington.
September 17	AEC signs contract with Phillips Petroleum Company for processing mill at Grants, New Mexico.
October 28	Address by Director, Division of Raw Materials, before Atomic Industrial Forum in New York City in which it was stated that "We have arrived at the point where it is no longer in the interest of the Government to expand the production of uranium concentrate."
November	First concentrate received by AEC from Texas-Zinc mill at Mexican Hat, Utah.
November 18	AEC signs contract with Lakeview Mining Company for processing mill at Lakeview, Oregon.
December 4	AEC signs contract with Fremont Minerals (Later, Susquehanna-Western, Inc.) for a mill at Riverton, in Fremont County, Wyoming.

1957 December	First concentrate received by AEC from Maybell, Colo., processing mill owned by Union Carbide.
December 5	Reorganization of the Grand Junction Operations Office affecting units responsible for programs for the evaluation of source material resources, uranium ore procurement, mining incentives, and the acquisition and production of uranium concentrates.
December 31	CY 1957, there was no AEC or USGS exploratory drilling. It was estimated that private industry drilled 9,200,000 feet.
December 31	Access road program in CY 1957 saw projects begun on 30 miles of roads at total cost of $1,483,976.
1958 January 24	Riverton, Wyoming, AEC ore-buying station closed.
March	First concentrate received by AEC from Utah Construction & Mining Company mill in Wyoming.
April 2	AEC announces program modification to permit a limited expansion of the domestic uranium industry by providing a market for certain ore reserves developed prior to November 1, 1957.
April 24	AEC requests restoral to public domain of 21,440 acres in Utah.
April 28	Lisbon Uranium Company of Salt Lake City collects the $10,000 bonus under Circular 2 only two days before the circular expired on April 11.
May 8	AEC announces plan to permit private sales of uranium.
July 1	FY 1958 ore production, 4,416,000 tons. FY 1958 AEC concentrate purchases, 10,250 tons at cost of $196,000,000; average cost per pound, $9.57.
July 1	FY 1958 bonus payments total $2,040,118.
August	First concentrate received from Cotter pilot plant at Canon City, Colorado.
August	First concentrate received by AEC from Phillips Petroleum Company mill at Grants, New Mexico.
August 6	Texas-Zinc Minerals contract for Mexican Hat mill extended from March, 1962, to December 31, 1966.
September	AEC receives first concentrate from Homestake-Sapin mill at Grants New Mexico.

1959	January	First concentrate received from Susquehanna-Western mill at Riverton, Wyoming.
	February 27	AEC contract with Western Nuclear extended to December 31, 1966, and capacity of mill increased.
	April 10	AEC signs contract with Federal-Radorock-Gas Hills Partners for processing mill in Fremont County, Wyoming.
	May 1	AEC extends contract with Lucky Mc Uranium Corp., (later, Utah Construction & Mining) from July 1, 1959, to December 31, 1966.
	May 9	AEC announces Government-owned processing mill at Monticello, Utah, will be closed January 1, 1960.
	May 13	AEC signs contract with Globe Mining Co., (Later, Union Carbide) for new processing mill in Natrona County, Wyoming.
	May 14	Initial production bonus payments to March 31, 1959, total $14,327,200 on 1,015 certified properties under Circular 6.
	May 18	AEC requests ore reserve data by August 1, 1959, under terms of November 24, 1958, announcement. (Deadline later extended to October 1, 1959).
	July 1	FY 1959 uranium ore production, 6,117,000 tons. FY 1959, AEC bought 15,160 tons of U_3O_8 at cost of $280,500,000; average price per pound, $9.25.
	August 3	AEC contract with Uranium Reduction (later Atlas) amended and extended to December 31, 1966.
	November 24	AEC contract with Kerr-McGee (Shiprock Mill) extended to June 30, 1965.
	December 1	AEC estimates domestic recoverable uranium ore reserves at 88,900,000 tons.
	December 11	AEC contract with Anaconda Company for Bluewater, New Mexico, mill extended to December 31, 1966.

1959	December 17	Cotter concentrate purchase contract extended to March 1, 1960. (Pilot plant enlarged to full scale mill).
	December	First concentrate delivered to AEC from Federal Processing mill in Wyoming.
1960	January 1	Government-owned uranium processing mill at Monticello, Utah, is closed.
	February 1	First concentrate received by AEC from Globe mill in Natrona County, Wyoming.
	March 29	AEC contract with Phillips Petroleum Co., amended to provide for deferral of 1,000,000 pounds of U_3O_8 to the 1962-1966 period.
	March 31	Initial production bonus program (Circular 6) terminates. From beginning March 1, 1951, to date, total of approximately $17,700,000 paid on 1,281 certified properties.
	April 26	Dawn Mining Co. processing contract extended to December 31, 1966, from March 31, 1962.
	May 27	AEC sold 1,581,000 pounds of vanadium pentoxide to Vanadium Corporation of America for $1 per pound.
	July 1	In FY 1960, uranium ore production, 7,616,064 tons. In FY 1960, AEC bought 16,403 tons of U_3O_8 at cost of $287,140,064; average price per pound, $8.75.
	July 25	AEC signs U_3O_8 purchase contract with Susquehanna-Western, Inc., for mill at Falls City, Texas; runs to December 31, 1966.
	July 27	AEC-Homestake-Sapin contract extended from June 30, 1963, to December 31, 1966.
	August 12	AEC signs contract with Petrotomics Company to purchase concentrate from Shirley Basin (Wyo.) ores. (Mill built later by Petrotomics.)
	September 22	AEC-Climax contract amended and extended to December 31, 1966, from August 1, 1960.
	December 28	AEC-Kermac contract extended to December 31, 1966, from November 1, 1960.
	November	Lakeview Mining Co., processing mill at Lakeview, Oregon, closed. Assets acquired by Kermac.

1961	January 4	AEC-Susquehanna-Western contract for Riverton mill extended from June 1, 1960, to December 31, 1966.
	February 2	AEC sold 1,139,900 pounds of vanadium pentoxide to private industry firms for $1,152,756.
	February 13	AEC exempts uranium miners from source material license rules.
	February 21	Uravan-Mineral Belt policy statement issued. Established historic production rate as basis for allocations.
	March 21	AEC extends contract with Trace Elements (unit of Union Carbide) from March 31, 1962, to December 31, 1966.
	May 1	AEC-Union Carbide Corporation contract for Rifle and Uravan mills extended from March 31, 1962, to December 31, 1966.
	May 22	AEC-VCA contract for Durango mill extended from March 31, 1962, to December 31, 1966.
	June	First concentrate received by AEC from Susquehanna-Western mill at Falls City, Texas.
	July 1	FY 1961, uranium ore production 8,311,064 tons. (Peak year). FY 1961, AEC bought 17,671 tons of U_3O_8 at a cost of $299,340. (Peak Year). Average cost per pound, $8.47.
	August	Grand Junction Operations Office changed to Grand Junction Office.
	August 16	AEC-Kerr-McGee Shiprock mill contract extended from June 30, 1965, to December 31, 1966.
	November 9	Homestake-Sapin Partners concentrate contract extended from September 1, 1961, to December 31, 1966. Concurrently, Homestake-Sapin acquired the assets of Homestake-New Mexico Partners.
1962	March 14	AEC announces Monticello, Utah, ore-buying station to close March 31, 1962.
	March 19	AEC-Mines Development contract for Edgemont mill extended from September 1, 1961, to December 31, 1966.
	March 31	Termination of Domestic Uranium Program Circular 5, Revised, which provided for minimum ore prices, premium prices, haulage and development allowances, etc.

1962	April	AEC receives first concentrates from Petrotomics Company mill in Wyoming's Shirley Basin area.
	April	Gunnison Mining Company, mill at Gunnison, Colorado, closed and assets acquired by Kermac.
	April 9	AEC extends concentrate contract with Vitro, Salt Lake City, from January 1, 1962, to December 31, 1963.
	June 29	AEC relaxes restrictions for small mines producing less than 20,000 pounds of U_3O_8 per year.
	July 1	FY 1962, uranium ore production, 7,436,343 tons. FY 1962, AEC bought 17,248 tons of U_3O_8 at a cost of $281,180,000; average price per pound, $8.00.
	August 18	AEC announces assignment of Uranium Reduction Company contract (Moab, Utah, mill) to Atlas Corporation.
	November 17	AEC announces domestic uranium procurement program through December 31, 1970. (Stretch-out program).
	November 19	AEC-El Paso contract for Tuba City, Arizona, mill extended from September 30, 1962, to December 31, 1966.
1963	February 25	AEC transfers Phillips processing mill contract to United Nuclear Corporation. Phillips mill closed March, 1963, and United Nuclear ores tolled through Homestake-Sapin mill in Grants, New Mexico, area.
	March	VCA's processing mill at Durango, Colorado, closed. VCA acquired Kerr-McGee mill at Shiprock, New Mexico. The AEC-Kerr-McGee contract assigned to VCA for Shiprock mill.
	May	Susquehanna-Western processing mill at Riverton, Wyoming, closed and arrangements made to toll some ores through Federal mill.
	July 1	FY 1963, uranium ore production, 6,435,359 tons. FY 1963, AEC bought 15,760 tons of U_3O_8 at cost of $246,210,000; average price per pound, $8.00.
	July 12	AEC announces appointment of Rafford L. Faulkner as Director of the Division of Raw Materials to succeed Jesse C. Johnson, retired.

1963	July 25	AEC-Vitro contract for Salt Lake City mill extended from December 31, 1963, to December 31, 1966.
	July 31	AEC approves consolidation of contracts of Atlas Corporation. (Moab mill) and Texas-Zinc Minerals (Mexican Hat mill).
	December 27	AEC announces signing of first stretch-out contract under the November 17, 1962 announcement with the Anaconda Company for the processing mill at Bluewater, New Mexico. Anaconda deferred approximately 3,000,000 pounds of U_3O_8 from the 1962-1966 period to 1967 and 1968.
1964	January 10	AEC announces uranium procurement program not affected by fissionable materials cutback; procurement commitments through 1970 to be carried out.
	March 13	Second stretch-out contract signed with Western Nuclear for processing mill in Wyoming. Western Nuclear deferred approximately 2,500,000 pounds of U_3O_8.
	May 13	Third stretch-out contract signed with Union Carbide Corp., for processing mill in Wyoming, formerly Globe Mining Co. Union Carbide deferred approximately 758,000 pounds of U_3O_8.
	July 1	FY 1964 uranium ore production, 5,430,471 tons. FY 1964, AEC bought 12,583 tons of U_3O_8 at cost of $201,370,000; average price per pound, $8.00.
	July 2	Fourth stretch-out contract signed with Utah Construction & Mining Co., for processing mill in Wyoming. Utah deferred approximately 2,100,000 pounds of U_3O_8.
	August 28	Fifth stretch-out contract signed with Kermac Nuclear Fuels Corp., for mill at Grants, New Mexico. Kermac deferred approximately 6,000,000 pounds of U_3O_8.
	December 10	Sixth stretch-out contract signed with Atlas Corporation for Moab and Mexican Hat, Utah, processing mills. Atlas deferred approximately 3,200,000 pounds of U_3O_8.
1965	January 28	Seventh stretch-out contract signed with Federal-Radorock-Gas Hills Partners for mill in Wyoming. Federal deferred approximately 1,400,000 pounds of U_3O_8.
	February	Cotter Corporation processing mill at Canon City, Colo., closed upon expiration of AEC contract.

1965	June	Dawn Mining Company mill at Ford Washington closed.
	June 23	Eighth stretch-out contract signed with Homestake-Sapin Partners for mill at Grants, New Mexico. Homestake-Sapin deferred approximately 4,100,000 pounds of U_3O_8.
	July 1	FY 1965 uranium ore production, 4,896,239 tons. FY 1965, AEC bought 11,819 tons of U_3O_8 at cost of $181,100,000; average price per pound, $8.00.
	July 27	AEC-Vitro contract for Salt Lake City mill terminated at request of Vitro because of declining ore production in district.
	August 5	Ninth stretch-out contract signed with United Nuclear Corp., operators in Grants, New Mexico, area. United Nuclear deferred approximately 3,800,000 pounds of U_3O_8. United Nuclear had choice of operating own mill or tolling through Homestake-Sapin mill. (At end of 1965, UN was tolling through Homestake).
	October 28	Tenth stretchout contract signed with Union Carbide Corp., for processing mills at Uravan and Rifle, Colorado. Carbide deferred approximately 2,520,000 pounds of U_3O_8.
	November 26	Eleventh and last stretch-out contract signed with Vanadium Corporation of America for mill at Shiprock, New Mexico. VCA deferred approximately 867,000 pounds of U_3O_8.

Summarizing the stretch-out program, AEC announced that in the eleven contracts executed, about 15,300 tons of U_3O_8 had been deferred from the 1962-1966 period for delivery in 1967 and 1968 at $8 per pound, and that the AEC expected to buy an additional 15,300 tons in 1969 and 1970 at an average price within the range of $5.50 to $6 per pound.