

**A Summary History of the Activities of the
Grand Junction Office of the AEC, ERDA, and DOE**

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Preface

This is our summary history of the activities of the Grand Junction office of the AEC, ERDA, and DOE. No names are mentioned, because we can't name everybody, and all of us were equal contributors to the Grand Junction effort. We are a part of history, and we won't forget that.

If you find errors or omissions, track us down and tell us. Perhaps we can do better next time around. Meanwhile, recall some wonderful accomplishments by all of you wonderful people.

Many thanks to Laurette Macomber and Sharon Stavast for helping us put it all together.

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The Atomic Energy Commission was created on August 1, 1946, by the Atomic Energy Act. On December 31 of that year, it was assigned all of the functions of the Manhattan Engineer District (MED) which had been charged with the development of atomic weapons during World War II.

The MED's activities included research and development, engineering and design, the operation of production facilities for weapons materials and components and, most important to what would become the Grand Junction operation, the acquisition of uranium, the basic raw material essential to the production of nuclear weapons.

The Colorado Raw Materials Office was established at Grand Junction, Colorado, in December 1947, to carry out the AEC's domestic uranium procurement program. An Exploration Branch, initially under the direction of the AEC's New York office, was also established at Grand Junction, and in November of 1952, the domestic uranium procurement and Colorado Plateau area exploration functions were combined within the newly formed Grand Junction Operations Office, under the overall direction of the Division of Raw Materials at Headquarters. Offices in Denver and Salt Lake City were charged with exploration activities in other areas west of the Mississippi. They functioned as branch offices under the Division of Raw Materials until June of 1956, when they were made area offices under the direct supervision of the Grand Junction office. The addition of 106 employees of the Denver office and 51 employees of the Salt Lake group brought the Grand Junction office to its peak complement of just over 500 direct AEC employees in 1956.

In 1947, when the Grand Junction office was established, the foreseeable supply of domestic uranium was desperately short of that which was required for defense purposes. To meet that situation the Division of Raw Materials, largely through the Grand Junction Office, initiated and carried out a variety of programs, utilizing Government personnel and private industry in a combination which proved highly effective. *

Beginning in April of 1948, through its Domestic Uranium Procurement Circulars, the AEC established guaranteed prices for certain uranium ores and mechanical concentrates purchased by the AEC, established a price for the vanadium content of the ores, provided for payment of haulage and development allowances, offered bonus payments for initial production of ores from new sources, and provided for the issuance of leases by the AEC to allow mining on certain lands not open to the location of mining claims.

Having set the prices it would pay for ore, the AEC began establishing buying stations to provide a market for the miners. The first of these was at Monticello, Utah, where the AEC began buying ore prior to the start-up of its Monticello uranium processing plant in late 1949. (Appendix A contains a detailed history of the Monticello mill and ore buying station operations.)

Over the next several years, the AEC established ore-buying stations in new uranium producing areas where it appeared that ore production would be sufficient to support a mill. If and when a privately owned mill was built to

provide a market for the ores, the AEC would withdraw and the accumulated ore stockpiles would be sold to the milling company for processing into concentrates to be purchased by the AEC.

Ore buying stations were operated for varying periods between 1949 and 1962 at Marysville, White Canyon, Moab, and Monticello, Utah; Shiprock and Grants, New Mexico; Globe and Tuba City, Arizona; Riverton and Crooks Gap, Wyoming; and at Edgemont, South Dakota. In addition, arrangements were made for mill owners 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, usually while mills were under construction.

During the period from February 1949 through February 1965, the AEC purchased a total of 3,368,809 tons of ore containing 20,584,553 pounds of U_3O_8 and 22,021,678 pounds of V_2O_5 .

The initial ore-buying agent for the AEC was American Smelting & Refining Company which also provided concentrate sampling and analysis at Grand Junction. After January 31, 1956, Lucius Pitkin, Inc. performed the services.

Between 1948 and 1956, the AEC pursued a broad program of exploration for uranium, first in the Colorado Plateau area, then in Wyoming and in the Grants, New Mexico, area and in parts of several other western states. The U. S. Geological Survey, which had offices at the Grand Junction compound, assisted the AEC in its search for uranium deposits by assigning over a hundred geologists and other experts to work with AEC's geologists and mining engineers. (See Appendix A for locations of field offices and field camps.)

From the beginning of the program through 1956, a Grand Junction firm, Walker-Lybarger Construction Company, acted as the on-site contractor, providing logistical services to the field camps, maintenance of the Grand Junction compound facilities, and purchasing of equipment and supplies. These services were provided by Swinerton & Walberg, a San Francisco-based firm, from January 1, 1957 through April 30, 1959, when Lucius Pitkin, Inc. took over those functions along with its sampling and analyzing duties. On July 11, 1975, Bendix Field Engineering Company took over the maintenance of the compound, together with other functions later described.

The exploration program included the withdrawal of some 700 square miles of public domain land for exploration purposes; geological studies of the area; physical exploration by drilling 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 to give private industry quick access to the accumulated knowledge.

Two AEC leasing programs evolved as a result of the AEC's withdrawal of lands from the public domain. Lands on which no uranium was discovered were restored to the public domain, but where deposits were found, the lands were retained under withdrawal to protect ore reserves developed at Government expense. The first leasing program was conducted between 1949 and 1962. A total of 49 leases were issued over the years to private firms, which

ultimately produced a total of 1 1/4 million tons of ore containing 7,261,000 pounds of U_3O_8 and 40,824,000 pounds of vanadium. Royalties of \$5,890,391 were paid to the Government.

The second program was instituted in 1974, when 43 mining leases were issued on the roughly forty square miles of lands remaining withdrawn or otherwise controlled by the AEC. As of June of 1986, the leases had produced 1 1/2 million tons of ore containing 5,900,000 pounds of U_3O_8 and 30 million pounds of vanadium. Royalties to the Government amounted to \$52,400,000. Thirty of these leases are still in existence.

Some 50 other mining leases, unrelated to the AEC land withdrawals, were issued in 1954 under the AEC's Circular 7 to make available for mining purposes certain lands which were not otherwise open to location of mining claims by reason of the Federal Mineral Leasing laws. No royalties were charged, and ore from the leased properties was purchased by private mills or at AEC buying stations as if it had come from valid mining claims. Legislative changes eliminated the need for new leases late in 1954, although many of the leases remained in effect for a number of years thereafter.

As aids in the exploration effort, AEC scientists developed many new and different techniques in the use of Geiger and scintillation counters at the electronics laboratory at Grand Junction. Among these were quantitative methods for gamma-ray logging and interpretation, a differential face scanner for in-place assaying in mines, and the gamma-only assay method to determine effective disequilibrium. These devices were tested constantly in the field by AEC geologists and engineers. A jeep-mounted drill hole logging unit designed by AEC technicians in 1951 served as a prototype for logging equipment later widely used by the industry. Grand Junction Office personnel continued the development of logging and other exploration equipment and measuring techniques into the 1980's. ★

The Grand Junction Office also provided industry with facilities for calibrating logging equipment. Test pits for that purpose were constructed at Grand Junction, Casper, Wyoming; Ambrosia Lake, New Mexico; George West, Texas; Spokane, Washington; Reno, Nevada; and Morgantown, West Virginia. In addition to assisting private industry, these calibration facilities enabled Grand Junction personnel to place greater reliance than would otherwise have been possible on ore reserve data furnished to the AEC by private companies.

The receipt of industry data by the Grand Junction Office was highly important to the AEC, ERDA, and DOE. In the earlier years it was necessary that the Defense Department have available, through the AEC, accurate assessments of the nation's uranium resources and production capability. The information was also essential to planning the operation of the Government-owned uranium enrichment plants, which were operated in turn by the AEC, ERDA, and DOE, and for making decisions concerning the enrichment of imported uranium for use in domestic power reactors.

The data collection process that evolved at the Grand Junction Office was unique in that nearly every major company involved in uranium production voluntarily gave its company-confidential data to Grand Junction Office personnel, and freely discussed the data with them on a periodic basis. The data were combined and processed at Grand Junction and made available to the

industry in the form of reports of the nation's overall ore reserves and potential, and forecasts of production capability.

In the early days of the uranium mining and milling industry, one of the major drawbacks was the inadequacy of roads in remote areas. To provide access to mining areas and mill facilities, the AEC, in cooperation with the Bureau of Public Roads and various state agencies, improved over 1,200 miles of roads in Arizona, Colorado, New Mexico, South Dakota, Utah, and Wyoming. A total of 90 projects embraced improvements ranging from creating bulldozer trails to blacktop paving.

The main objective of all of the Grand Junction programs through 1970 was, of course, the acquisition of uranium concentrates coupled, particularly in the programs' later stages, with the objective of maintaining a domestic uranium-producing industry capable of supplying raw materials required for peaceful uses of atomic energy, primarily nuclear power production.

In pursuance of these objectives, the AEC negotiated contracts with private companies for the purchase of uranium concentrates beginning in 1947. Some 40 uranium processing plants and upgrading facilities in Arizona, Colorado, Idaho, New Mexico, Oregon, North Dakota, South Dakota, Texas, Utah, Washington, and Wyoming produced uranium concentrates for sale to the AEC during the period. (See Appendix A for details concerning concentrate sampling and analysis, and for a history of the Grand Junction pilot plant operation.)

In the period prior to April 1, 1962, the prices paid for U_3O_8 in concentrate were individually negotiated with the milling companies, whose ore costs were based on the ore prices guaranteed by the AEC's published circulars; and the companies were required by their contracts to pay those prices for ores which they purchased.

On May 24, 1956, the AEC announced the establishment of a new domestic uranium procurement program for the period April 1, 1962, through December 31, 1966. The action was taken "in recognition of the need for a continuing Government market in order to maintain a high rate of exploration and development." The new program guaranteed a Government market for 500 tons of U_3O_8 in concentrate per year from any one mining property or operation at a flat price of \$8 per pound. Thus, in 1956, the stage was set for a continuing AEC concentrate procurement program after March 31, 1962, with an established price for concentrates rather than for ores.

By late 1957, domestic increases in reported ore reserves and in milling capacity prompted an AEC announcement that "it no longer is in the interest of the Government to expand production of uranium concentrate." Then, in November 1958, in order to prevent further expansion of production under its essentially unlimited purchase commitment, the AEC redefined its 1962-1966 procurement program by withdrawing portions of the program announced in May 1956. The Government stated it would buy, in the 1962-1966 period, only "appropriate quantities of concentrate derived from ore reserves developed prior to November 24, 1958, in reliance upon the May 24, 1956, announcement." Other aspects of the program announced in 1956 were retained: The AEC would buy only concentrates; the U_3O_8 price would remain at \$8 per pound; and ores would not be purchased nor ore prices guaranteed.

To limit its purchases under the 1958 announcement, the AEC announced and carried out an allocation program under which the Grand Junction office determined the maximum amount of U_3O_8 which would be purchased from individual mining properties. The office processed some 2,500 requests for such allocations and issued a total of 800. Special provision was made for properties in areas where ore bodies were generally not drilled out and developed prior to mining. There, a historical production rate was used to determine amounts salable to the AEC. Following a study which indicated that many of them could not operate economically at production levels imposed by the allocations, provision was also made to purchase up to 20,000 pounds of U_3O_8 per year from each of some 600 small independently owned mining properties (subject to an overall group limitation of 1 million pounds).

In 1962, it was apparent to the AEC that the private market for uranium concentrates would not be sufficient to sustain a viable domestic uranium industry by the end of 1966 when the AEC procurement program was scheduled to end. Thus, in November, 1962, the AEC announced its "stretch-out" program for 1967 through 1970. Under the program, the milling companies could voluntarily defer delivery of a portion of their 1963-1966 contract commitments until 1967 and 1968 in return for an AEC commitment to purchase, in 1969 and 1970, an additional amount of U_3O_8 equal to the quantity so deferred. The price paid for the deferred material in 1967 and 1968 was \$8 per pound, the same as in the 1962-1966 period. The price paid in 1969 and 1970 for concentrates produced from properties controlled by mill contractors was calculated by use of a formula based on average allowable costs of the contractor's production during the 1963-1968 period, as determined by an audit of mining and milling costs, subject to a maximum price of \$6.70 per pound of U_3O_8 . The price for all concentrates produced from ores purchased from independent producers was \$6.70 per pound of contained U_3O_8 .

Three years were required to negotiate and re-write the "stretch-out" contracts, which involved 10 milling companies operating 12 uranium processing plants.

The "stretch-out" program was the last of the major policy changes made in the AEC procurement program, although in January 1969, the AEC requested and accepted proposals for some further reductions in deliveries of concentrates in 1969 and 1970. The procurement program ended December 31, 1970.

By the end of 1970, the AEC had purchased uranium concentrate containing 348,818,438 pounds of U_3O_8 for a total cost of \$2,979,390,249.

After the uranium procurement ended, the Grand Junction office continued geologic studies and related projects to support the assessment of uranium resources. Ore reserve calculations and estimates of potential resources were made for the known uranium districts and in the general proximity of those districts.

In 1973, the resource assessment program was expanded to encompass the entire United States, and its goals and missions were redefined.

The National Uranium Resource Evaluation (NURE) Program was launched in 1974 by the AEC, and was continued by ERDA, which succeeded to the AEC's operating

functions on January 19, 1975, and by the DOE, which replaced ERDA on October 1, 1977. The program was designed to accomplish a comprehensive assessment of the nation's uranium resources and, in so doing, to identify those geographic and geologic environments in which potential resources may occur. In addition, as part of NURE, concerted efforts were made to improve and develop equipment, techniques, and procedures to aid in uranium exploration and evaluation. It should be emphasized that NURE was not designed as a uranium exploration program; the actual search for minable deposits of uranium in the United States remained the responsibility of uranium exploration companies. It was intended, however, that many of the results of the NURE studies and investigations be made available to assist the uranium companies in their exploration activities, while fulfilling the Congressional mandate for information on which to base decisions for the nation's long-range nuclear energy program.

Under the NURE Program, extensive geologic studies to identify and evaluate geologic environments favorable for uranium were carried out by geologists of the Grand Junction office; its prime contractor, Bendix Field Engineering Corporation; the U.S. Geological Survey; geological consulting firms; state geological survey organizations; and universities. These studies were supported by a NURE data acquisition program which included aerial radiometric and magnetic surveys, hydrogeochemical and stream sediment surveys, geologic drilling in selected areas, and geophysical logging of selected boreholes.

Data acquisition was completed in 1981 and the program was completed in 1984. During the eleven years of the NURE Program, an unprecedented quantity of geoscience information was gathered throughout the conterminous United States and Alaska. The resulting data bases in geology, geophysics, and geochemistry are substantial and can be applied to the search for many mineral resource commodities other than uranium.

The total cost of the NURE program, including outside investigation and support provided by the on-site contractor, totaled approximately \$320 million. Over 1,300 individual reports were open-filed. NURE reports and data tapes are now for sale by the U.S. Geological Survey.

Since completion of the NURE program, the Grand Junction office has continued to administer the Grand Junction Remedial Action Program, begun in 1972, and is involved in various remedial action projects concerning uranium mill tailings.

*REPORT BEING
FACILITY HISTORY
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APPENDIX A

Monticello Mill and Ore Buying Station

In late 1940, the Vanadium Corporation of America (VCA) opened a vanadium ore-buying station at Monticello, Utah, in order to stimulate vanadium ore mining in the region. Within a short time, ore production increased sufficiently to justify construction of a vanadium mill, and, in September 1941, the War Production Board approved VCA's proposal to build a mill. Funding was provided through the Government's Defense Plant Corporation (DFC). The Metals Reserve Company (MRC) assumed operation of the ore-buying station in April 1942, while VCA operated the mill. The first vanadium was produced on August 24, 1942. In 1943, VCA began producing a uranium-vanadium sludge for MRC. The product was sold to the Manhattan Engineer District (MED), which had recently initiated a program to obtain domestic uranium. The mill closed in February 1944.

VCA reopened the mill from 1945 to 1946 under lease from DFC and purchased the stockpiled ore from the MRC. During this period, VCA produced the U-V sludge which was sold to MED.

The AEC bought the Monticello millsite from the War Assets Administration in 1948. The AEC established an ore-buying station at the millsite with American Smelting and Refining Company acting as its agent, and The Galigher Company was engaged to design and operate a uranium-vanadium mill. The reconstructed mill commenced operation in 1949 and continued operation until mid-January 1960, when it was permanently shut down. The Galigher Company was engaged to design and operate a uranium-vanadium mill. The Galigher Company managed and operated the mill through March 1956. The National Lead Company, Inc. then assumed operation until shut-down. Ore-buying continued at the site until March 31, 1962 under Lucius Pitkin, Inc.

The Monticello plant was the only AEC-owned ore processing operation in the west and served the useful purposes of (1) stimulating uranium ore production in the area, (2) providing processing and cost data for AEC use in contract negotiation, and (3) providing personnel and facilities for testing ore processing modifications, health and safety practices, and environmental measures. The mill and ore-buying station also contributed significantly to the economy of the area, since about 300 people were employed at the site in the mid-1950's.

Field Office Locations

Alaska

Anchorage

Arizona

Phoenix
Tucson
Globe
Flagstaff

California

Bakersfield

Colorado

Denver

Georgia

Atlanta

Michigan

Ishpeming

Montana

Baker
Butte
Billings
Miles City

Nevada

Reno

New Mexico

Albuquerque
Grants
Milan
Prewitt

North Dakota

Dickinson

Pennsylvania

Pittsburgh

South Dakota

Buffalo
Edgemont
Hot Springs
Rapid City
Spearfish

Texas

Austin
Corpus Christi

Utah

Kanab
Monticello
Richfield
St. George
Salt Lake City

Washington

Spokane

Wyoming

Casper
Douglas
Moorcroft
Rawlins
Riverton

Grand Junction Field Camps

Arizona

- Black Mountain
- Cameron
- Chilchinbito
- Cove Mesa
- Cove School
- Echo Cliffs
- Ferron
- Fort Defiance
- Holbrook
- Hoskinnini Mesa
- Kayenta
- Lukachukai
- Monument No. 2
- Oak Springs
- Rattlesnake

Marble Canyon

Colorado

- Bull Canyon
- Calamity Mesa
- Durango
- Skull Creek
- State Bridge
- Tenderfoot Mesa
- Uranium Peak
- Wray Mesa

Cool Creek

New Mexico

- Catron Ranch
- Crow Point
- Dulce
- Gallina
- Haystack Butte
- Lime Kiln
- Ramah
- Rio Puerco
- Sanostee
- Smith Lake
- Toadlena

Utah

- Aldrich
- Big Indian
- Blue Hill
- Burr Trail
- Caineville
- Calf Mesa

Bow Knot

- Cane Creek
- Castledale
- Cottonwood Wash
- Deer Flat
- Dripping Spring
- Dry Valley
- Escalante
- French Seep
- Frey Canyon
- Green River
- Green Vein Mesa
- Hanksville
- Happy Jack Mine
- Hite
- Indian Creek
- Kaiparowits
- Lockhart Canyon
- Mineral Canyon
- Montezuma Canyon
- Notom
- Oljeto
- Poison Spring
- Polar Mesa
- Red Canyon
- Shooting Canyon
- Silver Spring
- Star Springs
- Steamboat Rock
- Stud Horse Buttes
- Swazy Flats
- Tidwell
- Torrey
- Trachyte Creek
- Vernal
- Wagon Box Mesa
- White Canyon
- Wild Horse Mesa
- Yellow Cat
- Yellow Circle

Circle Cliffs

EIK Ridge

Sinbad Flat

Temple Mountain

Casper Office Field Camps
(Wyoming)

- Baggs
- Carlisle
- Copper Mountain
- Crook's Gap
- Gas Hills
- Monument Hill
- Pumpkin Buttes
- Shawnee

Concentrate Sampling & Analysis

One of the principal functions of the GJO was the receipt, sampling, and analysis of uranium and vanadium concentrates from the numerous (32) ore processing operations in the Western U.S. A total of 347.3 million pounds of U_3O_8 (about 218,000 tons of concentrates) and 28.6 million pounds of V_2O_5 (about 17,000 tons of concentrates) were received during the period 1948-1971. Initially, these concentrates were packaged in 30-gallon steel drums, but later (mid-1950's) contracts specified use of 55-gallon containers.

In 1948 the AEC retained Ledoux and Company of New York to sample the concentrates, while analyses were performed by the National Bureau of Standards (Washington, D.C.). After American Smelting and Refining Company (AS & R) was retained in 1948 to set up ore buying stations for the AEC, it was also given the responsibility for receiving, sampling, analyzing, storing, and shipping concentrates. A new sampling plant was constructed at GJO in 1951.

In 1956 Lucius Pitkin, Inc. assumed the contractor's duties from AS & R and, as concentrate receipts increased rapidly, developed improved sampling and analytical procedures. A falling-stream sampling plant was constructed to determine the accuracy of the auger sampling methods, and an improved drying and moisture determination procedure was developed.

Some of the vanadium purchased and stockpiled at GJO during the period 1949-1959 was sold on a competitive bid basis in 1960 and 1961. The remainder was transferred to the Government's General Services Administration for disposal shortly thereafter.

During the 1960's, for a period of a few years, some mills shipped uranium concentrates directly to the AEC's feed materials plant at Weldon Spring, Missouri for sampling and analysis. After that plant was shut down in 1965, all shipments were directed to GJO again, and it was necessary to stockpile uranium concentrates at GJO. From September 1964 to February 1971, a total of 103,776 drums of uranium concentrates accumulated in the GJO stockpile. The drums required periodic maintenance to prevent leakage. The stockpile ultimately was shipped to plants in Ohio and Illinois for conversion and storage as UF_6 . The last shipment from GJO was in January 1975.

Pilot Plant

The recovery of uranium from its ores and other resources was the subject of extensive research in several laboratories, under the sponsorship of the MED and the Division of Raw Materials of the AEC for the period 1944-1961. A major role in this work was played by the Raw Materials Development Pilot Plant located at GJO. The Grand Junction pilot plant started in March 1953 and was shut down in June 1958. The first small pilot plant was constructed at Grand Junction in 1953 for the express purpose of developing the resin-in-pulp process. In 1954 a much larger pilot plant was constructed at the south end of the AEC compound. It included two large mill buildings, a crushing and sampling plant, office and laboratory, warehouse, maintenance shop, and necessary areas for stockpiling ores and tailings ponds.

The pilot plant had a two-fold purpose, (1) amenability testing of ores 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 pilot plant circuits were operated on a 24-hour day, 7-day week basis. National Lead Company Incorporated was the AEC contractor for operation of the pilot plant and employment grew from 18 in 1953 to about 100 in 1957.

During the course of the operation of the Grand Junction pilot plant, approximately 30,000 tons of ore from 40 different mines or locations throughout the Western United States were tested. Nearly all of the mills built during the 1950's and 1960's utilized processes and data developed at the G.J. pilot plant. Additionally, the pilot plant trained many of the mill operating crews and National Lead engineers and chemists assisted in the start-up of numerous mills.