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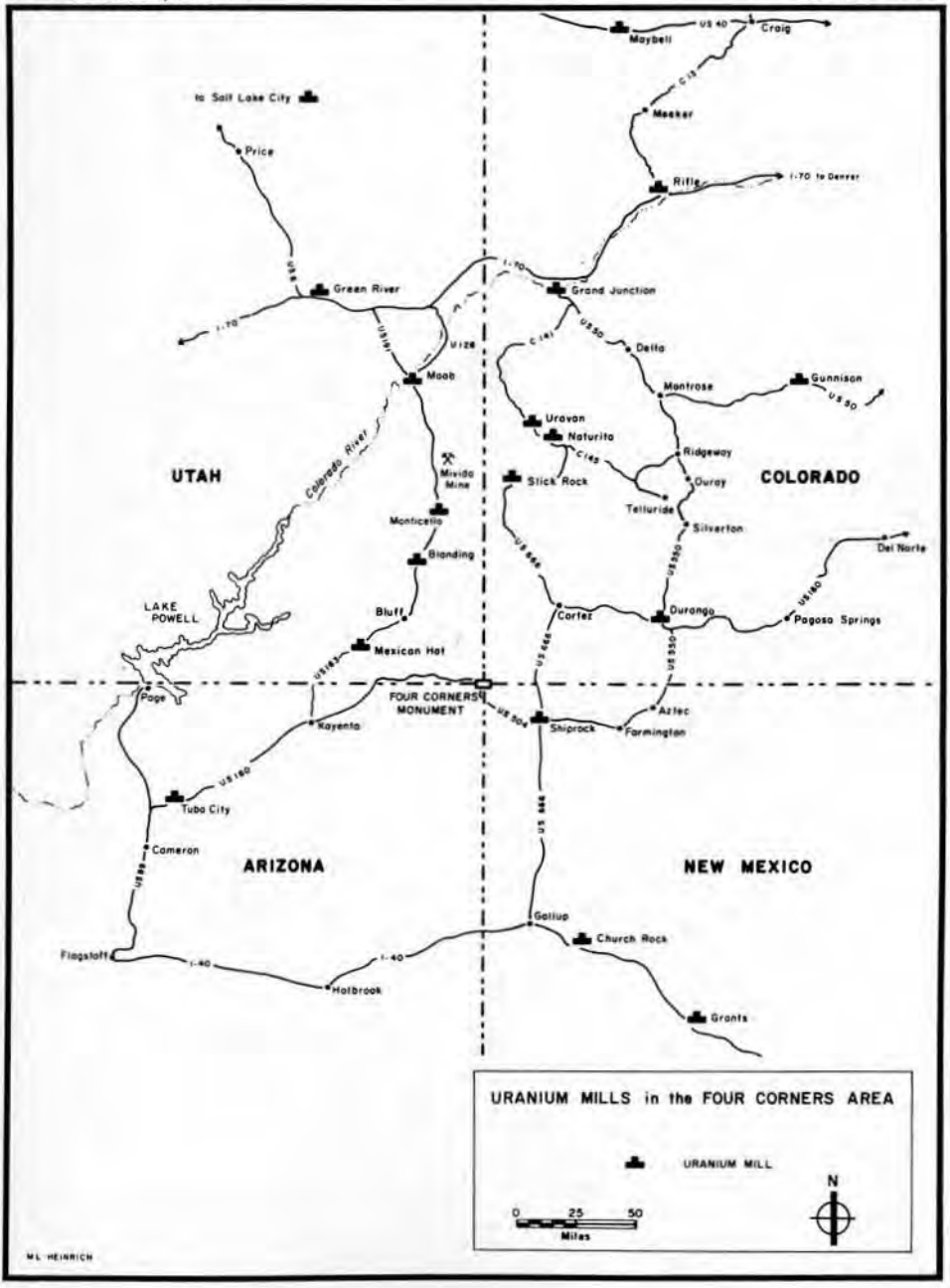

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100 YEARS OF URANIUM ACTIVITY IN THE FOUR CORNERS REGION

BY

ROBERT SULLENBERGER

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INTRODUCTION

The United States Vanadium Corporation (U.S.V.C.) hired Robert Sullenberger in 1940 for a uranium mining claim survey position near Egnar, Colorado on the Dolores River Canyon rim. Later, he worked in the company machine shop at their mill site in Uravan, Colorado. During the course of his employment with U.S.V.C., he acquired considerable insight on mining methods, uranium-vanadium ore refining processes, mill and mine equipment maintenance and new uranium mill construction.

Numerous incidents in the early 1940s that occurred are lacking in previous publications. Most former Uravan employees have passed beyond the horizon and one objective in writing this narrative was to record some of the author's Uravan memories of working for U.S.V.C. at the beginning of World War II.

A resurgence of activity occurred in the Four Corners region during the Uranium boom of the 1950s. With the discovery of several new uranium ore bodies, the demand for new uranium processing mills in Colorado, Utah, Arizona, and New Mexico rose.

Most of the Four Corners uranium mills no longer exist. Many have been dismantled, while others remain on a stand-by status awaiting direction from the United States Department of Energy to determine their future. Removal of radioactive tailings created by the mill operations began in 1977 and is expected to continue well into the twenty-first century.

Excerpts from unclassified United States Department of Energy's documents related to uranium mill site locations, ownership, history, dates of construction and closures, milling capacities and proposed tailings stabilization plans are also included in this document.

ABOUT THE AUTHOR

In the early stages of World War II, United States mining companies experienced an acute shortage of lead, zinc, copper, and molybdenum miners and mill personnel trained in metal refining processes. The United States Army, at the request of the Strategic Metals Production Board, initiated an intensive search through their records for soldiers experienced in mining and refining.

Robert Sullenberger and 4,500 other soldiers were rounded up and shipped to Fort Douglas, Utah for assignment in the nation's metal mines. Mine representatives selected soldiers who possessed work experience needed by their companies. The Army then transferred them from active duty to the Enlisted Reserve Soldiers Miner Corps. The Park City Utah Consolidated Mines Company representatives chose Sullenberger and two other former U.S.V.C. employees to work in their Judge Mine in Park City, Utah.

After working several months as a mucker in the Park City lead mine, Sullenberger transferred to the Climax Molybdenum Company mine on Fremont Pass near Leadville, Colorado. Here he worked on the mine's underground maintenance crew. Many of the soldier miners became seriously injured in mine accidents, with some even losing their lives before the strategic war metal crisis ended. Most men were recalled to active duty; however, some were discharged because of injuries suffered in mine accidents. These unfortunate individuals received no disability pensions and none of the time they spent in the Soldiers Miner Corps counted towards their military service, nor did the Veterans Administration calculate it for veteran's benefits after World War II. Sullenberger's recall to active duty became delayed since he suffered a serious leg fracture incurred in the Climax Mine.

After his military discharge, Sullenberger earned a degree in engineering at Utah State University. He worked for several years as a mechanical engineer in uranium and nuclear related industries before joining the faculty of Metropolitan State College in Denver, Colorado. During his tenure at Metropolitan State, the United States National Science Foundation selected Sullenberger to serve as a Technical Education Consultant for India's Polytechnic Colleges in New Delhi, India. In addition, he spent one year at the University of Petroleum and Minerals at Dhahran, Saudi Arabia as a visiting professor in their Mechanical Engineering Department.

ACKNOWLEDGEMENTS

I would like to express my gratitude to the Editorial Staff of the **JOURNAL OF THE WESTERN SLOPE** for their interest in my manuscript and the time spent reviewing it. Without their effort the document's publication would not have been possible.

I also extend my appreciation to Mrs. Corinne Roring, a Monticello, Utah resident, for providing photographs and historical information on early mining activity in San Juan County, Utah.

In addition, I owe thanks to the San Juan County Librarian, Vee Corrol, and the Mesa State College Reference Librarian, Mrs. Broadak, for their assistance in providing material used in this presentation.

EDITORS NOTE

The editorial board of the **JOURNAL OF THE WESTERN SLOPE** regrets the need to split this manuscript into two separate journals. To insure the integrity of the article, the quality of pictures, and to best serve our readers, this decision became necessary. The second segment of **100 YEARS OF URANIUM ACTIVITY IN THE FOUR CORNERS REGION** discusses uranium mills in Grand Junction, Gunnison, Maybell, Blanding, on Indian reservations, and in the New Mexico area. Please accept our apology for this unfortunate decision.

The editor made several grammatical corrections in the quotes found in **100 YEARS OF URANIUM ACTIVITY IN THE FOUR CORNERS REGION** to provide a clear, easy reading.

We would like to take this opportunity to extend our appreciation to the subscribers of the **JOURNAL OF THE WESTERN SLOPE** for their continued support. The students and faculty here at Mesa State College depend upon your support and welcome any ideas you may have regarding our publication. Once again, thank you for your patronage.

CHAPTER ONE
EARLY URANIUM MINING IN THE FOUR CORNERS

Howard W. Balsley, a Moab, Utah pioneer in uranium mining, sent the following Christmas letter to Mr. and Mrs. Bronson in Monticello, Utah. This letter contains information Mr. Balsley presented at a Moab, Utah meeting of the local chapter of the American Institute of Mining Engineers. Mrs. Corinne Roring, a San Juan County, Utah historian, and a lifetime Monticello, Utah resident, provided a copy of Balsley's letter presented below:

Dear Friends:

Assuming that you might be interested in some early history pertaining to the "miraculous mineral," known as uranium, found extensively in this area--commonly known as the "Uravan Mineral Belt"--I am taking the liberty of sending to you, in lieu of the usual Christmas Greeting Card, a copy of a paper I presented at a comparatively recent meeting of the local chapter of the American Institute of Mining Engineers.

Respectively submitted,

Howard W. Balsley

Dear Mr. and Mrs. Bronson: I have assumed that you folks might be interested in this little recounting of some of the early history of the uranium business in this general area. I had expected to have had all of these in the mail prior to Christmas, but just couldn't make it--please excuse my apparent negligence.

Very sincerely

Signed Howard B.

In talking with the Talbot Brothers, in Paradox Valley, just over the State line, in Colorado, in the early 1900s, when I was a Forest Ranger, I was told that, in 1879, they had found a fissure vein carrying some odd mineral, which they assumed to be silver, and sent a sample thereof to the American Smelting & Refining Company's smelter, at Leadville, Colorado, to be assayed. However, the folks at the smelter advised them that they had no idea what the material was, but they were sure it was not silver.

In October, 1898, this same fissure vein was re-discovered and located by a man by the name of Tom Dolan, also of Paradox Valley. A sample of this discovery was sent to the Smithsonian Institution, in Washington, D.C., for analysis. Word came back that the ore was high-grade uranium.

This alleged fissure vein was located on Roc Creek, just across the La Sal Mountains, in Sindbad Valley, in Colorado. Incidentally, the name of the creek above mentioned is spelled "ROC", and the name of the Valley is spelled "SINDBAD". Whoever named that creek and valley, as well as several other old landmarks in that part of the country, had unquestionably read a former very popular book entitled "Sindbad the Sailor", for these names were definitely taken from that book.

Well this so-called fissure vein turned out to be the very famous Rajah mine which eventually produced thousands of tons of very high-grade uranium ore. On various occasions, while riding over in that general area I have met strings of as many as fifty burros and pack mules, loaded

with high-grade ore, from this Rajah mine. This ore was all sacked before being loaded on the animals and packed to Paradox, from whence it was loaded on wagons and hauled to Placerville, Colorado. From there it was shipped by narrow-gauge railroad to Montrose, Colorado, where it was transferred to the broad-gauge railroad and sent on East, from whence most of it was shipped to France.

For many years, the Rajah mine was claimed to embrace the only fissure vein of carnotite (uranium) ore ever discovered. Just in case someone present should not know the difference between a fissure vein and a blanket vein: A fissure vein is presumed to stand up and down, sometimes called a vertical vein, but they are not always exactly vertical, whereas, a blanket vein lies more or less flat. All of the carnotite (uranium) ore I know anything about has come in blanket veins or in pockets.

Anyway, after many years, the geologists finally decided that this Rajah mine was really not in a fissure vein, but that a great shelf of sandstone, containing this blanket vein of carnotite ore, from which the underlying strata had been eroded away through the ages, had broken off and stood on end, making what was thought, for years, to be a fissure vein. I just thought this might be a little interesting side-line for some of you folks.

Quoting Mr. Frank Silvey, a veteran prospector in these parts for many years, 'Tom Francis, who was prospecting near the McIntyre Canyon District at the time, visited the Paradox District and was shown some specimens of uranium ore. When Francis came back to camp he told us boys he thought we had uranium here in McIntyre and he was quite sure he knew where there was some near camp. The next morning he went prospecting. Soon he came back on the run and yelled, 'Hooray boys! We have

it and enough for all of us.' Several of us started off with Francis that day and we staked a number of good uranium claims. The date was March 9, 1898, so we were among the pioneer discoverers of this rare material.'

In 1898, Messrs. Pouilot, and Voilique, two prominent French chemists and scientists visited Southwestern Colorado and Southeastern Utah, the territory surrounding the La Sal Mountains, which lie in both states, and investigated the uranium deposits which were known to exist there. They proceeded to build and equip, so far as is known, the very first uranium-concentrating plant in the world, over on the Dolores River, at Camp Snyder, San Miguel County, Colorado, near where State Highway No. 80 crosses the Dolores. I have a picture of that first uranium-concentrating plant.

As I am quite sure, most of you know that Madame Marie Curie, a noted Polish physicist and chemist, with her husband Pierre, discovered the element radium in uranium ore in 1898. She is credited with having been responsible for the coming of the said two Frenchmen and the construction of the uranium-concentrating plant just mentioned.

Madame Curie visited Southwestern Colorado and the said mill in 1899. She is also credited with having given the name "carnotite" to the type of uranium ore that has been produced in this area during the past seventy years. This ore was named in honor of A. Carnot, French inspector general of mines.

Carnotite occurs in the Salt Wash Member of the Morrison Formation. This type of ore carries uranium, vanadium and radium, as most of you know.

In 1922, Madame Curie again visited the United States and a number of philanthropic persons in this country purchased and gave to her, in

recognition of her wonderful contribution to science, in the discovery of radium, one gram of radium, for which they actually paid $80,000, and that was the wholesale price. Radium, at that time, was retailing at $120,000 per gram.

As nearly as I have been able to establish, the first uranium ore discovered in this immediate vicinity was by an old-time prospector by the name of Albert M. Rogers who, in later years, lived for some time in my home. This first ore was found on a famous old uranium property up near the foot of Brumley Ridge, not far from the turnoff to the M-4 ranch, in upper Spanish Valley, designated for many years as Poverty Flat. This mining property was later patented under the name 'Blue Goose'.

Ore from this Blue Goose property was mined and shipped to France and, reputedly, to Madame Curie's laboratory, in Paris. I have owned this property for many years and it has produced a very considerable quantity of unusually high-grade ore through the years. I have declined to sell this property, principally for sentimental reasons.

I 'grub-staked' Al Rogers on many occasions to go prospecting and he did discover and locate a number of very fine uranium claims. Just in case some of you younger folks do not know what 'grub-staking' is: that was a custom that has prevailed in all mining areas in the West, almost since the beginning of time. For instance, I would buy enough food, supplies, and tools to last the prospector for, say 30 days, together with grain for his pack and saddle animals. When the food and supplies were used up, if he still wanted to prospect, he would come in and get loaded up again. If, in the course of the prospecting expedition, one or more promising claims were found and located, one-half of the property thus acquired went to the person furnishing the

supplies, etc. As nearly as I can recall, it was the spring of 1915 that a long-time cowboy, who had turned uranium prospector and miner working on the Blue Goose property came to me and stated that he had just had a dream, in which he had plainly seen a yellow circle in a block of sandstone up in the Upper Cane Springs Wash area. He was sure it was uranium and that he could find it.

I never had much faith in dreams, but this man was so sincere, and I knew him to be honest and truthful, so I bought for him everything needed for his proposed prospecting expedition, including grain for his pack and saddle animals. (Just about everyone had his own horses or burros in those days).

After about ten days, this prospector--Charles Snell by name--came riding in and stated that he had actually found the yellow circle in the block of sandstone, just as he had dreamed, and that he was sure he had discovered a real uranium ore deposit, and that he had staked five claims in the vicinity thereof, in his name and mine.

Later, we located more claims in that area and the property has produced a vast tonnage of real good uranium-bearing ore through the years--more than a million dollars' worth, in fact. Unfortunately for me, I sold the property a number of years ago--just at the start of the boom in the 1950s--for a very nominal sum, and I wasn't smart enough to retain even a low over-riding royalty. It is a fact that Thornburg Brothers, whom some of you know, sold their lease on this property of 20 claims for $560,000 cash. Incidentally, a partner and I have, comparatively recently, re-acquired a one-fourth interest in this Yellow Circle property. I believe that there is still a lot of ore on the property, and quite an extensive drilling campaign is due to start up there very shortly. (Since writing the above, a

very fine new body of ore has been discovered on this property and several hundred tons of real good ore have been shipped during the past two months.)

When this Yellow Circle property--that is the name we gave it--was sold, the rock bearing the dreamed-of yellow circle was removed from its setting on the property and placed in my yard, here in Moab, where it can be seen at any time, should anyone be interested in seeing it.

During the winter of 1918, we had a very heavy snow-fall in the area where this Yellow Circle property is located, some 21 miles southeasterly from Moab. I had 24 men working on the property at the time, and they ran completely out of food supplies. One of the miners chopped down a cedar tree and fashioned from it a pair of crude skis and came down to advise me of the plight of the food-less miners. I went to Green River, Utah bought a big bob-sled, brought it to Moab, where we hitched four horses to the sled and took in a load of groceries for the men. We had a real time breaking a trail through more than three feet of snow. By the time we got there, the men were pretty hungry, but they <u>didn't</u> go on strike.

A year or so later, this same cowboy-prospector Charles Snell, came to me and asked that I 'grub-stake' him on another prospecting trip--this time into the Lisbon Valley area, so again I loaded up his two pack horses with supplies, horse feed, etc. and he took off. Some four weeks later, I received from the treasurer of San Juan County, where Lisbon Valley is located, a check for $27.00. I couldn't imagine why I was getting this check, or for what. About two weeks later, Charley rode in and the first thing he asked me was whether or not I had received a check from San Juan County for $27.00. I stated that I had but I couldn't figure what it was for. Then Charley said: well, I didn't find

any uranium I thought worth locating, but I did find a den of wolf pups--six of them. I killed them and took the pelts into the county clerk, at Monticello, and got $54.00 in bounty money, paid by the state for the destruction of wolves, and that $27.00 is your half of the bounty.' I said: 'Well Charley, I certainly wouldn't have expected you to do that,' whereupon, he said: 'Well, by George, I was eating your grub when I caught the wolves so half the money is yours.'

In the Spring of 1934, I entered into a contract with the Vitro Manufacturing Company, of Pittsburgh, Pennsylvania, whereby I agreed to supply their requirements for uranium ore. My contract provided that I deliver ore running a minimum of 1.50% in uranium oxide, and a minimum of 5% in vanadium oxide. Nowadays, we are real pleased if we can hold the minimum grade of our uranium ore up to 20/100ths of 1%, but we did find a lot of high-grade ore in the 'old days'. For instance, I shipped to Vitro from Polar Mesa, on the north end of the La Sal Mountains, 34 50-ton carloads of ore that actually averaged 1.57% in uranium oxide and 7.35% in vanadium oxide. And I also shipped a lot of high-grade from the Yellow Circle and Snowflake-Sunflower properties.

I had warehouses or other storage arrangements in Blanding, Monticello, Moab, Cisco, Thompson, and Green River, in Utah, and in Grand Junction, Newcastle, Meeker, Montrose, Naturita, Dove Creek, and Egnar, in Colorado. My contract called for shipment in 50-ton carload lots, so I had to accumulate enough ore in the various warehouses on the railroad to load a car. I bought ore from more than 300 small producers, scattered all over the Colorado Plateau. I bought ore in any sized lots, from 25 pounds to a carload, and every lot had to be broken up and hand sampled. I have had as many as 55 separate lots of ore in a single carload. Every bit of it

had to be sacked in 100-pound bags. Then, I had to blend, on paper, as we called it, the various lots going into the carload, so that the required minimum grades could be maintained.

I had a lot of difficulty in determining which lots to blend together--on paper, as I said--because I was buying and selling on a sliding-scale price list, and I could not afford to use high-grade ore to bring to grade too much low grade. Please understand that practically every lot of this ore was different in its uranium and vanadium contents. Sometimes a lot would run quite high in vanadium and very low in uranium, and vice versa. So, believe me, I had a real blending job.

Of course, most of these small producers were always broke, financially, and had to have advances on their ore. Most of the time there was not a single uranium assayer in the entire area, in which event I had to send the samples all the way to Pittsburgh for assaying, and that would require a minimum of two weeks. In the meantime, the producers and their families had to eat. So, I acquired an electroscope, which I have with me here tonight. This instrument is much more accurate in determining the actual grade of ore than is the modern Geiger counter and, should any of you be interested, I'll show you why. I actually have, in my warehouse, more than 6,000 pulverized samples of ore I have bought during the eleven years I was doing business with Vitro. With the aid of the electroscope, I could arrive fairly closely at the uranium content of the sample, so I could go ahead and make a substantial advance to the producer. Of course, I just had to guess at the vanadium content. Then, when the assay was received, I would pay the balance due, if such there was. Often I was talked out of considerably more of an advance than the ore delivered justified, but was always

promised more ore to make up the difference--very frequently, it never arrived and I took a considerable loss on that account just listening to 'sob stories'.

I failed to tell you what Vitro did with this ore I shipped to them: well, the firm was set up by two elderly German immigrants, for the purpose of supplying to the market ceramic colors from mineral pigments, to be used in potteries and glass factories. Their customers were numbered by the hundreds in this country and in many foreign lands. Vitro actually made 26 different shades of reds, greens, browns, and yellows from this uranium ore. They also used considerable unfused vanadium 'red cake' in their ceramic colors.

Vitro also extracted the vanadium from this ore. What they did not use in their own business, they found a ready market for-in the form of vanadic acid--at the steel mills, which there were many in the vicinity of Pittsburgh. Vitro also recovered the radium from this ore. The radium salts thus recovered were shipped to Philadelphia to a noted Czechoslovakian scientist who prepared it for insertion into cancerous tissue. This radium had to be shipped by truck, in a heavy lead cask, inasmuch as neither the railroad, nor the post office, would handle it.

During the eleven years I was affiliated with Vitro, I was the only ore buyer on the Colorado Plateau who paid for both the uranium and vanadium in the same ore. There were a couple of other buyers who would pay for the uranium content only, so I got most of the ore that was available from the smaller producers. Of course, during most of that time, the United States Vanadium Corporation, a wholly-owned subsidiary of Union Carbide & Carbon Corporation, was operating vanadium-extraction mills at both Uravan and Rifle , Colorado, and the Vanadium Corporation of America had a mill at Naturita;

however they only paid for the vanadium content of the ore. Occasionally both of these concerns would turn some of their ore with a high uranium content over to me.

During the many years I have been in the uranium-vanadium ore business, I have ridden the market up and down a number of times. For instance, during the early 1900s the only use for this ore was for its radium content. We producers got built up, what was considered in those days, a fairly good market for our uranium. Then, all of a sudden, they came up with a rich strike of pitch blende ore in the Belgian Congo, and we all went out of business over night.

Then, eventually, the wonderful properties of vanadium as a steel alloy, especially where great tensile strength was required, were recognized and, for a time, we had a very promising market for the vanadium content of our ore, but of course, we got nothing for our uranium. Then, about 1921, the Vanadium Corporation of America came up with a whole mountain of vanadium ore in South America, and although this ore had to be packed on llamas over a 14,000-foot pass in the Andes Mountains, we still could not compete with the price, even though that product had to be shipped by water to a port in the United States and thence by rail to a plant near Pittsburgh. So, we went out of business again.

Thereafter, and up until the Government decided it needed an unlimited amount of vanadium, early in 1942, sometimes we had a limited market for our ore--other than what I shipped to Pittsburgh--and sometimes we didn't. In May, 1942, the Government set up a corporation, designated as the Metals Reserve Company, the object of which was to produce a lot of vanadium in a hurry. A number of buying stations were set up around over the carnotite-producing area. We had one here in Moab, just

south of the old cemetery. I was in charge of it for a number of months. We were authorized to accept all of the vanadium oxide ore we could get, running 1.25% or better in vanadium oxide, and many thousands of tons of this type of ore were delivered to the various buying stations. The ore received here at the Moab Buying Station was trucked to Durango, Colorado, a distance of 160 miles, where the U.S. Vanadium Corporation had another plant that extracted the vanadium.

Well, all was going well and many old mine dumps that ran very low in uranium, but fairly well in vanadium, were scooped up and sold to the Metals Reserve. However, late in February 1944, the government suddenly discovered that it had vanadium 'running out of its ears', as it were, and orders were issued to cease buying vanadium promptly at midnight on February 28, 1944. So, we went out of business again, except for my contract with Vitro. At the time the close-down order came from Washington, I had a considerable tonnage of ore accumulated over at Dove Creek, Colorado, that was too low in uranium to be shipped to Vitro, but it had a good vanadium content. By working day and night with two good helpers, we got the last load delivered to the Dove Creek stock pile at exactly five minutes to midnight, February 28, 1944.

Then, late in 1944, and early in 1945, the government needed uranium badly, in connection with its Atomic Bomb program. That project was first handled by the Manhattan District, with headquarters in New York. After the bombs were dropped on Japan, the Manhattan District evolved into the Atomic Energy Commission and the headquarters were moved to Washington. In 1945, the government commandeered all of the uranium in the nation and took over the operation of all plants at which uranium was handled for any purpose.

The Vitro plant, at Canonsburg, Pennsylvania, not far from Pittsburgh, was taken over, a high fence was built around it and heavy guard was on 24-hour duty. A carload or two of ore I had at the plant was taken over, but eventually paid for.

As late as January 1947, no program had been set up by the newly-created Atomic Energy Commission for handling the uranium-bearing ores of the West. After a considerable amount of correspondence and long-distance calls, Senators Edwin C. Johnson--later Governor of Colorado--and Eugene D. Millikin, both of Colorado, and both members of the Joint Congressional Committee on Atomic Energy, arranged for Mr. Fendoll A. Sitton, a prominent citizen and ore producer, of Dove Creek, Colorado, and myself to meet with the Atomic Energy Commission, in Washington D.C., at noon on February 14, 1947.

We met in the Senate Office Building, as scheduled, with the full Atomic Energy Commission, headed by the chairman, who had just been appointed to the position by the President, but whose appointment was still under fire in the Senate, and Senator Edwin Johnson present.

After telling our story, the Chairman said very frankly: 'I just as well tell you gentlemen, I don't know the first thing about uranium. I don't even know where it comes from.' However, he said he would have a man flown down from New York that afternoon. He was in charge of a portion of the Manhattan District that had not yet been moved down to Washington, after the creation of the Atomic Energy Commission, and would know the answers.

That afternoon, Mr. Sitton and I were ushered into the presence of this New Yorker, a certain Lieutenant-Colonel, under heavily-armed guard, for as some of you may have known, anything at that time dealing with uranium was strictly

'Hush! Hush!' Uranium was not even mentioned by name--a code word was used instead. Anyway, this man said: 'Well there's no use in my trying to fool you folks--I don't know a d--- thing about uranium.' Well, we didn't get too much satisfaction out of this missionary trip to Washington except that we did get a promise that a full investigation would be made, in due course of time, of the uranium possibilities out here in Southwestern Colorado and Southeastern Utah, but it took a very long time for that to materialize.

Later in 1947, Mr. Ray Bennett, a business associate of mine, of Denver, and I made another trip to Washington, still without much encouragement, so we went on up to New York to confer with the man who was in charge of the Geological branch of the Atomic Energy Commission, not yet transferred to Washington. This party stated, very definitely to us, 'There just isn't enough uranium in the West to be of any interest. We can get all the uranium we want from Canada and South Africa.' How wrong this man's prediction turned out to be!

In a letter dated December 16, 1947, signed by both Senators Johnson and Millikin, this said: 'Dear Mr.Balsley: We have been urging the Atomic Energy Commission to take effective steps to encourage the exploration and development of our domestic uranium-bearing ores. It is our understanding that the Atomic Energy Commission desires to have your viewpoint.'

Then, under the date of February 7, 1948, almost a year after our first trip to Washington, I had the following letter from Senator Ed. C. Johnson: Dear Mr. Balsley: Thanks for your good letter. Senator Millikin and I have had a long, hard fight for recognition of our uranium production possibilities. During the past two weeks, we are beginning to see our efforts bear fruit. You may be certain it makes us feel good

and you may depend upon us to keep plugging.'

Well finally, an extensive and thorough exploration program was initiated by the Atomic Energy Commission here in our section of the country, resulting in an unbelievable amount of uranium being discovered, which lead to the historical and long-to-be remembered Uranium Boom of the 1950s.

Much has been written and recorded regarding that era, with which most of you are undoubtedly familiar. It would take a long time to re-tell that story, so I shall not attempt to go into the many ramifications of that tumultuous period at this time.

In closing, may I present this little episode? For a number of years past, I have had stored in my warehouse, here in Moab, approximately a ton and one half of beautiful, canary-yellow high-grade uranium ore. It was just too pretty and rare to sell the mills, so I kept it--for sentimental reasons, I guess. As you know, the emanations from uranium-bearing ore can be picked up from the air, with the assistance of a good Geiger counter or scintillator. Well, on several occasions during the Uranium Boom, planes would circle around my place, picking up those emanations. Then, the folks from the plane would come to inform me that they had discovered a high-grade uranium mine in my back yard, whereupon I would tell them: 'Yes, I know, it is right over there in my storehouse.'

'Thank-you.'[1]

David Kimmerle, a Blanding, Utah resident further illustrates the early history of mining in his document, "Cottonwood Vanadium Mill 1937".

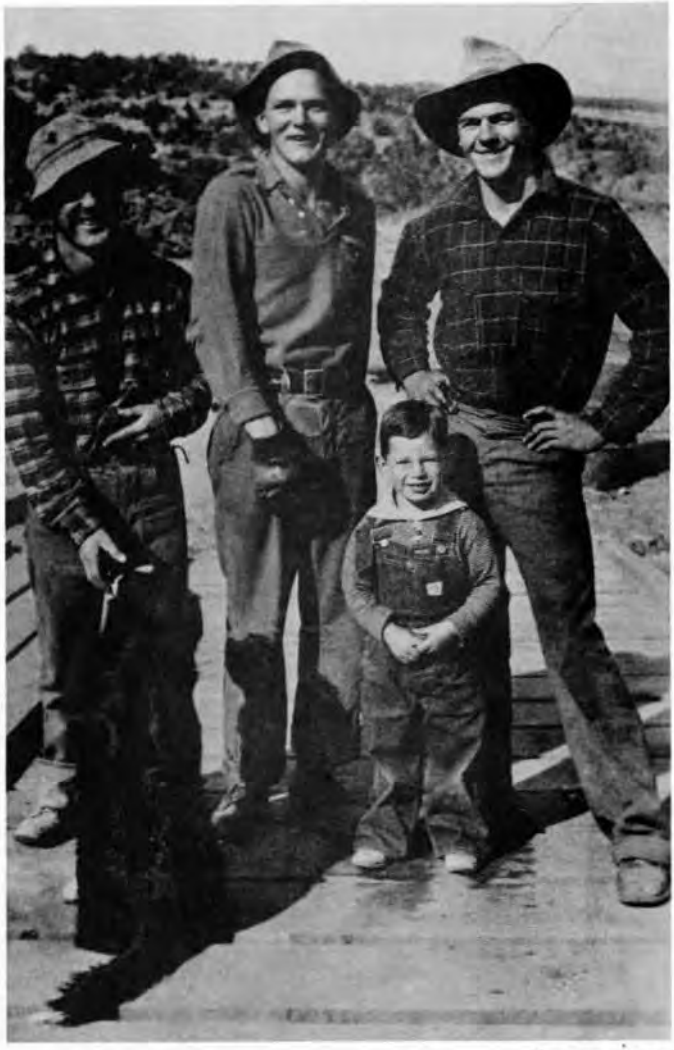
Frank Garbutt was the financial partner from Los Angeles, California. Howard J. Kimmerle was the Operator-Manager. The Cottonwood Vanadium

Mill's location was in San Juan County, Utah, 12 miles west of Blanding, Utah, T 37 So R 21 East Section 3 on the north side of Cottonwood Wash. The mill was built in six tiered levels so the milling process could occur by gravity feed. Water was available from the wash less than 50 yards away.

The machinery used in the mill came from California. It was transported by rail to Thompson, Utah, then by truck to the mill site. When the larger items, like the roaster and boiler, were loaded and transported to Blanding, it required road reconstruction while enroute at places like Peter's Hill north of Monticello, Devil's Canyon, and Westwater Canyon west of Blanding.

Vern Rowley put up a sawmill on site to cut lumber for the mill. The timber turned out to be dangerous as it was 'pitchy'. The timber next to the roaster heated up as the roaster required high temperatures. This pitch sap caught fire like hot tar and burned so quickly and so hot it could not be controlled. The mill burned to the ground and had to be re-built . This mill eventually was sold to the 'Blanding Mine Company'. The new owners were Marvin Lyman, Vet Bradford, and some Cortez, Colorado people with money.

The ore for the mill was mined by hand. Geologically, it was in the Morrison Formation 'Salt Wash Member' immediately adjacent to the mill. The first ore was exposed on the surface, eroded by Cottonwood Wash. Contract miners used star drills, hand held by one man and struck by a hammer swung by another man. Ore was transported by wheelbarrow and later track to the portal, loaded into a pick up truck and delivered to the mill site about 100-200 yards away. The Shumway families in Blanding were among those contract miners.



(Courtesy of author)

Warren Cliburn-Gene Blickenstaff-Howard Kimmerle "Moki"-Sonny Kimmerle (son of Bill and Gertrude Kimmerle).
Taken at Cottonwood, San Juan County, Utah while building the vanadium mill.

The first ore came from Spring Creek portals to the west of the mill site and from the south of the Howard Balsley claim. Several years later the 'Big Hole' vein was found. The ore ran consistently ten times as much vanadium as uranium by weight per ton, but nobody had use for the uranium. They did not extract it.

Enough ore was not the problem for this mill venture. The problem seemed to be milling. The vanadium was collected as red cake only after critical temperatures were maintained for proper time periods. It was difficult to maintain consistency in these requirements. The red cake was then heated to melting point and became black cake pancakes. It was then broken into pieces and put into a burlap bag. The vanadium was sold to Belgium until Hitler invaded and annexed Belgium as part of Germany. The United States Government banned sales to Belgium with impending war looming ahead. Ford Motor Company was the only other buyer for vanadium, but at a lower price. Leland Shumway of Blanding can remember in detail milling processes used at this mill. He is still alive.[2]

VANADIUM DEPOSITS IN THE EGNAR-SLICK ROCK DISTRICT, SAN MIGUEL COUNTY, COLORADO

Vanadium ore was discovered in the Egnar-Slick Rock District during the 1912-1923 period of "carnotite" mining when several of the deposits were developed on a small scale and mined chiefly for the high-grade uranium ore. From 1924 to 1930, activity was mostly limited to mines development and assessment work.

From 1931 to 1935 the Shattuck Chemical Company mined 2,000 to 3,000 tons of high-grade uranium and vanadium ore and operated a small plant at Slick Rock, Colorado. North Continent Mines Incorporated obtained the Shattuck Chemical

Company's holdings in the district in 1935 and increased production from 200 tons of ore in 1935 to about 6,400 tons in 1942. The company reconstructed its mill at Slick Rock in 1942 and increased their capacity from 15 to approximately 30 tons per day. The U.S. Vanadium Corporation of America acquired many claims in the district during 1940 and began intensive development and prospecting. Other mine operators were active from 1937 to 1941, but only a few produced significant quantities of ore. In 1941, three major companies held about 200 of the 260 claims in the district and produced approximately 80 percent of the ore. About 52,500 tons of ore containing 1 to 4 percent V2 05 had been mined from the district by the end of 1941. Production during 1941 doubled that of 1940.[3]

In June 1942, the Metals Reserve Company, in order to stimulate production, authorized their purchasing agent, the U.S. Vanadium Corporation, to raise the price of purchased ore 50 to 100 percent above the existing price of 21 cents per pound of contained V2 05 in ore containing 2 percent V2 05. The Vanadium Corporation of America and the U.S. Vanadium Corporation likewise raised their schedule of prices paid for purchased ore, but production of the mines operated by these companies was not influenced by the price increase. Existing mines and equipment in the district might have yielded more ore in 1942, but scarcity of labor and temporary unseasonable shut downs of some of the better mines were the factors chiefly responsible for holding production nearly to the 1941 level.[4]

NOTES: CHAPTER ONE

[1]Howard W. Balsley, to Mr. and Mrs. Bronson, circulated late 1960s, copy of letter in hand of Robert Sullenberger, Arvada, Colorado.
[2]David Kimmerle, " Cottonwood Vanadium Mill," Copy of document in hands of Robert Sullenberger, Arvada, Colorado.
[3]W.L. Stokes, Vanadium Deposits in the Egnar-Slick Rock District, San Miguel County, Colorado. U.S. Department of Interior, Geological Survey. Prepared for the U.S. corps of Engineers, Manhattan Engineering District, Washington D.C., 1942, (RMO-50).
[4]Ibid.

(Courtesy of Author)

U.S.V.C.'s Mine Employees, Colorado Mining Camp (1940).

CHAPTER TWO
WORKING IN THE U.S. VANADIUM CORPORATION IN THE 1940s

In the Summer of 1940 Alvin Patcheck and I left Durango, Colorado in his 1928 Chevrolet for Grand Junction in search of employment with the United States Vanadium Corporation. The company operated vanadium mills at Rifle and Uravan, Colorado, with their headquarters located in Grand Junction, Colorado. Patcheck was my high school classmate who grew up on a farm in Thompson Park west of Durango.

The Corporation's Grand Junction office suggested we go to Uravan where their hiring office was located. After a 90 mile trip over a long, dusty dirt road, we arrived at the mill's hiring office and found a long line of men waiting to make application for employment. Dick Morris was the company's representative in charge of hiring miners and mill employees. He filled his hiring quotas before we reached the employment window. We set up camp on the San Miguel River, about three miles upstream from the mill site, and each morning joined others in a line at the company's employment window. After nearly a week of sweating out the line, we were hired for work on a mining claim survey crew located near Egnar, Colorado. United States Vanadium Corporation was in the process of purchasing a large number of uranium mining claims on the Dolores River Canyon rim north of

Egnar, Colorado. Two local ranchers, Snyder and Dunning, located the claims and our assignment was to survey the claim boundaries and calculate their coordinates for company maps and county mining claim records. William Nichols, a New Mexico School of Mines graduate, was in charge of the mining claim surveys, while George Argyle, a Colorado School of Mines graduate, was the mining superintendent who also possessed administrative authority of the company's mining camp.

EGNAR, COLORADO MINING CAMP

U.S. Vanadium Corporation was concentrating on an exploratory drift tunnel, building ore storage bins and bulldozing access roads to the mine site when we arrived at the camp in the summer of 1940. North Continent Mines managed a small uranium-vanadium mill at Slick Rock on the Dolores River which was visible from the U.S.V.C mine. We heard the mill's steam whistle and used it to begin the day's shift, break for lunch and quit work at the end of the day.

The camp constructed a main street with employee tent houses lined up on each side and a boarding house located at the street's end. Mrs. Zufelt, a Mormon lady from Monticello, Utah became the camp's cook and manager of the boarding house. The food was adequate with the exception of meals served during hunting season, since they contained venison and bear meat. The company deducted our board bills from the employees' paychecks.

Miners, carpenters, cat skinners, ore truck drivers and surveyors resided in canvas tents mounted on wooden platforms and equipped with small cast iron wood burning stoves. When snow covered the tents and outside temperatures dropped far below zero the stoves offered little in the way of heating but provided a means for

heating shaving water. The weather remained pleasant and mild through the summer and fall of 1940, allowing us to complete most of the claim surveys before the company transferred us to Coal Bed Canyon near Monticello, Utah for additional surveys of mining claims the company showed interest in buying.

Some rather interesting characters lived at the Egnar mining camp. In particular Cassidy, a camp carpenter, also a direct descendent of the desperado Butch Cassidy. Another man, Mike Dillon, entertained camp members for hours on end by spinning stories of his underground mining experiences in many of the nation's hard rock mines. A man named Bostwick had a criminal record and carried a large scar across his throat that he received in a fight. Bostwick proved one of the camp's more undesirable residents.

One of the miners got married and was assigned to a tent house on the camp's main street. For lack of something better to do, George Argyle, the camp's boss, decided it fitting and proper to give the newlyweds a shivaree. When the couple turned out their lantern to retire for the night, several boxes of company dynamite were detonated near their tent, blowing it from its wooden platform. Cortez residents heard the blasts fifty miles away. The celebration ended with the groom loading his bride in a wheelbarrow and strolling her down the camp's main street.

COAL BED CANYON MINING CLAIM SURVEYS

Reaching the Coal Bed Canyon mining claims required about a three mile drive down the canyon's creek bed. After several days of good surveying weather, a severe winter storm moved in during the night and dumped several inches of snow on our camp. The situation became rather serious because of the deep snow drifts in the

(Courtesy of author)

U.S. Vanadium Corporation's Egnar, Colorado mining camp (1940).

canyon, plus the fact that we traveled a long stretch of unplowed country road to return to the main highway. We broke camp and chained up the old 1928 Chevy for the long crawl out. Luckily we made it out and proceeded back to the company's Egnar mining camp.

WINTER MUD AND IMPASSABLE ROADS

The Egnar camp also received substantial snowfall. The eves of the tents all contained large icicles that reached the ground. We spent several weeks camp bound because of snow and mud, wading through knee deep snow drifts, attempting to complete more mining claim surveys before returning to Uravan. The roads in and out of the camp became impassible because of bottomless mud holes and deep ruts cut by company ore trucks hauling supplies in from Uravan and uranium ore back from the Egnar mine. The dirt road through Disappointment Valley became totally impassible, leaving ore trucks unable to bring in essential supplies, such as dynamite and drill rod.

Large D-8 caterpillar tractors pulled the ore trucks to and from the ore bins at the mine site. The depth of the ruts obstructed camp personnel from driving their vehicles to the Egnar Post Office. Bill Nichols attempted to drive his 1937 Chevrolet to the post office and ended up buried in the mud. After several hours of fruitless effort in trying to dislodge the vehicle, he and his passengers decided to spend the night in the car and hike to the mining camp in the morning. During the night, one of the passengers lit a cigarette and ignited fumes from the gasoline can stored in the trunk. Nichols and his passengers escaped without injury, but left the car completely totaled. The car remained on the road for several weeks before a wrecker recovered it.

(Courtesy of author)

U.S. Vanadium Corporation's mining claim survey camp in Coal Bed Canyon, Utah (1940).

SURVEYING IN THE COMPANY MINES

After transferring to Uravan from the Egnar mining camp, Alvin Patcheck, Bill Nichols and I spent several months surveying in the company's Long Park mines south of Uravan and in U.S.V.C.'s coal mine near Nucla, Colorado.

Two of the richest mines in the Long Park mining district, the R.A.M. (Ragged-Assed-Miner), and the Sharkey, contained large petrified trees rich in carnotite uranium ore. Miners usually stripped down to their waists because of high mine temperatures. The poorly ventilated mines contained high levels of radiation. Miners became aware of the fact that those working in uranium mines often contracted lung cancer and died prematurely. The scarcity of employment opportunities in Southwestern Colorado meant miners accepted radiation exposure as a fact of life and disregarded the enormous risks involved.

HIGH-GRADING URAVAN'S BEST URANIUM ORE

Colorado's gold mining history frequently documented accounts of miners carrying off high grade gold and silver in their lunch boxes and other containers. Uravan mines proved no exception. Long Park miners accused Joe Weston, the company's mine supervisor, of stealing high grade carnotite ore from area mines. Weston requested that his employees fill empty dynamite boxes with the mine's best carnotite uranium ore. He was observed loading the boxes into his personal pick-up and driving off into the night. The miners knew nothing of U.S.V.C's involvement in the government's Manhattan Engineering Project nor of the ore's final destination. Weston hauled the ore to Grand Junction, Colorado. From Grand Junction the ore was transported to Union Carbide Corporation in Oak Ridge, Tennessee for further

Blair Burwell Sept

Uravan, Model Town 12/31/37

Uravan is a neat town of 600, at the confluence of the Dolores and San Miguel rivers, ninety-four miles south of Grand Junction. It is a modern community, with comfortable small homes, a hospital, theater, hotel, school and stores. It was built for miners of the carnotite ores, containing vanadium and uranium, which are found there in great richness. This picture by Dean of Grand Junction shows some of the homes of Uravan, with the plant of the U. S. Vanadium corporation in the background.

A URAVAN, COLORADO PHOTO FROM A DECEMBER 31, 1937 ISSUE OF THE DENVER POST. BLAIR BURWELL WAS THE UNITED STATES VANADIUM CORPORATION'S SUPERINTENDENT WHEN THIS PHOTO WAS TAKEN AND HIS HOME IS VISIBLE IN THE LOWER RIGHT SIDE OF THE PHOTO. A URANIUM MILL WAS BUILT ON THE URAVAN MILL SITE AS PART OF THE U.S. GOVERMENT'S MANHATTAN ENGINEERING PROJECT AT THE BEGINNING OF WORLD WAR II. NOTES BY ROBERT SULLENBERGER OCTOBER 16, 1992.

refinement. The ore came from mines owned by the United States Vanadium Corporation, a subsidiary of Union Carbide Corporation. The uranium, in all probability, ended up in the first atomic bomb blast at Trinity, New Mexico and in the two atom bombs dropped on Japan in World War II.

CLAIM JUMPING IN THE LONG PARK MINING DISTRICT

The Vanadium Corporation of America (V.C.A.) owned mines adjacent to U.S.V.C's mines in Long Park. Tension between the two companies began heating up over claim boundary lines. U.S.V.C. discovered that Vanadium Corporation of America's underground miners mined ore bodies on claims they owned. When making a survey of the diamond core drill hole locations on one of U.S.V.C.'s claims, Bill Nichols, our engineer, had just removed his transit from one of the core drill stations when V.C.A's miners working underground fired their round. The blast broke into the core drill hole and blew out the 4x4 wooden post that marked the hole location on the surface of the mining claim. The post shot skyward like a rocket, almost wiping out our engineer. The Vanadium Corporation of America reached an out-of-court settlement with U.S.V.C. over mining ore bodies that did not belong to them. After this incident, we became apprehensive when setting up our transit over core drill hole location posts in Long Park.

SURVEYING ACCIDENT IN THE SHARKEY MINE

A surveying accident in the United States Vanadium Corporation's Sharkey mine cut short engineer Bill Nichols' career with the company. Nichols had his transit set up in the mine's main haulage tunnel for the purpose of determining the location and size of an adjoining stope. We were

busy taking measurements when an ore train ran over the transit. We picked up the broken pieces of the transit and headed back to the engineering office at Uravan. Here we learned that the transit belonged to Blair Burwell, a Vice President of Union Carbide and President of United States Vanadium Corporation, and that Nichols would in all probability be fired when Burwell learned that the transit proved a total loss. Nichols resigned that day and requested that his last paycheck be mailed to his family's home in Socorro, New Mexico. After the surveying accident I was transferred to the company's machine shop in Uravan. My work there included repair of mine and uranium mill equipment and heavy duty earth moving machinery.

GETTING RID OF WORN OUT MINE ROCK DRILLS

During the early part of World War II, a serious shortage of replacement parts for mine rock drills developed and the company's drills continually broke down. Miners often lost money when they failed to complete their shift's drilling activity because of breakdowns in machinery, since they were paid on a contract footage basis. Disgruntled miners took corrective action on their own and eliminated the worn out drills by discarding them in ore storage bins. Ore in the bins was hauled by truck to Uravan where it ended up in the mill's Simons rock crushers. The crushers, unable to digest the rock drills, were put out of commission every time one of them entered it. This method of rock drill disposal stopped ore feed to roaster furnaces and caused the mill to be shut down until maintenance crews repaired the crushers. Mill down time, because of crusher failure, proved a major concern to the company's management and to those of us on crusher duty who received calls for

repairs in the middle of the night.

U.S. VANADIUM CORPORATION'S URAVAN & DURANGO URANIUM MILLS

URAVAN MILL

Blair Burwell, a Colorado School of Mines graduate and a pioneer in uranium-vanadium mining and ore refining, served as President of U.S. Vanadium Corporation when the Uravan mill construction began in 1936 & 1937. Burwell also held the position of Vice President of Union Carbide. He worked out of the corporation's main office in New York City during the period U.S.V.C. became involved with the World War II Manhattan Engineering Project.

RADIATION HAZARDS IN URANIUM-VANADIUM MILL MAINTENANCE

The Uravan mill utilized Skinner and Edwards furnaces in the ore roasting process. The Skinner roasters contained several vertical hearths with large rabble arms mounted in a rotating vertical column. The rabble arms moved crushed ore from each hearth to the one located directly below it. The rabble arms often broke loose from the main column, necessitating its replacement with a new arm. Temperatures in the hearths were cooled down to the point that workmen, clad in asbestos suits, could enter through access holes to replace the faulty arm. Workmen on the furnace arm change crews became exposed to very high levels of radiation emitted from hot uranium ore lying on the furnace hearths. Adam Seager, an associate of mine in the company's machine shop, often worked in roaster maintenance and uranium liquor pump repair. Consequently, he died of throat cancer due to radiation exposure.

(Courtesy of author)

U.S. Vanadium Corporation's vanadium mill at Uravan, Colorado (1946).

In my machine shop activity, I often machined the tapered ends on the roaster arms to fit sockets in the arm's center column. When arms failed to match with the column, it became necessary to enter the furnace to determine the cause of the breakdown. Workmen, including myself, became exposed to a significant amount of radiation during replacement operations.

URAVAN'S INDUSTRIAL ACCIDENTS AND THE MANHATTAN PROJECT'S FIRST URANIUM MILL DURING WORLD WAR II

The Edwards roasters were low horizontal roaster furnaces that utilized open rotating line shafting above them. The shafting drove moving machinery inside the furnaces. The most gruesome industrial accident I experienced involved an Edwards furnace.

A night shift employee walked under one of the rotating shafts and caught the back of his coat, leaving him unable to free himself. The next morning he was discovered by members of the day shift crew with his legs completely beaten off by protrusions and still rotating with the shaft.

When America entered World War II, the United States Vanadium Corporation began construction of the U.S. Government's Manhattan Engineering Project sponsored uranium extraction mill at Uravan, Colorado. In 1942, construction employees from Stearns Rogers Engineering firm in Denver and U.S.V.C. personnel built the new uranium mill. I participated in this construction by fabricating and machining necessary parts.

Immediate source of ore for the new uranium mill lay in a large tailings pile on the banks of the San Miguel river. The tailings dated back to the early 1900s when Standard Chemical Company owned a radium mill on this site. This mill served as the source for the radium samples used by Madame Curie in her historic radium

experiments. Colorado State Highway 141 bisected U.S.V.C.'s mill site, with the tailings on the opposite side of the highway from the newly constructed mill. A cable-drawn scraper blade moved the tailings across the state highway. An employee operating an air slusher motor that controlled the blade movement got his glove caught in a cable as it wound on the air motor drum. The accident severed the man's hand and left the tendons attached to the fingers. Superintendent Al Coleman carried the hand to the company hospital in the hope that Dr. Olsen could re-attach it to the man's arm. Unfortunately, the Doctor's attempt failed.

URAVAN'S POWER PLANT OUTAGE

U.S. Vanadium Corporation operated its own power plant which provided electricity for the mill, company houses, post office, theater, commissary, school, and boarding house. The power plant used coal fired boilers to produce steam for the generator turbine. An auxiliary back-up system, consisting of a large Fairbanks V-12 diesel connected to a generator, supplied power when the main system underwent repair.

One night the power plant operator fell asleep on the job and failed to maintain adequate steam pressure to operate the turbine generator. When he awoke, he realized a serious problem had arisen. He then rushed into the auxiliary power plant room and fired up the diesel engine, placing it on line without first making sure it was in phase with the steam driven turbine generator's electrical output. The expensive diesel engine, along with its generator, literally exploded. The power plant operator lost his life in the accident.

PLUMBING DIFFICULTIES IN URAVAN'S MANHATTAN PROJECT URANIUM MILL IN 1942

When the mill was completed and ready for its first pilot run, company officials from Union Carbide Corporate offices in New York and General Groves, who headed the government's Manhattan Project, witnessed the first uranium yellow cake precipitation process at Uravan's new mill. The demonstration became a dismal failure when the liquor, containing high concentrations of uranium, ended up in the San Miguel river. Due to the pipe fitters' error in hooking up the plumbing betwen the tanks, the uranium-rich liquor ended up in drain pipes that discharged into the river rather than into the desired precipitation tank.

UNION ORGANIZING ATTEMPT AT URAVAN

U.S. Vanadium Corporation employees lacked unionization in the early 1940s, so the Mine and Smelter Union representatives in Denver actively sought the organization of a union at Uravan. Most employees took a pro-company stance since few other employment opportunities existed in southwestern Colorado.

In an effort to organize workers, the union in Denver dispatched an organizing team to Uravan. The company's management learned of the union's departure from Denver and assembled a greeting committee comprised of the largest and toughest of the mill's employees. The welcoming crew intercepted the union organizers on Dallas Divide near Ridgeway, Colorado. Rumors spread of the Uravan crew overhauling the organizers and returning them to Denver before they accomplished their mission.

U.S. VANADIUM CORPORATION'S SALT WORKS AND SULFURIC ACID PLANT

The Uravan mill consumed large quantities of salt and sulfuric acid in the uranium-vanadium refining process. These essential chemicals arrived in Uravan from Salt Lake City, Utah and Grand Junction, Colorado. Salt came from Salt Lake City, while Grand Junction supplied sulfuric acid. In an effort to reduce transportation costs of salt, U.S.V.C. built a salt recovery facility in the Paradox Valley near the Dolores River. They pumped salt solutions into evaporative ponds and hauled salt into a refinery building located at Uravan. The company assigned project charge numbers to different segments of the mill operation and workmen filled in the applicable work charge numbers daily on their time cards. Goof-off time always ended up charged against the salt works number. As a result, the project proved uneconomical and eventually failed.

During the uranium boom of the 1950s, U.S.V.C. built a sulfuric acid plant at Rico, Colorado. Old metal mines in the Rico area contained large quantities of iron pyrite, an essential ingredient in manufacturing sulfuric acid. The Rico plant furnished sulfuric acid to the company's uranium mills in Uravan and Rifle, Colorado. The closure of the Rifle mill in 1972 left the sulfuric acid plant abandoned.

LEISURE TIME ACTIVITY AT URAVAN

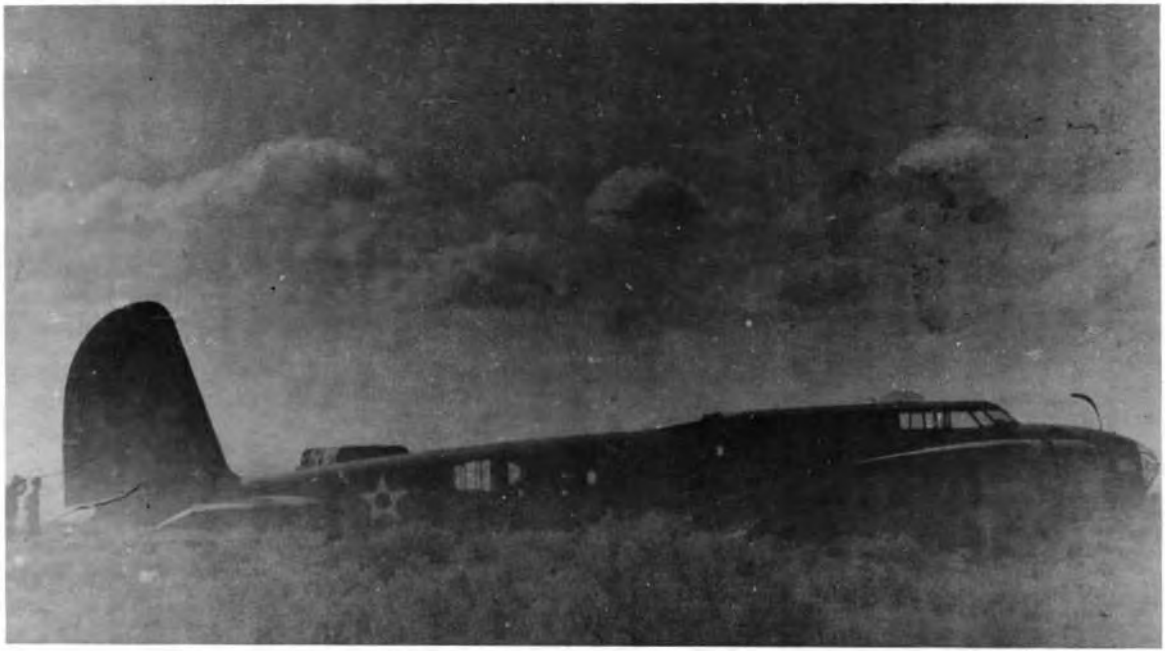
During the early stages of World War II a notable event occurred at Uravan. Deer hunting proved a favorite out of season pastime for company employees. This activity led to a massive raid on the company town by the Department of Fish and Game. A mill employee seeking reward money tipped off officials in Denver by providing

the names of employees hunting out of season.

Game wardens arrived at the plant's main gate just before noon. The company restricted access to the mill for national security reasons. All individuals entering the premises required a pass issued by Al Coleman, the plant's superintendent. Coleman suggested the wardens join him for lunch at the boarding house while waiting for their passes from the personnel office. During the lunch break, runners throughout the mill advised employees of the impending raid. Mill operations ceased while employees rushed home to conceal their venison. The game wardens found none of the meat in the company housing, but some less fortunate individuals residing in private housing did get arrested for illegal possession of deer meat. The company paid their fines in Montrose, Colorado and deducted a given amount from their paychecks until the fines were paid back.

UNIDENTIFIED BOMBER OVER URAVAN DURING WORLD WAR II

In the winter of 1942, Uravan residents became quite alarmed when a large low-flying aircraft flew over the mill site during a snow storm. Uravan implemented tight security measures, fearing potential wartime sabotage. The company immediately reported the incident to the military command at Lowry Air Force Base in Denver. The Air Force responded by dispatching fighter aircraft to investigate the presence of such a large aircraft over a government restricted area. The plane, a friendly B-17 bomber, turned out to be lost, low on fuel, and looking for a place to land. It crashed on a sage brush covered flat west of Nucla, Colorado, but all of the crew members escaped injury. They disassembled the wreckage and trucked it to Hill's Air Force Base in Odgen, Utah for repair.



(Courtesy of author)

A United States B-17 crash at Nucla, Colorado (1941).

U.S VANADIUM CORPORATION'S URAVAN MILL AFTER WORLD WAR II

In 1946, the Uravan mill was no longer in operation. Few people remained in the company town. The abandoned company houses, broken windows, missing tin siding, and removal of equipment from the site's interior became signs of its desertion. Jerry Foster, a long time Uravan employee who previously managed the company's commissary, remained as the mill's caretaker. The 1946 photo shows the Manhattan Engineering Project's uranium mill on the left, the ore roaster buildings near the center, and the vanadium recovery building on the right.

During the uranium boom days of the 1950s, U.S.V.C. dismantled most of the World War II mill and built a new uranium mill on the old site. The company resumed their vanadium and uranium refining activity and continued operation until March 1981. The company retained approximately 110 employees to do rehabilitative, maintenance and security work at the plant. In August 1981, the mailing of recall notices brought the mill's work force to a normal level of 180 employees. On August 27, 1981, a San Juan Record article addressed the re-opening of the Uravan mill by stating:

The mill opening will not affect Union Carbide's mining activities in the Uravan area. About 300 workers are employed in the mining operations. A company spokesman said that Union Carbide decided on the 6-month shutdown, as they had firm commitments for only half the mill's total annual production. The mill has a capacity of 750 tons per day.

An October 3, 1984 article in the San Juan Record read:

UMETCO MINERALS suspends milling operation--

Because of continuing depressed conditions in the U.S. uranium industry, UMETCO MINERALS (formerly U.S. Vanadium Corp.) will suspend milling operations in Uravan, Colorado in November of this year [1984], according to E.W. Shortridge, Uranium Operations Manager for UMETCO MINERALS. This shutdown will reduce employment by about 110 employees, Shortridge said. A small force of hourly and salaried employees will be retained to maintain the mill in a standby condition. UMETCO closed its mines in the Uravan area at the end of 1983 and the mill has been running ore stockpiled from earlier mining activity, as well as toll processing ore for other concerns.

The length of time that operations will be closed at Uravan will depend on conditions in the marketplace. UMETCO continues to believe that market conditions will eventually improve and allow a return to normal operations, however it is expected that production will continue to be severely curtailed during the next few years.

Since its closure in October 1984, U.S.V.C. dismantled employee housing units and other structures. The uranium mill remains on the Uravan site. Club Mesa, just south of Uravan, served as the disposal site of uranium mill tailings. A movement is presently underway to save the old Standard Chemical boarding house, built in the early 1900s, as a Colorado historic landmark. It remains on the site.

U.S VANADIUM CORPORATION'S DURANGO, COLORADO URANIUM MILL HISTORY

The American Smelting and Refining Company erected a lead smelter in Durango, Colorado in 1880 to process ores from the Silverton, Colorado mines. It continued to operate until 1930 when the Great Depression forced its closure.

In the spring of 1942, the United States

Vanadium Corporation, a Union Carbide subsidiary, began converting the lead smelter to a mill capable of processing vanadium and uranium ores. The company's Uravan and Grand Junction engineering departments became responsible for the conversions.

The goal of the new mill was to furnish vanadium to the Metals Reserve Company, a division of the Manhattan Engineering Project. The establishment of the Metals Reserve Company by the Federal Government aided in purchasing of strategic materials needed during World War II.

Blair Burwell, a pioneer Colorado mining engineer, served as the Durango smelter's Chief Engineer during its construction in 1880. Sixty-two years later, his son, Blair Burwell II, became Chief Executive Officer responsible for revamping the old smelter to handle uranium and vanadium ores. Burwell II served as Vice President of Union Carbide Corporation in New York. Later, he assumed the presidential position with U.S.V.C. during the mill's four years of operation as a uranium mill facility.[1]

Tom Brock, a long time U.S.V.C. Uravan employee, received the appointment for Construction Superintendent for the Durango mill, along with John Carney, transferred from Uravan to a mill foreman's position at the new site. As Chief Engineer, Burwell hired Lawrence Sullenberger.

ORE STOCKPILE REPORTS and ORE SOURCES FOR U.S VANADIUM CORPORATION'S DURANGO URANIUM MILL

A diary kept by Lawrence Sullenberger provides an accurate record of ore processed through the Durango mill from 1942-1944. He also logged his survey activity while employed at U.S.V.C.'s Durango mill. Excerpts from his diary appear below:

When the mill began operation in 1942, a mix of mill tailings from Blanding, Utah, crushed ore from Moab, Utah mines, and crushed ore from the company's Dove Creek, Colorado ore stockpile was fed to the mill.

A December 1, 1942 recap of the ore stockpile at the Durango mill site shows the mill received 14,740 tons of ore from May 15 to December 1, 1942. Of this amount, the mill processed 8,027 tons. V2 05 content averaged 1.81 percent.

There were 1205.54 tons of Dove Creek ore on the mill site when the plant began operations and 944.89 tons had been processed by November 30, 1942. The mill's stockpiles contained Blanding mill tailings, Dove Creek crushed ore, Dove Creek mill ran ore, Farmington crushed ore, and Moab mine ran ore at the time of the November 30, 1942 ore stockpile report.

On December 1, 1942, there were 954.92 tons of Blanding mill tailings on the Durango mill site and tonnage figures for other sources of ore stock piled in Durango are shown in the table below:

UNIT	TONS
Dove Creek #2 pile	944.89
Blanding tailings	954.89
Mixed feed #1	1,239.27
Dove Creek #4 pile	227.86
Moab mine run	91.90
Dove Creek #3 pile	327.12
Thompson, Utah #3 pile	427.81
Farmington, New Mexico	676.95
Dove Creek #1 bin	2074.00

On March 29, 1943 there were 531.780 gross tons of Blanding, Utah tailings in a pile at the Durango mill and 306.907 gross tons of Dove Creek crushed ore in the Dove Creek #2 pile.

On March 31, 1943 the Durango mill site

contained 338.789 gross tons of ore in Dove Creek bin #1. For the period April 1 through April 7, 1943, 161,620 lbs. of ore were received at the Nisley & Wilson Gateway, Colorado mill which was an ore collection facility for the Durango mill. An April 7, 1943 report shows 75.6225 tons of mine run ore and crushed ore in 28 piles in Gateway, Colorado awaiting shipment to the Durango mill.

The Farmington #22 pile of crushed ore located by the smelter's old smokestack contained 108.712 tons on April 1, 1943.

On April 3, 1943 the Moab ore bin near the company's office on the mill site contained 32.562 tons and the Moab ore bin by the roaster building contained 150.239 tons.

The company's Thompson, Utah ore stock pile facility had 30.69 tons of crushed ore in bins and 1.0000 ton of mine run ore on the ground on April 6, 1943. The Grand Junction, Colorado ore pit stock pile contained 1586.81 tons of ore on the same date.

From the time U.S.V.C. began operations at the Durango mill in 1942 until its closure in 1946, the company purchased substantial quantities of ore from the following Moab, Utah mines: Cactus Rat, Parzo #6, Telluride #18, Little Pitts #8, Trachyte, and Flat Top. U.S.V.C. trucked ore from these mines to the Thompson ore storage and railroad facility. At Thompson, the ore was loaded on standard gauge rail cars for shipment over The Denver and Rio Grande Western Railroad to Alamosa, Colorado. In Alamosa, ore was transferred to Denver Rio Grande Western Railroad's narrow gauge rail cars for the remaining trip to Durango. Ore traveled approximately 800 miles between Thompson and Durango.

On April 3, 1943, Moab uranium ore stored at the Thompson rail head facility was loaded onto

Metals Reserve Company's railcar #51 (Union Pacific #22023) for shipment to Union Carbide Corporation's Oak Ridge, Tennessee plant. Four standard gauge railroad cars of Moab ore traveled from Thompson to the U.S.V.C.'s Durango mill during the month of March 1943.

United States Vanadium Corporation built an ore loading dock at the railroad yard in Farmington, New Mexico in August 1942. Ore from mines located in the Carrizo Mountains, west of Shiprock, was trucked to Farmington, crushed, and transported to the Durango mill over the Denver & Rio Grande Western Railroad's branch line, a distance of approximately 50 miles.

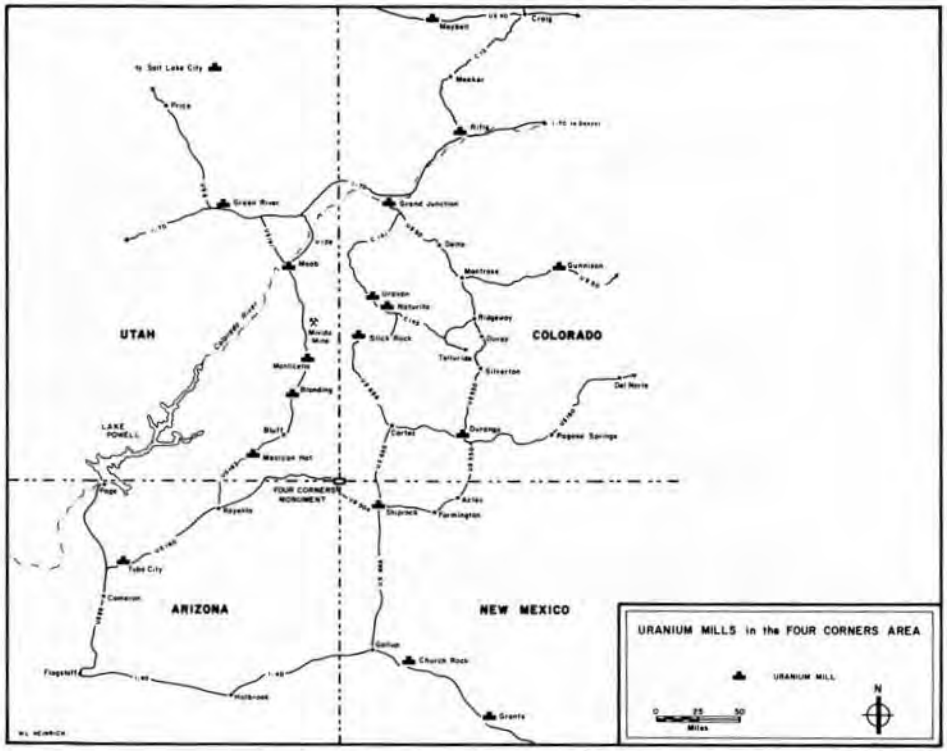
During the summer of 1942, another ore loading facility was built at Dolores, Colorado. Mine run ore from the company's Bear Creek uranium mines near Placerville, Colorado was transported to Dolores and then loaded on Denver & Rio Grande Western Railroad's narrow gauge rail cars for a 46 mile trip to the Durango mill.[2]

MINING CLAIM SURVEYS

In addition to his engineering responsibilities in Durango, Lawrence Sullenberger's activities included mining claim surveys in the Carrizo Mountains, road and mine surveys on Lightener Creek west of Durango, Hermosa mining claim surveys north of Durango, and Bear Creek mine surveys near Placerville, Colorado.

NOTES: CHAPTER TWO

[1]Blair Burwell II worked for U.S.V.C. in 1924 when they constructed their first Rifle, Colorado mill and remained with the company until 1948, when he founded Minerals Engineering Corporation.
[2]Sullenberger, Lawrence. "Ore Stockpiles Reports and Ore Sources for U.S. Vanadium Corporation." Diary. In hands of Robert Sullenberger, Arvada, Colorado.



(Courtesy of Michael Heinrich)

Map of Four Corners region uranium mines.

CHAPTER THREE
U.S VANADIUM CORPORATION'S RIFLE and VANADIUM CORPORATION OF AMERICA'S NATURITA, MONTICELLO and DURANGO MILLS

U.S. VANADIUM CORPORATION'S RIFLE MILLS

The original mill site is located approximately 0.3 of a mile from Rifle, Colorado. The site is bordered on the North by U.S. Highway 6 and 24. Tracks of the Denver and Rio Grande Western Railroad and the Colorado River serve as the southern boundaries. The new mill site resides roughly two miles west of Rifle, with the northern borders being the tracks of the Denver and Rio Grande Western Railroad and Interstate 70 and the Colorado River being the southern boundary.

OWNERSHIP

The United States Vanadium Corporation originally owned and operated the Rifle mill; however, Union Carbide purchased the mill in 1924. It retained its original name, but became a subsidiary of Union Carbide, who owned both sites.

HISTORY OF MILLING OPERATIONS AND PROCESSING AT BOTH SITES

OLD RIFLE SITE

Initially the plant was built to recover vanadium from roscoelite ore in 1924. The mill continued operations until 1932 when the failing

(Courtesy of author)

Union Carbide's uranium mill tailings pile at Rifle, Colorado (1992).

economy forced a shutdown. In 1942, the increased demand for vanadium reactivated the plant. The alteration of the process in 1946 permitted the recovery of uranium as well as vanadium. Also in 1946, the mill closed, only to re-open in 1947 under an AEC contract. Permanent closure of the mill occurred in 1958 when the new Rifle mill replaced it. The old mill processed 761,000 tons of ore from 1947 until its closure, with an average grade of 0.36 percent U3 08. Ore from the Uravan Mineral Belt, eastern Utah, Meeker and Rifle Creek was transported by truck or rail to the mill.

The plant recovered vanadium from roscoelite-type ores by salt roasting, water leaching, and the addition of sulfuric acid to the water solutions to precipitate a sodium hexavanadate red cake. In 1947, acid leaching and subsequent process steps to recover uranium were added to the old Rifle plant. The record of production prior to 1949 is unavailable, but from 1949 until the mill's closure in 1958, the U3 08 sold to AEC amounted to 2,274 tons.[1]

NEW RIFLE SITE

The mill started operation in July 1958, with the uranium and vanadium recovery circuits shutting down in December 1972. The construction of the mill as a part of a complex included the upgraders at Slick Rock, Colorado and Green River, Utah, all of which had an overall capacity of 1,000 tons per day. The products from Slick Rock and Green River were hauled to Rifle for further processing.[2]

MILL TAILINGS

After the old mill closed in 1958, 350,000 tons of tailings remained on approximately 22 acres.

(Courtesy of Denver Public Library's Western History Division)

North Continent Mine at Slick Rock, Colorado.

They were pushed back away from the railroad track, leveled out, and covered with six inches of dirt. Other mill debris was also buried in the tailings on the site.

The new Rifle mill site contained roughly 300 acres, with its tailings pile covering approximately 32 acres and containing 2,700,000 tons of debris. The company dismantled the mill in 1991-1992. As of yet, the U.S. Department of Energy has not selected a disposal site for mill tailings. Estes Gulch, near Rifle, is one proposed site under consideration.[3]

SLICK ROCK, COLORADO URANIUM MILL SITES

There are two uranium mill sites at Slick Rock: the North Continent site and the Union Carbide site. These sites are located three miles northwest of the Slick Rock Post Office, approximately nine miles east of the Utah-Colorado border and 25 miles north of Dove Creek, Colorado. These sites are .5 miles apart from each other in the Dolores River Valley at an elevation of 5,450 ft. above sea level. Typical of most of Western Colorado, this arid locale is surrounded by canyons, mesas, steep cliffs, and valleys.

THE NORTH CONTINENT SITE

Shattuck Chemical Company originally owned the site in 1931. North Continent Mines Incorporated acquired Shattuck Chemical Company's interests in 1934. Union Mines Development Corporation, a U.S. Government-established corporation, assumed ownership in 1945 for the sole purpose of supplying uranium and vanadium for the Manhattan Project. The U.S. government acquired title of the site in 1949. In 1957, Union Carbide Corporation purchased the property. From 1931

(Courtesy of Denver Public Library's Western History Division)

North Continent Mine at Slick Rock, Colorado.

until 1942 a method of acid leaching was used on ore averaging three percent V2 05. The initial mill capacity was ten to fifteen tons daily. In 1942, the installation of a rotary kiln roaster allowed for the conversion of the mill to a salt roasting process along with acid leach for the recovery of V2 05, U3 08, and a radium concentration. At that time, the mill capacity increased to 30 tons per day. An estimated 37,000 tons of ore were processed through the mill during its lifetime, creating an equal amount of tailings. The mill received ore averaging .28 per cent U3 08 and 3.0 per cent V2 05 from company controlled mines within a ten mile radius.

The tailings pile was situated on the southeast bank of the Dolores River. It covered 6 acres on the 168 acre site, with 6 inches of earth stabilizing it. All of the former mill structures have been removed, leaving no evidence of the presence of a milling operation.[4]

THE UNION CARBIDE SITE

The Union Carbide Corporation has owned and operated the site since its inception in 1956. The mill up-grader became operational in 1957. Mines in the Slick Rock area delivered ore to the up-grader. The up-graded material arrived by truck to U.C.C. for further processing. Roughly 350,000 tons of sand tailings remained on 19 acres of the site's 335 acres. Again, six inches of dirt stabilized them. The company fenced the tailings pile with barbed-wire and constructed a small earthen dike between the pile and the Dolores River.

In addition to the uranium mill buildings, the site contained a housing and trailer court area, gymnasium, theater, a service station, and employee housing units. All these structures now stand abandoned. A gas sweetener plant, built by

Rocky Mountain Gas Company on five acres of the old mill site, continues to operate.[5]

VANADIUM CORPORATION OF AMERICA'S NATURITA, MONTICELLO, and DURANGO MILL SITES

THE NATURITA MILL

The Naturita mill's location rests two miles northwest of the town of Naturita, in Montrose County, Colorado. This area is in the San Miguel River Valley. The Rare Metals Company constructed the mill in 1930. It did not become operational until 1939, when Vanadium Corporation of America (V.C.A.) acquired the mill and converted it to a salt-roast, water leach for vanadium recovery. In 1942 the process underwent modification again in order to extract uranium. Shipments of uranium concentrates to AEC continued until the mill's shutdown in 1958. An up-grader remained in operation until 1963 by V.C.A. The company dismantled the mill in 1963 and merged with Foote Mineral Company (F.M.C.), transferring site ownership to them.

During its life, the mill processed 704,000 tons of ore. Prior to the shutdown in 1958, the ore averaged .30 percent U3 08 and 1.8 percent V2 05. The period of the up-grader saw processed ore averaging .25 percent U3 08 and 1.65 percent V2 05. The supply of ore came from throughout the Uravan Mineral Belt and beyond.

In 1976 Ranchers Exploration and Development Corporation of Albuquerque, New Mexico bought the portion of the site occupying the tailings from F.M.C. The Foote Mineral Company retained ownership of the rest of the site, leasing a portion of it to General Electric Company for an ore buying depot in the late 1970s.

The company removed old mill buildings, but some of the housing units south of the mill

remained.[6]

VANADIUM CORPORATION OF AMERICA'S MONTICELLO, UTAH VANADIUM MILL

HISTORY OF THE MONTICELLO MILL OPERATION

Vanadium Corporation of America operated the Monticello plant built by Stearns Rogers of Denver during World War II. The recovery of vanadium became the mill's primary purpose from 1942 to 1944. Some uranium, however, was recovered as a byproduct. The Atomic Energy Commission acquired the plant in 1948.

The mill underwent an extensive rehabilitation and expansion program by Walker Lubarger in 1949. The rework provided capacity of nearly 200 tons of uranium ore daily. Galigher Company and National Lead Company operated the mill until its 1959 closure. In 1962 the company dismantled it.

Between 1949 and 1955, ore was roasted prior to carbonate leaching. This produced residues that settled very rapidly in small tailings ponds. The process of raw carbonate leach replaced the traditional roasting process, but created a slime problem in the ponds because of the finer grind. This required greater settling areas in the tailings ponds.

In November 1955, a new plant circuit using the acid leach resin-in-pulp process began. This process complemented the existing circuit and the combined tonnage of ore processed in both circuits increased to 600 tons per day. The resin-in-pulp (RIP) process increased the tonnage rate and required a greater increase in the flow of processed water. To clarify the tailings pond effluent, it became necessary to build a larger pond. Maintaining and extending dams in a more systematic manner also became essential. The mill began using the new tailings pond (the South

(Courtesy of A. Corrine Rorine)

V.C.A. Mill in Monticello, Utah about 1942. Built by Stearns-Rogers and operated by V.C.A. Remodeled by Walker-Lybarger and operated by the Galigher Co. and National Lead Co. Closed 1959. Dismantled 1962.

Pond) in 1955; however, it proved unable to accommodate the larger volume of tailings. Therefore, in 1956, the purchase of an additional parcel east of the existing property enabled the mill to construct another tailings pond, known as the East Pond.

The plant process underwent further modification in August of 1958, with the elimination of acid leaching and conversion of the RIP unit to the carbonate process. This alteration did not require significant changes in the disposal method.

In June 1965, the radiological assistance team from AEC's Idaho Operations Office conducted an extensive survey. The survey provided an independent appraisal of the radiological conditions at the Monticello project. Samples of air, water, and vegetation showed no evidence of radioactive material transport from the tailings areas. Radiation measurements taken over the covered piles proved only slightly above background and well below harmful or injurious levels.

Approximately 900,000 tons of low-level radioactive solid residues (tailings) confined to four separate areas, totaling approximately 400 acres, were stabilized and covered. The project began in August 1961, but was suspended during the winter and completed the following spring at a cost of $190,000. The stabilizing, leveling, and grading of tailings facilitated drainage. The tailings then were covered with rock and soil, with the planting of grass on top serving as an erosion barrier.

STATISTICAL DATA

907,917 tons of tailings were buried between 1949 and 1960.

The original area covered by tailings at the termination of operations consisted of 39.5 acres.

The volume of tailing sands moved for new contouring was approximately 80,000 cubic yards.

The volume of soil and gravel moved for covering all exposed sands was approximately 135,000 cubic yards.

The volume of drainage channel excavation and creek channel realignment was roughly 20,000 cubic yards.

A total of 570 tons of barnyard fertilizer, along with 2.5 tons of commercial fertilizer was used in the original application.

The time required to complete the project equaled 80 working days and an average of ten pieces of heavy construction equipment.

The total cost of the project came to $190,000, with $36,00 going to the grading and removing of sand from older ponds to the East Pond.[8]

Thirty-two years after the Monticello, Utah mill closed in 1960, uranium tailings radiation teams returned to Monticello and proposed the uncovering, removal, and relocation of mill tailings. The cost of this venture may equal or surpass the $24 million estimated for cleaning up Union Carbide's uranium mill tailings at its Maybell, Colorado site. The uranium mill tailings clean-up cost for V.C.A.'s Durango site was estimated at $9,080,000 in 1977. The actual cost, however, proved considerably higher. The Vanadium Corporation of America became the mill's operator of the Monticello, Utah uranium mill in 1942.

(Courtesy of Denver Public
Library's Western History Division)

The Standard Smelter at Durango, Colorado (1894).

VANADIUM CORPORATION OF AMERICA'S DURANGO MILL SITE

The Durango mill site consists of a 147 acre tract on the southwest side of the city. Durango and the mill are situated in the valley of the Animas River, at an elevation of 6,500 feet above sea level and butts up against Smelter Mountain. Originally, a lead smelter, constructed by the American Smelting & Refining Company in 1880, occupied the site and continued operations until 1930. The United States Vanadium Corporation acquired the smelter in 1942. U.S.V.C. proceeded to convert the smelter into a uranium-vanadium mill to furnish vanadium to the Metals Reserve Company.

Re-treatment of vanadium tailings for the recovery of uranium began under U.S.V.C. in 1943 to provide materials to the Manhattan Engineering Project. The Durango mill continued operations until its closure in 1946. The V.A.C. reopened the mill in 1949 under a lease and contracted to market uranium to AEC. The Vanadium Corporation of America later purchased the plant and continued operations until it closed again in 1963. V.C.A. retained ownership of the mill site and adjoining property until its 1977 merger with the Foote Mineral Company. In 1976 and 1977 the Ranchers Exploration and Development Corporation of Albuquerque, New Mexico purchased the entire site, with the exception of two small parcels deeded to the Colorado Highway Department and the La Plata Electric Company.

During the 14 years of processing uranium for the AEC, the mill supplied roughly 1.5 million tons of ore. The deliveries of ore from various mines in the Uravan Mineral Belt, White Canyon, Utah and Monument Valley, Arizona averaged 0.29 percent U3 O8 and 1.60 percent V2 O5.

Two tailings piles resided on the site,

covering approximately 21 acres. The smaller pile contained 325,000 tons and stood 90 feet above the mill, while the larger one consisted of 1,230,000 tons of tailings and rose 230 feet high. These piles butted up against Smelter Mountain.

The initial milling capacity of 175 tons of ore per day expanded to 430 tons daily in 1956. In 1958 750 tons per day became commonplace. In addition to ore from the Uravan Mineral Belt, the Durango mill received ore from Dry Valley, Carrizo, Dove Mesa, Placerville, Hermosa Creek and Lightner Creek. The company also purchased ore from independent operators and upgrader products from company-controlled properties. All mill feed was transported to the Durango mill site by trucks.

Concentrates from the company upgrader plants and ores were salt-roasted. The calcines were quenched in carbonate solutions, then treated by counter current washing. Pregnant solutions underwent treatment to precipitate the uranium and filtered. The filtration further processed the concentrates to recover vanadium. The re-treatment of tailings from carbonate leaching operations allowed for further recovery of uranium and vanadium by means of acid-leaching. The pregnant acid-leach liquor then was treated by solvent extraction to recover both uranium and vanadium.

The removal of mill buildings occurred prior to 1977, with mill tailings being transported to the Bodo Canyon disposal site in the 1980s. The United States Government's 1977 estimated cost for moving the 1.5 million tons of mill tailings from the Durango site to the Bodo Canyon disposal site equaled $9,080,000.[9]

NOTES: CHAPTER THREE

[1]Phase II-Title I Engineering Assessment of Inactive Uranium Mill Tailings, Rifle Sites, Rifle, Colorado. U.S. Department of Energy, October 1977.
[2]Ibid.
[3]Ibid.
[4]Interview with Charlie Simonson, October 27, 1992. Transcripts in the hands of Robert Sullenberger, Arvada, Colorado.
[5]Engineering Assessment. Rifle, Colorado.
[6]A Summary of the Phase II Title I Engineering Assessment of Inactive Uranium Mill Tailings, Naturita Site, Naturita, Colorado. U.S. Department of Energy, November 1977.
[7]A Report of the Monticello Mill Tailing Erosion Control, Monticello, Utah. Construction and Supply Division of Raw Materials, U.S. Atomic Energy Commission, December 20, 1992.
[8]Ibid.
[9]Phase II-Title I Engineering Assessment of Inactive Uranium Mill Tailings, Durango Site, Durango, Colorado. U.S. Department of Energy, November 1977.

(Courtesy of author)

Atlas Mineral's uranium mill at Moab, Utah (1992).

(Courtesy of author)

Atlas Minerals uranium mill at Moab, Utah (1992).

CHAPTER FOUR
URANIUM ACTIVITY IN THE 1950s & 1960s

For a short period after World War II, uranium and vanadium mining activity in the Uravan Mineral Belt, Slick Rock Mining District and southeastern Utah became sharply curtailed. Low prices paid for ore and uranium mill products forced the closure of many mines and suspension of uranium mill operations at Uravan, Rifle, Naturita, Durango and Monticello.

The demand for uranium improved in the early 1950s because of implementation of an ore buying policy established by the United States Atomic Energy Commission. The plan established profitable prices paid for uranium ore and mill products. Coupled with a better price structure was an increasing demand for uranium used in the operation of nuclear power plants. These events precipitated a uranium boom not unlike the gold rush days of Colorado's early mining history.

In the 1950s Moab, Utah became the center for a vast number of uranium prospectors seeking their fortunes by staking mining claims on rich uranium ore bodies. They traveled throughout the Moab country on foot, on horseback, in jeeps and aircraft that contained sophisticated electronic gear capable of detecting the presence of uranium. The Minerals Engineering Company drilled many core drill holes around Moab and in other areas of the Four Corners Region searching

for new uranium deposits. Mining companies bulldozed many miles of primitive roads to mines on land that later became Canyonlands National Park. Shaffer's Trail, White Rim jeep road and the Mineral Canyon road serve as three examples.

A July 28, 1955 Moab Times Independent newspaper article read as follows: *RECORDER FILES 11,858 NOTICES IN SIX MONTHS-- At the end of the first six months of 1955, Esther Somerville, recorder of Grand County finds business in her office is not exactly as usual. It is a little monotonous. During the first six months of 1955, there were 11,858 location notices of mining claims recorded. This is an initial count and does not include any other type of paper than location.*

In the 1950s, mining resumed in the Uravan Mineral Belt and Slick Rock Mining District, with the discovery of new bodies of ore in southeastern Utah, Maybell, and the Gunnison area. Additional uranium deposit discoveries occurred in Monument Valley, Utah and in the Grants, New Mexico area. This chapter contains historical information on uranium mines and mills built during the uranium boom and Minerals Engineering Company's role in designing and building uranium filter presses for use in the industry.[1]

CHARLIE STEEN'S MI VIDA MINE AND THE MOAB, UTAH URANIUM MILL

Charlie Steen, a 1943 graduate of the Texas College of Mines and Metallurgy, in search of uranium, packed his belongings in a trailer pulled by a World War II vintage jeep and left Houston, Texas bound for the Colorado Plateau. He studied geological reports and locations of existing mines. Steen received additional motivation from AEC's incentives offered for

discoveries of new uranium deposits. Steen arrived in Dove Creek, Colorado in 1950, where he rented a parking space for his trailer and began his search for uranium. His wife Minnie Lee, who preferred the name M.L., and their four children soon joined him.

During one of Steen's early prospecting trips, he met Bob Barrett, a Dove Creek bean farmer. Barrett introduced Steen to the Big Indian Mining District in southeastern Utah, the future locale of Steen's famous Mi Vida uranium mine. Bill McCormick, a Dove Creek resident and owner of the Dove Creek Mercantile Store "grubstaked" Steen during his uranium search. McCormick later became a 49 percent partner in the Mi Vida mine. He later served as Steen's mine superintendent.

After several months of prospecting, Steen moved his trailer and family to the remote Yellow Cat Canyon in southeastern Utah.[2] While residing in Yellow Cat, he staked several claims, one being named Mi Vida (Spanish for "my life").[3]

Steen's financial situation left him unable to do exploratory work on his claims. He and his family moved to Tucson, Arizona until enough money could be saved for their return to Mi Vida.[4]

In 1952 the Steens returned to southeastern Utah and rented a tar paper shack in Cisco near the Denver and Rio Grande Railroad, approximately 50 miles west of Grand Junction.[5]

With a core drill borrowed from Bill McCormick, Steen proceeded to drill a prospect hole on his Mi Vida claim. The drill rig broke down on July 18, 1952 before reaching the desired depth of 250 feet. Steen lacked the necessary funds for repairs and decided to return home to Cisco. Before leaving, he loaded up a core drill sample in his jeep. At Cisco, Steen checked the sample with a Geiger counter, only to discover it rich in uranium.[6] It turned out to be

pitchblende, a uranium ore not previously found on the Colorado Plateau.

The discovery marked the beginning of the fabulously rich Mi Vida uranium mine, the UTEX Exploration Company and the Atlas Minerals uranium mill in Moab. Newspapers across the nation carried articles of Charlie Steen's uranium discoveries. Not long afterward, southeastern Utah and southwestern Colorado became inundated with hundreds of uranium prospectors. Moab rapidly became the Uranium Capital of the region.

One 1955 headline of Moab's Times Independent newspaper article read:
AMERICA'S URANIUM INDUSTRY IS BUILT AROUND MOAB, UTAH - HUB OF THE WHEEL THAT WILL POWER TOMORROW'S INDUSTRY. *The article following read: HUGE STOCKPILE of ore and sampling station near Moab containing more than 125,000 tons of uranium are representing the economy of the east central Utah community. Most of the ore is worth approximately $50 per ton, therefore, represents well over 6 million dollars which, when added to the already plentiful Moab economy will enable the town, rapidly becoming a city, to expand even further.*

Moab has been going through serious growing pains in trying to meet the constantly changing population picture, but city leaders are busy adopting new codes and plans to meet what they term an emergency situation. Housing, services of all kinds, and facilities are being expanded as rapidly as possible.

It is even hard to get a hotel room in Moab for an over-night stay. Things are that bad. There are just too many people in Moab for the accommodations available.

Visitors find it is difficult to find a motel compartment, a hotel room, or even a hospital bed if they are ill. The atomic-boom took care of

that. There are signs in hotels advising: 'No sleeping in this lobby over night'.

Once quiet streets are now busy thoroughfares as concrete trucks dash about delivering 'mud' to the many construction jobs in progress. There are painters, carpenters, bricklayers, and others in the building trades, hustling to and from work, or from job to job as work progresses.[7]

Shortly after the July 1952 discovery of uranium on the Mi Vida claim, nine miles south of La Sal, Utah, Steen contacted Mitch Melich, a Moab lawyer, to draw up required legal documents for a corporation. Melich received a small amount of stock in return for his services. Steen suggested the name UTEX EXPLORATION COMPANY for the new corporation. This name combined Utah, the mine's locale, and Texas, Steen's home state.[8]

On October 4, 1952 Steen began sinking an exploratory mine shaft near the original core drill hole on the Mi Vida mining claim. In December 1952, after reaching a depth of 68 feet, the drilling crew struck a rich ore body that measured 14 feet deep. The uranium ore assayed out at 0.34 to 5.0 percent U3 08. The mine produced a million dollars worth of ore within six months. It also shipped 200 tons of ore daily to U.S.V.C.'s Uravan mill. A small powder box of uranium oxide from the mine held a value of $5,000.[9]

In mid-1953, Steen and his partner Melich decided to build their own uranium processing mill. The existing mills at Uravan and Monticello experienced an overload of ore and were no longer capable of handling the increased ore production from the Moab mines. Mill capacity became crucial with ore production multiplying.

Steen and Melich formed a partnership with E.H. Snyder, Melich's father-in-law from Salt Lake City. The combination of UTEX EXPLORATION COMPANY, with Snyder's METALS REDUCTION COMPANY

(Courtesy of author)

Charlie Steen's home in Moab, Utah.

created the new corporation of URECO (Uranium Reduction Company). Following the merger the corporation planned the construction of a Moab uranium mill capable of processing 1500 tons of ore daily. The mill construction required nine million dollars, which Steen and Melich proceeded to raise. Floyd Odlum's Atlas Minerals purchased 30 percent of URECO's common stock, agreed to provide substantial funds for the mill's construction, and to process all Atlas Corporation's ore from area uranium mines.

American Lead, Zinc, and Smelting Company signed a contract to assume responsibility for finances, construction, and operation of the mill. Steen purchased the mill site adjacent to the Colorado River northwest of the town of Moab for $40,000 in 1955. Foley Brothers Incorporated initiated mill construction on October 4, 1956, with the formal dedication taking place on September 14, 1957.[10]

Atlas Minerals closed the mill on March 15, 1984, although it continued on a stand-by status for eight years. The mill currently retains its license to operate under the Department of Energy and employs a small custodial crew; however, salvage crews began dismantling the mill in September of 1992.

In 1962 Steen sold the Mi Vida mine and most of Uranium Reduction Company for 25 million dollars to the Atlas Corporation of New York. Steen received 12 million dollars.

Between Reno and Carson City, Nevada, Steen built what some have called his monument. A 35-room home with five pagoda-peaked copper roofs, lavish teakwood cabinetwork, and bathroom fixtures of gold plating and sterling silver made his Moab hilltop house seem like the shack at Cisco. Travertine marble covered the floors and doors, walls and steps, and a moat surrounded the dining area. The swimming pool was 40 feet long

and an incredible 19 feet deep. A fallout shelter as big as most houses and a stable for nearly two dozen horses were included to add to the grandeur.

But the Internal Revenue Service hit Steen a stunning blow in February of 1968. Without warning, the IRS seized his Reno office building and its contents, including 85 bulging file cabinets, his geology library, and mineral collection. Also seized was Cassair Inc., his light plane sales and service company, and liens were filed against his horse ranch. The IRS said Charles Steen owed $1,839,932 in back taxes, which was later upped to $3.3 million.

The Steens were evicted from their Reno mansion in 1974 and the courts sold the million dollar home for less than $300,000 to help pay for an estimated six-million dollar debt. Steens's assets were liquidated for $3,394,746. After paying secured creditors, attorney's fees, and the IRS there was nothing left to pay the $1,167,746 owed to general creditors.[11]

Charlie Steen, the uranium millionaire, went from rags to riches and back again. Some Moab residents and others feel he received unjust treatment from the IRS.

On October 8, 1981, The San Juan Record ran a newspaper article entitled; *IN THE NORTHWEST CORNER OF SAN JUAN COUNTY WHERE CHARLIE STEEN ONCE MADE HIS MILLIONS, THE MI VIDA MINE IS STILL IN OPERATION*:

In the 1950s and 1960s Steen discovered the mine and removed over $60 million from it before he was finally forced to give it up to San Juan County for taxes.

In 1976 'Minerals West Venture', a company located in Monticello, took out a 20-year lease from San Juan County and began mining the old claim in 1978. Minerals West, whose president and vice-president are brothers Stephen and William

Nielson also discovered an additional ore body in the 22 acre mine.

The tunnels are still being developed through Steen's previous diggings and using the 'Pillar And Room System.' The three miners who work in the Mi Vida excavate enormous caverns with huge pillars for support. The ceilings are girded intermittently with giant bolts to reinforce the rock over head. When a portion of the mine is depleted the pillars are then pulled and the miners work their way out of the mine this way.

Entering the mine on a sunny day, one encounters sudden darkness, a feeling of dizziness at first, and a blast of cool wind. For safety, Minerals West force 100,000 cubic feet per minute of air through the mine to keep down radiation and insure pure air.

At the present time, the mine is one of few in operation because of the low price for uranium. Steve Nielson estimates Minerals West takes 1,000 tons of ore from Mi Vida a month, as compared to 5,000 tons before the price dropped off. 'I do think the price will come back up,' Neilson says opportunistically, 'but it may take 2 or 3 years.'

There are seven separate patented claims in the Mi Vida mine which is unusual. It is the only mine in the county owned by the county. Because it is old and has an interesting history it is probably more popular to speak of.

Nielson says Minerals West will continue to mine ore for the next several years from the mine.[12]

VITRO CHEMICAL COMPANY'S SALT LAKE CITY, UTAH URANIUM MILL

The Vitro site resides on a 128 acre tract roughly 4 miles from Salt Lake City's downtown area. The mill processed uranium ore from 1951-

1964. During this period, the plant processed 1.7 million dry tons of ore with an average grade of 0.32 percent U3 08. It also produced 4,787 tons of U3 08 in concentrate (yellow cake.) Uranium sales within this period came to approximately 103 million dollars. In 1955, the Minerals Engineering Company in Grand Junction designed, built, and installed a large capacity uranium filter press in Vitro's Salt Lake City mill.

In 1965, the mill converted to vanadium production, but ceased in 1968. The mill processed roughly 106,000 tons of vanadium-bearing materials. Vitro dismantled the plant in 1970.[13]

MINERALS ENGINEERING COMPANY, GRAND JUNCTION, COLORADO

In the late 1940s, Blair Burwell, a Colorado pioneer in the uranium-vanadium industry, left his Union Carbide Corporation's vice-president's position in New York to initiate the Minerals Engineering Company with headquarters in Grand Junction, Colorado. Burwell, a 1915 Colorado School of Mines Graduate, spent his lifetime in uranium-vanadium mining and mill operations with U.S.V.C. on the Colorado Plateau.

Minerals Engineering, in its infancy, concentrated on building truck mounted diamond core drilling rigs, machining core drill parts, and manufacturing diamond core drill bits. The company also owned several core drilling rigs that drilled on mine properties throughout the four corners region. In addition to Grand Junction manufacturing, Minerals Engineering established a considerable Geiger counter repair business and established an assay lab capable of handling most minerals.

As the company grew, it acquired control of rich tungsten ore deposits near Dillon, Montana;

they constructed a tungsten refinery in Salt Lake City and acquired interests in South African gold mines near Johannesburg.

In 1955, Minerals Engineering Company implemented a uranium filter press design and fabrication program at the Grand Junction manufacturing plant. The project became a joint venture with the Eimco Corporation in Salt Lake City. Burwell developed the design concept; Robert Sullenberger designed piece parts, prepared final assembly drawings, and supervised shop fabrication crews. The first uranium filter press was shipped to Salt Lake in December of 1955 for installation in Vitro Chemical Company's uranium mill. Homestake Mining Company purchased filter press number two, a different design, for installation in their Great Bear Lake uranium mill in Canada.

Minerals Engineering continued to grow and prosper until Burwell's death in 1977. After his death, M.E. moved from Grand Junction to Denver and concentrated more heavily upon gold mining. In February 1982, M.E. acquired interest in Chevron Resources Company's Creed, Colorado Underground Gold Mining Project. A portion of the Denver staff transferred to Creed to work on the project. Currently, the American Stock Exchange no longer lists the company and the Creed gold mine remains closed.

A Minerals Engineering Company 1955 newspaper article, published in the Moab Times-Independent, reads:

MINERALS ENGINEERING CO. IS BUILDING IN A HURRY. Minerals Engineering Company of Grand Junction advertises itself as the outfit that's 'building a company...and...is in a hurry.'

Their recent activities in acquiring a 50 percent interest in the mineral rights to approximately 40,000 acres owned by Judge Roy Hughes apparently is concrete evidence of the

company's desire to move rapidly. Exploratory drilling is being carried on in this territory, in Dry Creek Basin. The areas are underlain by the Salt Wash Member.

Naturally, the drilling rigs come from Junction Bit and Tool Company, a subsidiary of ME, and ME crews are supervising the operations. Ore discoveries will be assayed by Minerals Assay Laboratory, while any Geiger or scintillation counters needed at the job will be furnished by the electronics division of the firm.

Mere mention of these activities gives the reader some idea of the scope of Minerals Engineering, which was so limited in space seven years ago, when the firm was founded, that George A. 'Dutch' Hertzke, present maintenance superintendent, built the first drilling rig outside the plant--he had no room to work in nor a roof to work under.

Hertzke has been associated with Blair Burwell, styled the 'grand old man of the uranium business' since the two joined forces in 1948. Since then, Minerals Engineering has grown to the point that it supplies 95 percent of all wagon drills on the plateau and holds the patent on a tungsten-carbide drill bit engineered by Hertzke.

For construction of bits for diamond drilling, the firm maintains a stock of diamonds worth approximately $30,000. The diamonds, however, are safely under lock and key, plus being embedded in steel so loose gems pose no problem to Hertzke, who needn't worry about loosing them to sticky fingers.

Junction Bit is proud of Jerry Foster, one of the old-timers in the business and currently an employee. Foster operated the first diamond drill ever seen on the plateau. Running on Club Mesa, the drill was set up in 1913 and was pushed by a 6 horsepower Fairbanks-Morse engine. The rig, Foster said, weighed 1,200 pounds, and when it

had to be moved, he had to get a team of horses to pull it to the next location.

Ray Sullivan, vice president of the firm, revealed that ME plans several expansion moves, during 1955. The first will be the investigation of the feasibility of a demonstration pilot plant, which ME is now enlarging. Provided the plant is a success, it will be used as a model for 'several' to be built at different points throughout the plateau.

On the drawing board is an ingenious machine which, if successful, will cut the cost of building a mine shaft in half, Sullivan believes. The shaft drill, as it is called, will be built precisely for the Plateau. It will drill 12 feet daily, up to eight feet in diameter, using only four to five men, as against the 15 men now needed to get such footage.

Sullivan sees a 'crying need' for tools with which to boost the efficiency of uranium mining, and to that end is directing the energies of ME.

Besides uranium, in all its many facets, the firm holds tungsten interests at Glen, Montana, together with a mill and a mine, the Salt Lake City tungsten refinery, and a small mill at Ely, Nevada, plus the 'Monte Cristo' mine near that city.

In Grand Junction, ME employs approximately 400 persons, with an annual payroll of $1.7 million. A 10 percent dividend was voted to stockholders on Dec. 20, 1954.[14]

CONTINENTAL URANIUM, INCORPORATION MILL AT LA SAL, UTAH

On December 6, 1955 the Times Independent newspaper, in Moab, Utah, published an article entitled: *CONTINENTAL GIVES DETAILS FOR LA SAL MILL OPERATIONS*, giving details for Continental Uranium's La Sal, Utah uranium mill. The article

reads as follows:

Continental Uranium Inc. and the Atomic Energy commission have signed a contract under which the AEC will purchase all the concentrate produced in a uranium ore processing mill to be constructed by Continental Uranium at La Sal, Utah.

Details of the contract were given by Continental Uranium Chairman Gerald Gidwitz concurrently with the announcement of the signing of the contract by the AEC office in Grand Junction, Colorado.

Because the company will process its own ores, Continental Uranium will derive not only a mining profit as in the past, but also a milling profit on the ore produced from the company's two mines, Gidwitz said.

In addition, Continental expects to process substantial quantities of uranium ores to be purchased from other producers, the chairman pointed out. Ore purchases will begin as soon as the ore sampling unit of the mill is completed.

'Furthermore,' Gidwitz said, 'the process to be used in our mill will recover the vanadium as well as uranium content of the ore. Under our contract with the AEC we will retain ownership of the vanadium, and we are negotiating long term arrangements for sale of the vanadium.' Vanadium is used in the production of hard steels.

Continental Uranium will construct the mill on a forty acre site at La Sal, leased by the company. The mill site is one of the few areas in the uranium mining district in Utah that has water available, according to Gidwitz. Soil tests have already been completed preliminary to beginning the excavation for the foundations. At the mill, uranium ore will be processed to reduce it to a uranium oxide concentrate.

The mill is to be completed by July 1, 1956 and will cost approximately $1,250,000, to be amortized over a five-year period. The AEC will

purchase the entire production of uranium concentrate of the mill until July 10, 1962.

Continental Uranium is one of the largest independent producers of uranium ore. It operates two producing mines, Continental No. 1 and Rattlesnake mine owned by a subsidiary. Both mines are located in San Juan County, Utah. The company is listed on the American Stock Exchange.[15]

UNION CARBIDE CORPORATION'S GREEN RIVER, UTAH URANIUM MILL

The Green River mill site and tailings pile resides in the east central region of Utah in Grand County. The locale rests one mile east of the town of Green River and 70 miles west of the Utah-Colorado border. The Green River runs .5 miles west of the tailings site, roughly 4,080 feet above sea level. Mesas and steep cliffs, reaching elevations of 6,400 feet, surround the northern side of the valley. The vegetation proves sparse because of the arid climate.[16]

OWNERSHIP AND HISTORY OF MILLING OPERATIONS AND PROCESSING

The Union Carbide Corporation constructed the mill in 1958 and it remained operational until 1961. The mill processed 183,000 tons of ore, with an average grade of 0.29 percent U3 08, and generated an estimated 137,000 tons of tailings during its three years of production. Union Carbide sent upgraded concentrate to Rifle, Colorado for additional processing. The majority of ore came from the Temple Mountain mine area, 60 miles southwest of the Green River site.

TAILINGS

The tailings covered roughly a nine acre rectangular parcel with a slightly sloping

surface, averaging a depth of seven feet, and were stabilized by six inches of soil. A flash flood washed some 14,000 tons of tailings away, leaving 123,000 tons still on the site.

The AEC's estimates of the Green River tailings indicate an average U3 08 of.005 percent for the tailings. Reprocessing of tailings was not considered a practical solution until 1977 when the market value of U3 08 reached $300 per pound.

A field survey identified only one off-site location where tailings use occurred. The cost estimates of remedial action for this location totaled $20,000. Cleanup estimates for the windblown tailings surrounding the pile and water-eroded tailings in Brown Wash, from the railroad bridge to the road bridge, totaled $170,000. The estimates of total remedial action costs for off-site structures and for decontamination of off-pile open lands equaled $190,000, excluding engineering and contingency costs. No alternative disposal sites for the tailings piles were considered.

The following Green River uranium mill article, 600 TONS OF URANIUM SHIPPED EVERY DAY, appeared in 1955 in THE TIMES-INDEPENDENT newspaper:

Green River, Utah is shipping about 600 tons of uranium ore every day. Half of it by truck, to Salt Lake City and to Grand Junction.

The town recently purchased a $20,000 filtration plant and by this spring will have hooked it into the present town system.

It all is a part of the town's efforts to keep up with its natural growth as people move there in the increasing search for uranium ores.

Construction has started on a $350,000 consolidated grade and high school, and $10,000 worth of improvements have been made on the airport in a joint city and state project.

Planned are a new hangar with a complete shop and fueling facilities.

Most uranium activity around Green River is in the Muddy River region, where five companies are hotly contesting for claims.

Troubles beset the population, too. For example, all available Post Office boxes are rented and over 150 people must receive mail through the general delivery window. Since 1953, fifty new companies have settled in Green River and are receiving mail through the local Post Office--adding considerably to the volume.[17]

NOTES: CHAPTER FOUR

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