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W. W. Karna, 1977, pp. 251-252

in:

San Juan Basin III (northwestern New Mexico), Fassett, J. F.; James, H. L.; [eds.], New Mexico Geological Society 28th Annual Fall Field Conference Guidebook, 319 p.

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UTAH INTERNATIONAL'S NAVAJO MINE

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INTRODUCTION

Located on the northern fringe of the Chihuahuan desert in the San Juan Basin, the Navajo mine and Four Corners generating station comprise the world's largest contiguous coal mine and power generating complexes. The mine, which is owned and operated by Utah International, an affiliate of General Electric, was opened in 1963, and now comprises some 31,400 acres of land leased from the Navajo Nation with estimated reserves of 1.1 billion tons of coal. The power plant, owned by a group of Southwestern utilities and operated by Arizona Public Service Company, burns about 7 million tons of coal per year to generate 2,085 megawatts of electricity. The plant is tied into an electric power grid that encompasses the cities of Los Angeles, Phoenix, Albuquerque, Tucson and El Paso for use in industries and homes.

The Navajo mine is in the sub-bituminous coal beds of the Fruitland formation formed in Upper Cretaceous sediments.

It is interesting to note that of the approximately 500 people employed at the mine 72% are Navajo Indians. Of the 500 employees, only about 100 are directly employed in mining. These miners are dragline and other mining equipment operators, blasting crews and train operators. The rest of the employees are support personnel. These non-miners include mechanics, welders, accountants, health and safety engineers, electricians, secretaries, clerks, surveyors, technicians, warehousemen, mining engineers, environmental engineers, supervisors and laborers. All of the employees are important and valued team members without whose efforts mining would not be possible.

MINING OPERATIONS

The Engineering and Production departments have the responsibility for planning and carrying out all of the steps of the mining operation. These are illustrated in Figure 1 which is a schematic of the operation. The first physical step which takes place in any new mining area is the result of an environmental concern; that is, the saving of the suitable upper mantel materials or topsoil. Prior to entering into any new area, the environmental department maps out areas in which topsoil must be saved. The engineering department then schedules the necessary manpower and equipment to remove the topsoil. Removal is accomplished by means of three 33-cubic yard self-loading scrapers.

After topsoil removal, the overburden, or waste material above the coal seam, is drilled and blasted. The overburden, usually a shale or sandstone, is too hard to dig without first being shattered. Blast holes of 9-7/8 inches in diameter are drilled and loaded with ammonium nitrate and fuel oil. Nearly a half a pound of this mixture of ammonium nitrate, a fertilizer product, and fuel oil is required to properly fracture one cubic yard of overburden.

The next phase is stripping, the removal of overburden. This is the process in which the coal is uncovered. The term "stripping" comes from the type of pits or strips which are created in the normal mode of operation. Each "strip" is approxi mately 100 feet wide and varies in length from 1 to 3 miles. The overburden removal is accomplished through the use of three large walking draglines. Each dragline weighs nearly 41/2 million pounds and has a boom length of about 300 feet—the length of a football field. Each bucketful of material that the dragline takes, about 40 to 50 cubic yards, would fill the living room of an average home, and would weigh nearly 68 tons. The dragline has the capacity of walking from one pit to another at a rate of 14 feet per minute. A new dragline costs 8 to 12 million dollars and requires from 12 to 18 months to build. Stripping is the most important part of the mining operation and all other mining and reclamation activities are planned around the operation of these large machines. It should be emphasized that the draglines are used only for removing overburden and are not used for mining coal; they simply uncover the coal.

After the coal is uncovered, it must be drilled and blasted prior to mining. Once the coal is broken up, it is loaded into a 120-ton bottom-dump coal hauler by a diesel-electric front-end loader. Each loader has a 231/2-cubic yard bucket that holds approximately 18 tons of coal. Once loaded in trucks, the coal will either come directly into the preparation plant by truck or it may be hauled into an intermediate railroad stockpile. At the railroad stockpile the same kind of front-end loader will load the coal into an eleven-car train capable of hauling 125 tons per car, or 1,375 tons. Approximately 1/3 of the coal produced is hauled directly from the pit to the plant by the trucks, with the rest being hauled by train.

Coal is received at the preparation plant from the train or trucks at rates up to 40,000 tons per day or an equivalent 300 car-train per day. The purpose of the preparation plant is to prepare, sample, blend and deliver the coal to the Four Corners power plant on a 24-hour per day, 7 days per week schedule. The coal is crushed from a run-of-mine size of 2 or 3 feet down to 1/4 inch, then transported by conveyor belt through the sample tower and into one of ten blend piles. Here, coal of grades varying from 6,500 to 9,600 Btu per pound are blended to a uniform blend of 8,750 Btu per pound, this being the grade necessary for the efficient operation of the power plant. Each blend pile has a capacity of 30,000 tons, slightly over a one-day fuel supply. As needed, large bucket wheel reclaimers load the blended coal onto some of the 7 miles of conveyor belt at rates of 1,800 tons per hour for delivery to the adjacent power plant.

Ash generated from burned coal in the power plant is hauled back into the pits from where the coal was originally mined. After the ash disposal is completed, the overburden from the next strip is piled on the top of the ash so that in most cases the ash has at least 30 feet of cover. In all cases it has at least 3 feet of cover.

In the process of stripping, the dragline places the overburden in the mined out strips creating rows of conical shaped spoil piles. The first step in reclaiming the mined land is the grading of these spoil piles into a gently rolling topography and starts within one or two spoils rows of active mining.

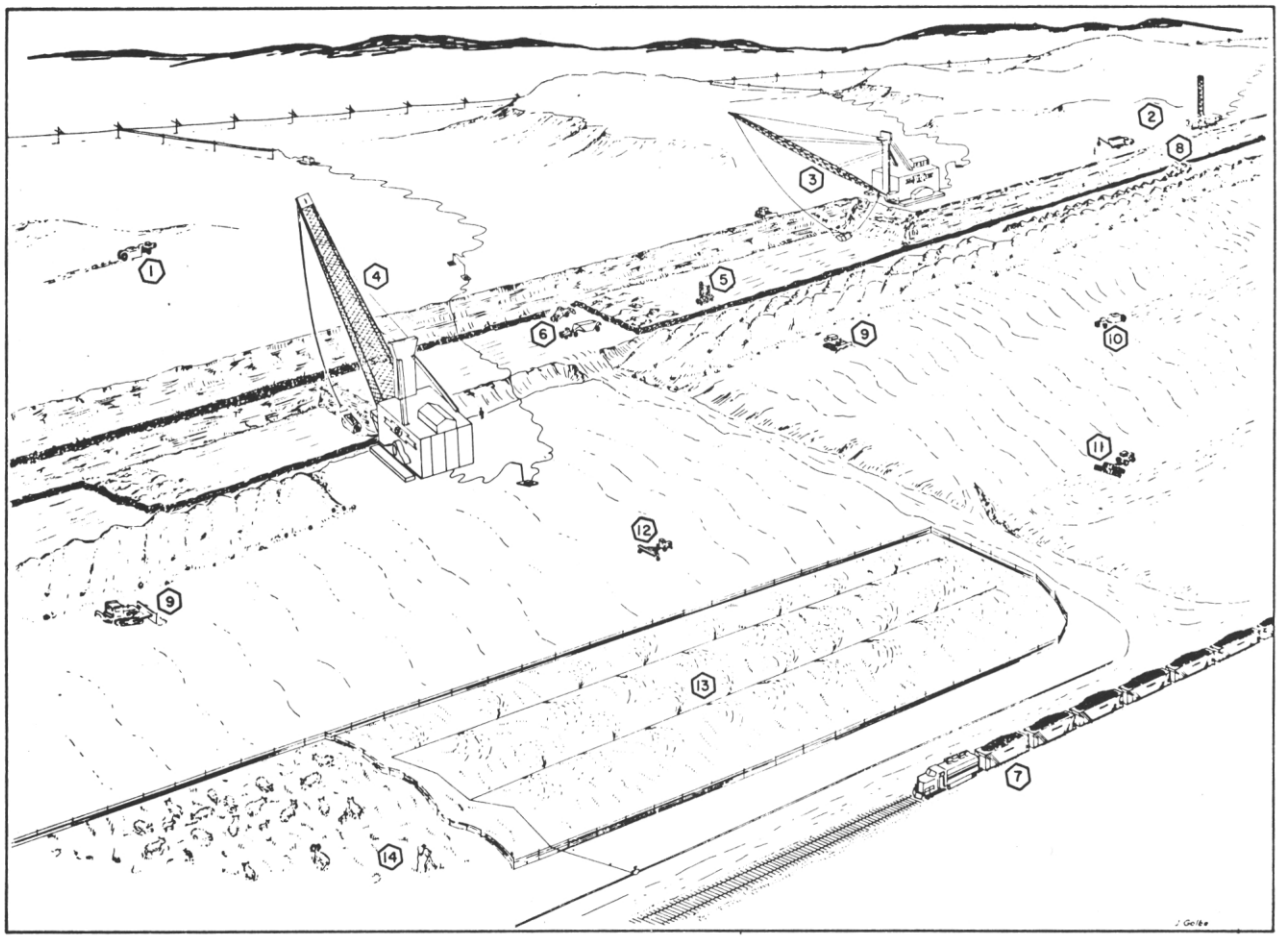

Figure 1. Typical operation at Navajo mine: (1) topsoil investigation; (2) overburden drilling; (3) stripping; (4) dragline operation; (5) coal drilling; (6) coal hauling; (7) transport facilities; (8) stockpiling; (9) ash disposal; (10) grading of spoil piles; (11) erosion control grading; (12) discing and revegetation; (13) sprinkler operation; and (14) completed land restoration.

Rough grading is accomplished by large crawler tractors and final grading is done by a special twin engine grader with a 24-foot wide blade. Grading helps control erosion caused by runoff and enables us to use the farm machinery necessary to accomplish the revegetation.

After grading, the new soils created by mining are mapped and analyzed to determine topsoiling and seeding requirements. Topsoiling is done on those areas marked and staked by an environmental engineer, who also checks to see that a uniform six-inch layer is put down. In some cases rather than being stockpiled, the topsoil is removed from an area before stripping and placed directly on the mined soil. This is one of the most costly operations involved in revegetation work.

Discing is done to mix the mined soil and topsoil interface and also to break up overly compacted areas. The equipment used to accomplish this is a special heavy duty hydraulically controlled disc pulled by a four-wheel drive tractor. After grading, topsoiling and discing, the soils are ready for seeding. Seeding is accomplished with two seed drills connected in series. Two seed drills are used because of the large range in size and shape of the 10 different seeds used. The seeding rates differ with each area and all but two are native species which must be hand collected at a rate of about 10 tons per year. After an area has been seeded, the final step is to mulch the soil with straw or bottom ash to conserve moisture and protect the seeds during the germination phase.

A major effort of the revegetation program has been to supplement natural precipitation by irrigation. The heart of the irrigation operation is a large filtration and pumping station. The main distribution line is a 16-inch steel delivery line and is fitted with measuring devices that record water consumption. The line runs nearly 12 miles to provide water to areas being revegetated. Aluminum submains are transported to the irrigation sites, where they are assembled by hand and clamped in place. The complete irrigation system requires careful planning and scheduling.

The irrigation program for a given revegetated area consists of frequent irrigation during germination to help the young plants get started, followed by infrequent irrigation to provide adequate moisture through the late summer months. A yearly spring irrigation is applied the following year to complete the revegetation program. Total net water application amounts to about twelve inches.

To maintain our economy and the standard of living we must continue to mine coal. We must understand and accept mining as an interim land use. While mining does disturb the environment, just laws and reasonable management by the mining companies can reduce disturbance so that all can benefit. Utah International believes in this temporary land use ethic and complies with, or exceeds all legal requirements.