An Overview of Two Decades of Regulation on Surface Coal Mining and Reclamation in North Dakota[1]

by

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Abstract. In North Dakota, coal (lignite) production and utilization methods have changed considerably since the first commercial coal mine was opened in 1873. Surface mining was started in 1919 and became the exclusive method of coal recovery by 1966. The number of coal mines, mostly small underground operations, declined from an all time high of 320 in 1940 to the current 10 active surface mines. But coal production has increased steadily, reaching 28 million tons in 1988. Today, 78% of North Dakota lignite is used for electrical generation, 20% for synthetic gas production, and the remainder as domestic and commercial fuel. Environmental regulation of North Dakota's lignite industry began in 1969 when the state passed its first mining and reclamation law. Reclamation requirements at that time were limited to topping and seeding the spoil peaks. Since then, the reclamation laws and rules have increased significantly in their scope and stringency and have had a profound effect on the quality and usefulness of lands following mining disturbance.

Additional Key words: history of mining, lignite, impacts of mining

Introduction

North Dakota has the largest lignite coal reserves in the United States. These reserves, estimated at 600 billion tons (Burr 1954), are mainly in the western part of the state, in the Tongue River and Sentinel Butte formations. The lignite bearing area in North Dakota covers about 28,000 square miles.

In 1988 approximately 28 million tons of coal were mined from the 10 active mines in North Dakota. The state's lignite industry presently employs about 18,300 people and produces an estimated annual total business volume of $988 million (North Dakota Lignite Council 1988).

Lignite is a dark brown low-grade coal that is softer than ordinary bituminous coal. It is characterized by a relatively high moisture content (averaging about 37%), low heating value (about 6800 BTU), moderate ash content (6-7%) and low sulfur content (about 0.6%) (Burr 1954). Presently about 78% of North Dakota lignite is used for

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electrical generation, 20% for synthetic gas production, and the rest for domestic and commercial fuel and charcoal briquetting.

Although lignite mining is very important to the economy of North Dakota, its negative impacts to the environment and to the usefulness of land can be drastic. Therefore, in order to protect the environment from the harmful effects of mining, the state legislature passed its first reclamation law in 1969. This law was amended and changed several times, including modifications related to passage of the federal Surface Mining Control and Reclamation Act of 1977.

The objectives of this paper are to discuss the history and importance of coal development in North Dakota, and to describe how the development of an environmental regulatory program has led to mitigation of many of the adverse environmental impacts of mining in the state.

History Of Mining In North Dakota

The use of North Dakota lignite as a fuel source was first recorded in the journals of the Lewis and Clark expedition. Lignite was used to fire a blacksmith's forge during the winter of 1804-5 at Fort Mandan, near the present town of Washburn. During the 1850s and 60s, steamboats that navigated the Missouri River occasionally used lignite as fuel because of scarcity of wood in some areas along the route. Later, during the 1860s and 70s, military posts within present North Dakota experimented with lignite, but its use was limited because the posts originally lacked stoves adapted to burn it. Fort Stevenson was the only post that relied heavily on lignite. By the late 1870's civilian contractors supplied much of the lignite.

In 1873, Dennis Hannifan and John S. Warn formed the first coal company in North Dakota near Sims, about 30 miles west of Bismarck. The following spring they were driven off by Indians, and the mine remained inactive until the early 1880s when it was developed by the Northern Pacific Coal Company (Oihus 1978). According to the earliest official record, annual lignite production in North Dakota reached 35,000 tons in 1884 (Burr 1954). Many more mines were opened in the 1880s and 90s, generally near towns and villages along the railroads. Most of these mines were small operations but some, like the Baby Mine near Sims and the Mouse River Coal Company's Davis Mine northwest of Minot, were relatively large. Each of these mines at its peak produced about 100 tons of lignite per day (Oihus 1978).

Underground mining was the predominant method until the 1920s and 30s. It was usually done by the room and pillar method, in which coal was mined in blocks called rooms and wooden pillars were left to support the roof. Underground cutting machines and blasting were used as early as the turn of the century (Oihus 1978).

One of the largest lignite producers around the turn of the century was General W.D. Washburn's Wilton Mine. It produced 115,340 tons of lignite in 1910, over 25% of the state's production, which sold for $1.50 per ton at the mine. Besides supplying heating fuel for a large area, the Wilton Mine also operated a power plant that supplied power to the mine and the town of Wilton (Oihus 1978).

During the depression years of the 1930s, the number of small mines increased as farmers began mining lignite as an alternate source of income. The number of coal mines in North Dakota peaked at about 320 in 1940 (Dahlberg et al 1984).

An important change in North Dakota's lignite industry began in the 1920s when the steam shovel facilitated relatively easy removal of overburden, and made strip mining feasible on a large scale. There were 12 strip mines operating in 1920 . The number increased to 69 by 1929, and by 1939 there were more surface than underground mines in North Dakota (Oihus 1978). Strip mines were more efficient, less labor intensive, and generally safer than underground mines. However, their impacts on the environment were extensive.

Lignite markets changed during the 1940s as households began to switch from coal to natural gas and fuel oil. By 1948, about 65% of the state's coal was used to generate electricity (Oihus 1978). This market shift set the stage for the present era in North Dakota mining in which a few large scale strip mines provide fuel for huge electrical generating plants. By the end of the 40s only about 100 commercial mines remained; by 1960 the number had been reduced to fewer than 50, and by 1980 to 12 (Dahlberg et al 1984).

Large electrical generating plants were constructed in North Dakota beginning in the 1960s. Most of these are "mine-mouth" operations; that is, the generating plants are located near the mines that supply their fuel. During the 1970s and 80s the Great Plains Gasification Project was initiated near Beulah. This resulted in construction of a coal gasification plant which began production in June, 1984, and presently utilizes about five million tons of lignite annually, supplied by Coteau Properties Company's Freedom Mine.

Environmental Impacts of Mining

The first finding of the North Dakota law governing surface mining and reclamation (Section 38-14.1 NDCC) states that "many surface coal mining operations may result in disturbances...that adversely affect the public welfare by diminishing the utility of land." It has been estimated that about 7000 acres were strip mined in the state prior to enactment of the first reclamation law in 1969 (Hagen 1974). The majority of this acreage was used as cropland or rangeland prior to mining. The disturbances caused by strip mining reduced the utility of this land by wasting the nutrient rich topsoil, and by leaving spoil piles in place of what was once productive agricultural land.

Besides reducing the productive capacity of land, surface mining caused other negative environmental impacts. The spoil piles were steeply sloped and often could not support much vegetation. Erosion of the spoil piles led to water and air pollution and to deposition of undesirable sediments on nearby areas.

Research on the potential for reclamation of strip mined lands in North Dakota has been conducted since the early 1960s. The earliest efforts were concerned with reestablishment of grassland on spoil areas. Through the 1970s and 80s major advancements have been made through the efforts of various universities and research centers within the state. In fact, reclamation research has been a forerunner of much of the state's important legislation controlling the environmental impacts of mining.

Regulation of Mining

The North Dakota legislature passed laws regulating mining as early as 1907. These early laws dealt mainly with licensing, mine safety, and the prohibition of child labor in the mining industry. Since mining operations were relatively small and did not affect a large portion of the state, control of the environmental impacts of mining did not generate much public concern.

In the 1960s, however, public concern was aroused by the unreclaimed spoil piles left by the new large scale strip mines.

In 1963, the state legislature ordered a study of reclamation methods. This study concluded that no legislation was necessary at that time (Hagen 1974). The legislature passed another resolution in 1967 to investigate the need for reclamation of mined lands and to recommend appropriate legislation. This resolution resulted in enactment of the first reclamation law in North Dakota which was passed during the 1969 legislative session and became effective January 1, 1970.

Regulatory Program Development

The 1969 Law

The policy of the 1969 reclamation law was to provide for reclamation of affected lands to encourage their productive use. This law required each operator of a coal mine, where overburden depth exceeded ten feet, to obtain a permit. It designated the Public Service Commission as the agency responsible for the implementation and enforcement of the provisions of the law and provided for inspections to ensure compliance. The operator was required to submit a bond of $200 per acre to ensure reclamation in the event of permit revocation.

The law required the operator to strike off the tops of the spoil peaks to a minimum width of 35 feet for pastureland or 24 feet for afforested land, with peaks and ridges not to exceed 25% slope for cropland (unless the original grade was greater). It also required the operator to submit a reclamation plan based on the advice and assistance of the State Soil Conservation Committee, the State Game and Fish Department, and other agencies and individuals having experience in reclaiming mined lands. This plan had to designate which areas would be reclaimed for forest, pasture, cropland or other uses. Affected lands were required to be planted with appropriate seeds, plants or cuttings as approved by the Commission. Areas failing to support plant growth after initial planting had to be planted again.

The 1969 law was an initial step toward requiring coal mine operators to restore affected lands to the agricultural or other uses that existed prior to mining. Lands reclaimed under this law often became more useful than unreclaimed spoil piles. However, the success of reclamation was highly dependent on the physical and chemical properties of the spoil. For example, the glacial till spoil material at the Velva Mine in Ward County, being relatively low in sodium and salts, could be revegetated fairly easily. Therefore, grading required by the law made it possible to harvest hay or crops from the flattened spoil peaks, and thus made the land more useful. However, at other locations such as the Larson Mine in Burke County the sodic, clayey textured spoil made successful revegetation of affected areas nearly impossible. In fact, grading may have been counterproductive because it eliminated the shelter provided between the spoil peaks for wildlife.

The grading and seeding required by the 1969 law helped somewhat to stabilize the spoil piles and thereby reduced attendant air and water pollution. However, no containment or monitoring of runoff was required at that time.

The 1973 Law

Revisions made to the law in 1971 included a requirement that the operator obtain the landowner's preference for reclamation. But the next major changes to the law occurred in 1973: the operator was required to grade affected lands to approximate original contour (except for final cuts), remove all topsoil up to a depth of two feet prior to mining, and respread it after regrading of the spoil was completed. These changes greatly improved the usefulness of reclaimed lands.

The new grading requirements led to the elimination of the steep slopes (unless they existed prior to mining) that were an accepted consequence of mining prior to 1973. The requirements also led to a higher level of agricultural capability by increasing the proportion of the land that could be used for crop or hay production.

The requirement to save and respread topsoil greatly increased the potential for plant establishment on reclaimed areas. Power et al, (1974) found that as little as two inches of topsoil markedly increased vegetative establishment and production. Forage and crop yields on reclaimed lands respread with 12 inches of topsoil were found to be even better, with yields occasionally approaching premining levels (Doll et al 1983).

The 1973 law prohibited mining in certain areas where reclamation would be impossible or mining would imperil the welfare of the state. The operator was required to impound or otherwise treat all runoff water prior to discharging it from the minesite. This helped to reduce water pollution and sedimentation on agricultural lands. The law also required public notification of permit application. The amount of bond required was also increased at this time.

Important effects of the 1973 law were that reclaimed mined lands became nearly as useful and productive as they had been before mining, and many of the adverse environmental impacts of mining were confined to the minesite. This was especially true of those areas with good quality underlying spoil. It is important to remember that several major electrical generating stations had recently come on line or were being constructed at this time and, consequently, mining operations were becoming larger than ever before.

Another important result of the 1973 law was the creation of the Reclamation Division of the Public Service Commission. The Commission, with funds appropriated by the legislature, hired Dr. Edward J. Englerth as full time reclamation inspector. Subsequently, the Reclamation Division under the directorship of Dr. Englerth employed a multidisciplinary staff with expertise in geology, ecology, agricultural sciences, engineering and other disciplines in order to administer the ever more comprehensive regulatory program. The Reclamation Division was charged with reviewing permit applications, recommending and formulating programmatic changes, and conducting mine inspections to ensure compliance with the reclamation law.

The 1975 Law

The reclamation law was again revised in 1975. Perhaps the most important part of the 1975 law was its intent: "to restore mined areas designated for agricultural purposes to the level of inherent productivity equal to or greater than that which existed in the permit area prior to mining."

This declaration of intent had important ramifications to both the

mining industry and the Commission. How is the level of inherent (premining) productivity defined? How can it be proven that this level has been restored after mining? The 1969 law required only that the land be graded, seeded, and if necessary reseeded. The 1973 law was more comprehensive but its only requirements for release of operator liability were to reclaim the land according to its approved plan to the satisfaction of the Commission. The 1975 law now required the operator to restore the land's premining level of productivity.

However, the question of how to define premining productivity and to prove that it had been restored after mining was largely left unanswered in the 1975 law. The operator was required to have a soil survey completed by a professional soil classifier prior to any mining disturbance. This survey had to consist of a map identifying soil types and topsoil and subsoil depths, and a report giving soil volumes and describing the chemical and physical characteristics and other properties of the soil materials.

The operator was required to: a) remove both topsoil and subsoil to a total depth of 5 feet, if available, prior to mining, b) segregate and save them according to land ownership, and c) respread them in two layers within the land boundaries of each landowner from which the soil was removed. However, upon landowners consent, respread across property lines was allowed. It was felt that by these elaborate soil investigations and procedures for soil removal and respreading, the inherent productivity of the land would be preserved. The final decision on whether the requirements of the law had been achieved and the mining company could be released from bond liability was still left to the discretion of the Commission.

Other important requirements mandated by the 1975 law related to the collection of premining environmental data, protection of rights of landowners, and bond liability. The operator was required to conduct archaeological, geological, and hydrological surveys as a part of the limited and extended mine plan. If any landowner's well was disrupted or diminished, the mine operator was required to replace or repair it at no cost to the landowner. A three stage bond release process was implemented whereby the operator could be released from 40% of bond upon completion of grading, an additional 30% after soil respreading, and the remaining 30% after all reclamation was completed. Required bond amounts were increased. Also, a new law, the Surface Owner Protection Act, was enacted to provide maximum constitutionally permissible protection to landowners from the adverse affects of mining.

The 1975 amendments to the reclamation law were not as drastic as those of the 1973 law, but they were important in clarifying the overall intent: to protect agricultural lands from degradation as a result of surface mining. Reclamation of agricultural lands did improve as a result of the 1975 law. Researchers found that plant growth and production generally increased as the total topsoil and subsoil respread thickness increased, at least to a depth of 28 inches (Power et al 1979). Environmental protection also increased as a result of the 1975 law. Mining companies were required to monitor surface and groundwater and to mitigate the adverse affects of mining on these resources.

Another revision was made to the law in 1977. This required mine operators to grade disturbed lands

to the gentlest topography consistent with the adjacent landscape. Standards for evaluating the success of revegetation were also included in Commission rules at this time.

Regulation Of Mining Under SMCRA

On August 3, 1977 the 95th Congress enacted Public Law 95-87, entitled Surface Mining Control and Reclamation Act of 1977 (SMCRA). SMCRA continued in a developmental phase until March 13, 1979 when regulations implementing the Act were published in the Federal Register. Title V, Control of the Environmental Impacts of Surface Coal Mining, required that each state wishing to assume exclusive jurisdiction over regulation of surface coal mining and reclamation within its borders must submit a state program capable of carrying out the provisions of the federal act (SMCRA). In accordance with this provision, North Dakota's permanent regulatory program was approved by the Office of Surface Mining (OSM) on December 15, 1980.

Although North Dakota already had an effective regulatory program prior to enactment of SMCRA, several changes had to be made in order to comply with all the provisions of the federal act. The state had an interim program which became effective May 3, 1978. Some important changes at this time were that regulation of the use of explosives came under the Commission's jurisdiction, all runoff from disturbed areas had to be treated in sedimentation ponds, complete backfilling of final pits was required, and special rules regarding prime farmland were established.

For the approval of North Dakota's permanent regulatory program, it was necessary to make further amendments in its reclamation laws and rules. These amendments were made in 1979, and were designed to make the State program as effective as the federal program. The 1979 law designated areas prohibited from mining. It also required detailed statements of the probable and cumulative hydrologic impacts of proposed mining operations. Detailed quantitative premine vegetation data were required to be included with each permit application. Measurements of productivity, cover, diversity, and seasonality were required for reclaimed grasslands prior to request for bond release. No final bond release could be approved until a minimum of ten years after the last augmented seeding.

The changes included in the 1979 law probably had only minor effects on the overall quality of reclamation and environmental protection. But they did set forth means of assuring that extensive premining assessments would be made and also set performance standards to guide each phase of mining and reclamation.

Recent Regulatory Developments

There have been several recent modifications to the state program in the form of program amendments, law and rule changes, and policy memoranda. These have come about largely as a result of public comments, reclamation research, and input from the mining industry. Some of the important modifications relate to bonding, soil removal and respread, and methods to prove reclamation success.

In December of 1985, the Reclamation Division of the Public Service Commission issued Policy Memorandum No. 16 to Mine Operators. This policy established the "worst case" method of calculating reclamation costs for the purpose of bond liability. This method required calculation of the

amount of money it would take for the Commission to have the permit area reclaimed if bond was forfeited when the maximum amount of reclamation work was outstanding during the permit term. This method replaced the per acre cost assessment method in which different levels of bond were required per acre, depending on the level of disturbance. The per acre method often resulted in overbonding because it required a bond amount for each acre within the permit area irrespective of whether it would be disturbed during the five year permit term or not. The new bonding method provided a reasonable estimate of reclamation costs at the "worst case" during the permit term. It continued to ensure adequate money for reclamation in the event of bond forfeiture, without unnecessarily requiring bond for each permitted acre, and consequently saved money for the mining industry. Further changes were made to rules regarding bond requirements in 1988. These changes allow self bonding by a permit applicant in some instances.

A rule change was adopted in January of 1987 that affected the amount of subsoil that had to be saved and respread. This rule change was largely based on research conducted by North Dakota's Land Reclamation Research Center and the USDA/ARS Northern Great Plains Research Center in Mandan. This research concluded that the amount of subsoil needed for respread should be based on underlying spoil quality. Where mining companies were previously required to remove all soil identified by the soil survey, they could now remove a lesser amount of subsoil if the overburden was of satisfactory quality. Again, the state program was made more efficient; the quality of reclamation was maintained, but at a lower cost.

In 1989, after years of formulation, complete guidelines for the collection and evaluation of revegetation data for final bond release were completed by the Reclamation Division. Previously, the only approved method for evaluating revegetation success was by comparing unmined reference areas to reclaimed areas to determine if the reclaimed lands had achieved a level of vegetative productivity equal to or greater than that which existed prior to mining. This required that the mining companies manage and monitor a duplicate undisturbed tract of land in the same manner as the reclaimed tract. By using the new revegetation guidelines, they now can establish success standards for revegetation by a number of other methods using SCS data that relate productivity to soil series. These revegetation guidelines were the result of a cooperative effort between the reclamation division and the mining industry and were the first of their kind to be approved by OSM. This document will undoubtedly be used to develop similar revegetation guidelines for other states.

Summary and Conclusion

This paper provides a brief discussion of the history and importance of lignite mining in North Dakota, and the negative environmental impacts that were associated with mining prior to the reclamation law. It also outlines the development of the State's regulatory program that established the requirements for the reclamation of mined lands. This program began very simply, merely requiring the mine operator to obtain a permit, to grade spoil peaks, and to seed them. Within six years, it developed into a complete regulatory program requiring that the land be restored to its premining level of usefulness, or better, after mining. The further developments

that occurred in the program following enactment of SMCRA are also discussed. Presently, the State Program is as effective, and in some cases more stringent, than the federal program.

The success of North Dakota's mining and reclamation regulatory program is evident by the fine reclamation that has been achieved in the state. The state's reclaimed mined lands include highly productive farmlands, rangelands, well maintained industrial sites, and fish and wildlife areas including reconstructed wetlands that have been cited by the federal Office of Surface Mining for their excellence. In fact, mined lands in North Dakota have been reclaimed to as diverse uses as a golf course and an airport.

There are several reasons for this success. First, the commitment of the people of the state against leaving wastelands behind after mining. Secondly, the wise administration of the state's program: taking gradual steps and working cooperatively with other state and federal agencies, the research community, and the mining industry. Thirdly, the research community in the state provided much needed research as a basis for improving reclamation technology. Finally, the efforts and cooperation of the mining industry in its willingness to go the extra mile to reclaim the land appropriately and to prevent offsite impacts of mining to the highest degree possible.

What about the future of mining and reclamation and its regulation in North Dakota? Only time will tell. But it appears that it will continue to be as dynamic as in the past, balancing the economic needs of the state with the need to protect the environment.

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