

LINKING RESEARCH AND REGULATORY POLICY TO ENABLE ADVANCES IN RECLAMATION PRACTICE¹

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Abstract. Advances of coal-mine reclamation practice commonly involve scientists who conduct mining and reclamation research, industry reclamation specialists who apply those scientific advances in the field, and regulatory agency personnel who must approve of those changes by interpreting state and federal laws. In the state of Virginia, interactions between the Virginia Division of Mined Land Reclamation and Virginia Tech researchers have enabled adjustments of regulatory procedures to accommodate research findings. Elements of those interactions include (1) development of research designs that consider regulatory issues while addressing scientific principles; (2) effective communication between researchers and regulators prior to and during research, and in response to research findings; and (3) cooperative involvement by university and state-agency personnel in communicating practical implications of research findings to federal agencies and industry.

Additional Key Words: Surface Mining Control and Reclamation Act.

Introduction

The advance of coal-mine reclamation practice through scientific research commonly involves scientists who conduct reclamation research, industry reclamation specialists who apply those scientific advances in the field, and regulatory agency personnel who must approve changes of reclamation practice in order for them to be lawful. In states that have achieved primacy under the Surface Mining Control and Reclamation Act (SMCRA), coalmine reclamation practices are regulated by state agencies under federal oversight. In the state of Virginia, regulatory policies have been adjusted in response to research findings with federal

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consent. The purpose of this paper is to describe elements of the cooperative relationship between Virginia Tech's reclamation research program and the Virginia Division of Mined Land Reclamation (DMLR), the state agency that regulates coal mining under SMCRA. This cooperative relationship has enabled adjustments of regulatory policies to accommodate research results.

First, we will describe selected advances in reclamation policy and consequent advances in reclamation practice that have occurred in response to reclamation research. Then, we will describe elements of the Virginia Tech – Virginia DMLR relationship that have aided these advances.

Since 1980, Virginia Tech's coal-mine reclamation researchers have cooperated with one another and the Virginia coal industry through participation in the Powell River Project (Zipper and Rockett, 1997; Zipper, 1993). Working through Powell River Project and individually, these researchers have also maintained relationships with Virginia DMLR field and administrative personnel.

The Virginia Division of Mined Land Reclamation (DMLR) is within the Department of Mines, Minerals and Energy (DMME), Secretariat of Commerce and Trade. The DMLR was created in 1966 with enactment by the Virginia General Assembly of reclamation laws and regulations governing the coal industry. In 1977, Congress enacted the Federal Surface Control and Reclamation Act (Public Law 95-87, SMCRA). Virginia passed its own law (Virginia Coal Surface Mining Control Reclamation Act: Chapter 19, Title 45.1 of the Virginia Code) in 1979, which provided for the adoption of regulations comparable with SMCRA, thus gaining the authority to regulate coal mining within the state. Virginia's permanent regulatory program (4 Virginia Administrative Code 25-130-700.1 *et seq.*; 4 VAC 25-140-10 *et seq.*) was approved by the U.S. Office of Surface Mining and Reclamation Enforcement (OSM) in 1981. With this approval, the state gained primary authority for the enforcement of coal surface mining and reclamation requirements (“primacy”) under OSM oversight. In states with primacy, OSM's role is oversight and coordination with the state program to ensure that it meets the intent of SMCRA and the federal regulations implementing the Act (30 Code of Federal Regulations, 700 *et seq.*)

Virginia Reclamation and Policy Advances

Coal Refuse Revegetation

Reclamation of coal refuse disposal areas in Virginia is regulated by 4VAC25-130-816.83, which reads:

Following final grading of the refuse pile, the coal mine waste shall be covered with a minimum of four feet of the best available, nontoxic and noncombustible material, in a manner that does not impede drainage from the underdrains. The Division may allow less than four feet of cover material based on physical and chemical analyses, which show that the requirements of 4VAC25-130-816.111 through 4VAC25-130-816.116 will be met.

This regulation is intended to ensure that all reclaimed refuse disposal areas are able to meet SMCRA requirements for surface stabilization with permanent, self-sustaining vegetative cover. In the field, the regulation does have its intended effect but it also requires refuse operators to bear significant costs that are necessary to obtain 4 feet (1.2 m) of soil cover in mountainous terrain while disturbing additional land in borrow areas. Observation of pre-SMCRA refuse fills demonstrated that some refuse materials could be revegetated successfully with less than 4 feet (1.2 m) of soil cover or with direct seeding. Although the regulation does allow for a waiver of the topsoil thickness requirements, few firms were conducting analyses necessary to obtain such waivers during the 1980s.

Research to address coal refuse revegetation was initiated in 1986. This work included extensive sampling and analysis of refuse materials from throughout Virginia's coalfield (Stewart and Daniels, 1992) and field-plot revegetation experiments on 5 sites (Dove *et al.*, 1987). As a follow-up to the sampling survey, researchers installed revegetation field plots on 5 active refuse sites, testing revegetation strategies in controlled field-plot experiments (Daniels and Stewart, 2000). Based on this work, they recommended a range of revegetation strategies that could be implemented on Virginia refuse materials. Physical and chemical analyses of the refuse material to be revegetated are integral to deciding among these varied strategies. Depending on results, revegetation can be accomplished using recommended topsoil thicknesses

ranging from 25 cm to 1 m, fertilization and liming rates, and mulching and seeding practices. These recommendations were published as reclamation guidelines for the coal industry (Daniels *et al.*, 1995).

Based on this work, Virginia DMLR began approving revegetation plans for refuse disposal areas that conformed to Virginia Tech guidelines when supported by the recommended analyses and meeting all other requirements. Positive results of this approach have included reduced disturbance of topsoil borrow areas and reclamation cost savings by industry. In some cases, topsoil thickness waivers have allowed mining firms to advance coal-refuse reclamation plans more rapidly than would have been likely if a full four feet (1.2 m) of soil cover had been required.

Biosolids

Research on mining sites throughout eastern and midwestern US has demonstrated the benefits of controlled biosolids application to reclaimed mine areas (Haering *et al.*, 2000), including enhanced biological productivity of the mined area. Research to address use of biosolids to reclaim mined lands in Virginia began in 1981 with field plot experiments (Roberts *et al.*, 1988). The work continued in the late 1980s through a 150 acre controlled and monitored application of biosolids on an active mining operation (Daniels and Haering, 1994). When this application was initiated, Virginia's regulatory program contained no specific provisions for permitting biosolids applications. Thus, the permit was developed as an agreement between DMLR, the Virginia Department of Environmental Quality and the Virginia Department of Health to allow for the use of biosolids as an alternative soil amendment on an experimental basis. On-site water and vegetation monitoring data collected by Virginia Tech and the mining operator's water quality contractor demonstrated a successful application that stimulated biological productivity, relative to results that would have been likely had conventional reclamation practices been applied, with no adverse environmental impacts.

Virginia DMLR responded to this successful application by issuing Guidance Memorandum No. 6-95, Biosolids Use Guidelines, which defined biosolids application procedures demonstrated as effective by the experimental application. Furthermore, DMLR modified its permitting requirements by establishing permitting procedures specifically for the purpose of accommodating biosolids applications (Virginia DMLR, 1996; Section 9.6). In 2001, Virginia

DMLR eliminated all agency requirements specific to biosolids applications, referring operators to Virginia Department of Health regulatory program (12 VAC 5-585 *et seq.*) while retaining administrative procedures for permitting these areas.

Mine Reforestation

Virginia Tech research has been addressing mine reforestation practices since 1980 (Torbert and Burger, 2000). Based on research findings, reclamation guidelines for lands being reclaimed to forest were published in 1993 (Burger and Torbert, 1993). These recommendations include use of oxidized "brown" sandstone and some natural soil materials (where available) to produce a suitable mine soil, minimal surface grading so as to avoid soil compaction, and use of tree-compatible groundcover species and low levels of N fertilizer to minimize groundcover competition with seedlings. Use of these recommendations can create economic benefits, including reduced reclamation costs and increased timber value on the reclaimed mine area (Burger *et al.*, 1998).

Research results leading to these recommendations began emerging in the late 1980s and early 1990s. Changes in reclamation practice, however, did not follow these findings directly. Researchers found perceptions among operators that use of research recommendations on active mining sites could lead to regulatory difficulties. Prevailing reclamation practices at that time included routine "tracking in" and associated compaction of mine soils prior to revegetation, and use of aggressive groundcovers such as tall fescue (*Festuca arundinaceae*) in combination with high fertilization rates so as to achieve rapid and dense groundcover vegetation. At that time, these practices were conducted routinely by the mining industry, with full support by both state and federal inspectors. When approached by the researchers in attempts to advance on-site practices, mining operators stated their beliefs that such practices were required by SMCRA and were necessary to satisfy inspector preferences. A reading of SMCRA and supporting state and federal regulations, however, led DMLR to conclude that this was not the case. In order to communicate this fact to mining operators, Virginia DMLR issued several communication documents (Virginia DMLR, 1996; Virginia DMLR, 2001), which were explicit in defining allowable reforestation procedures that are consistent with research-based recommendations. As a result, reclamation practices recommended by Virginia Tech and DMLR, based on research findings, are now in routine usage by some Virginia mining firms.

Remining to Reclaim Abandoned Mined Lands

Abandoned Mined Lands (AML) are lands that were mined prior to SMCRA implementation but were inadequately reclaimed. AML areas are common in Appalachian and Midwestern coalfield areas today; projected reclamation costs far exceed resources expected to be available through SMCRA's Title IV Abandoned Mine Reclamation Fund (AML Fund).

Re-mining of AML is being conducted on a routine basis by coal-mining operations in eastern states such as Virginia. Many AML features lie in close proximity to mineable coals. Given the AML Fund's limitations, remining and reclamation by active operations can be seen as a reasonable and low-cost means for achieving reclamation of such areas. However, under SMCRA, re-mining operations often fail to permit and reclaim AML, especially those areas which present the most severe environmental problems. An operator who permits these areas assumes the liability for any environmental problems that may exist at the site. Public benefits occur when remining operations are able to fully extract coal resources remaining on AML sites while using revenues from those resources to help pay for reclamation.

Virginia Tech and Virginia DMLR cooperatively addressed remining issues in Virginia. In the late 1980s, Virginia DMLR established a task force to address remining issues, seeking to develop policies to enable and provide incentives for reclamation of AML by active operations. Virginia Tech's Powell River Project participated in that activity, but a number of task force recommendations failed to receive federal approval by OSM. In the early 1990s based on that experience, Virginia Tech initiated research to address policy barriers created by SMCRA for AML reclamation by active operations, including environmental consequences of then-current policies (Zipper *et al.*, 1992) and perceptions by mining industry, regulatory agency, and environmental interest personnel of policy options (Santopietro and Zipper, 1996). In 1994, Virginia Tech's Powell River Project produced a video presentation to enhance public awareness of the AML reclamation problem, with Virginia DMLR cooperation (Zipper and Slempe, 1994), which was circulated to other state agencies and within OSM. In 1996, DMLR established a second task force to address remining issues that included participation by the mining industry, natural resource agencies, and community interests (Zipper and Lambert, 1998). This task force proposed a number of policy changes, for the purpose of enhancing opportunities for AML

reclamation by active mining operations. In order for these changes to be implemented by DMLR, approvals by OSM were required. The broad-based composition of the re-mining task force and a field visit to a Virginia re-mining site by OSM officials, co-hosted by Virginia Tech and Virginia DMLR, were instrumental to OSM approval of selected task-force recommendations.

Policy changes occurring in response to these activities have resulted in AML reclamation by active mining operations. For example, Virginia DMLR is now able to issue “no cost contracts” for reclamation of AML adjacent to active mining operations, thus allowing operators to reclaim AML voluntarily using excess spoil. The “no cost contract” agreement is between the Virginia AML program (administered by Virginia DMLR under SMCRA Title IV) and an operator of an active mine site which is permitted by Virginia DMLR under SMCRA Title V. The agreement allows the operator to place spoil on AML without permitting the AML spoil-placement under Title V. Spoil placement and reclamation practices on the AML site, however, are governed by the no-cost contract, under SMCRA Title IV. The benefits include cost savings for the Title IV AML reclamation program and a savings to the operator in spoil handling. Where conditions are favorable for this practice, the mining firm is able to reduce or eliminate excess spoil disposal in hollow fills while reclaiming AML features.

Another innovative means being used to reclaim AML in Virginia today is the experimental practice program. SMCRA Section 711 allows experimental practices, which may include departures from the Section 515 and 516 performance standards, on an experimental basis “[i]n order to encourage advances in mining and reclamation practices or to allow post-mining land use ...” Virginia’s re-mining task force identified spoil handling constraints imposed by the requirement to use all “reasonably available” spoil on the permit site to backfill the highwall “to the maximum extent technically practical” [30CFR 816.106] as a major constraint to active Title V operations on AML (Zipper and Lambert, 1998). As a result, Virginia DMLR and the re-mining task force began looking for innovative ways to reclaim AML while allowing an operator flexibility in spoil handling practices. The Virginia DMLR presented to OSM an interpretation of the current regulation that allowed spoil to be diverted from second-cut (AML re-mining) areas and placed on AML as long as the second-cut area is reclaimed in a manner that promotes environmental protection. OSM did not agree with this interpretation and suggested another approach to achieve the desired results. Both agencies concurred that this could be done

as an experimental practice (SMCRA Section 711). Because of the cooperation between both agencies, several innovative practices that reclaim AML are taking place today. Under this program, Virginia mining firms today are voluntarily reclaiming AML that otherwise would remain as unreclaimed environmental liabilities.

Virginia Tech – DMLR Cooperation to Support Policy Adjustment

Adjustment of regulatory policies to support research recommendations has occurred within the context of a wide-ranging relationship between Virginia Tech reclamation research faculty, working through Powell River Project, and Virginia DMLR. On-going and wide-ranging communication has been a key component of this process.

Committee Service

Virginia DMLR (working with its parent agency Virginia DMME) routinely establishes and leads committees representing the mining industry and other “stakeholder” groups for the purpose of obtaining feedback on its policies. These committees include the Governor’s Task Force on Reclamation, Abandoned Mined Land Reclamation Advisory Committee, and the Remining Ad-Hoc Advisory Committee. Since the 1980s, Virginia DMME has requested participation by Virginia Tech reclamation-research faculty on these committees, and those faculty have devoted time and attention participation in committee activities.

Research Design

Virginia Tech research has addressed regulatory and enforcement issues directly, in the context of research designs that also address scientific principles. For example, research addressing revegetation practices on coal refuse evaluated alternatives to the default requirements of Virginia’s regulatory program. The reforestation research program has also addressed regulatory issues. For example, SMCRA requires that reclamation operations “to effectively control erosion and attendant air and water pollution” [Sec. 515 (b)(4)]. Research was conducted to assess the capability of loosely graded spoils revegetated with less-aggressive “tree compatible” groundcovers, as recommended for forest sites, to satisfy this requirement (Torbert and Burger, 1996). In the AML reclamation area, research addressed policy issues

directly, assessing potential policy alternatives designed to stimulate AML reclamation by active operations from the perspective of knowledgeable parties and affected interest groups (Santopietro and Zipper, 1996).

Working through Powell River Project, Virginia Tech researchers routinely request review and comment by DMLR on research proposals that contain regulatory implications while those proposals are in the development stage. DMLR personnel devote time to providing thoughtful and thorough review of those proposals. This communication supports researcher efforts to address policy issues in a manner that respects and is supportive of the agency's role and responsibilities.

In cases where research takes place on active mining permits, direct and formal communication between research and regulatory personnel occurs. This communication also involves the industry cooperator. For example, submission of the mining permit application for biosolids use in reclamation was preceded by a series of meetings among regulatory, industry, and agency personnel and site visits. At present, Virginia Tech is working with mining operators to install mine reforestation field trials using advanced reforestation procedures. Again, consistent communications with both DMLR and industry cooperators are preceding any work in the field.

Research Progress

Working through Powell River Project, Virginia Tech researchers commonly host field reviews of in-process research. Personnel from Virginia DMLR, OSM's Virginia field office, and the mining industry commonly participate in these activities. For example, coal refuse revegetation and biosolids application experiments on active refuse areas were visited by large groups for field discussions on a repeated basis. Much of the reforestation research is conducted at the Powell River Project's Education Center site in Wise County, Virginia. Field programs focusing on reforestation research and reclamation practices, and involving mining industry and state and federal agency personnel, were held regularly at the Education Center over the 1995 – 2001 period. Such field reviews provide a context for informal discussion between participants about the research and potential implications while informing the agency of preliminary research results in advance of final findings.

Dissemination of Research Results

At Virginia Tech, publications issued through Virginia Cooperative Extension are an important mechanism for disseminating research-based reclamation-practice recommendations to industry. Virginia Tech personnel routinely request formal Virginia DMLR review of all Extension publications dealing with regulated practices or having regulatory implications. In this manner, authors are able to ensure that all recommendations to industry are consistent with regulatory requirements.

Virginia Tech and Virginia DMLR also cooperate in communications involving research-recommended reclamation practices to OSM. Virginia's regulatory program operates under oversight provided by US Office of Surface Mining (OSM). Thus, all formal communications to mining operators, such as Guidance Memoranda, must be approved by OSM. Virginia OSM field office personnel are invited to participate in all field research reviews. On several occasions, Virginia Tech and DMLR have co-hosted OSM's Director at its Education Center research for events communicating research results. These jointly hosted visits by OSM administrators to Virginia have contributed to OSM support and approval for policy changes regarding reforestation and AML reclamation through re-mining.

Conclusion

Virginia Tech's reclamation research commonly addresses reclamation-science issues that have regulatory implications. In Virginia, the Division of Mined Land Reclamation (DMLR) enforces SMCRA under federal primacy. When supported by research findings, DMLR has adjusted its policies so as to enable advances in reclamation practice by industry. These changes have occurred within a context defined by ongoing and consistent communication between personnel at Virginia Tech and Virginia DMLR.

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