THE SURFACE MINING CONTROL AND RECLAMATION ACT: A RESPONSE TO CONCERNS ABOUT PLACMENT OF COAL COMBUSTION BY-PRODUCTS AT COAL MINES

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Abstract

The use and disposal of Coal Combustion By-Products (CCBs) (i.e. fly ash, bottom ash, flue gas desulfurization material, and fluidized bed combustion material) at coalmines has become an area of intense interest, research, activity, and controversy during the last decade. The U.S. DOI, Office of Surface Mining (OSM) was created in 1977 as part of the Surface Mining Control and Reclamation Act (SMCRA) to provide minimum levels of protection concerning public health, safety, and the environment and balance this with the need for a viable U.S. coal supply. Beginning in May of 1994, OSM has taken an active role in encouraging and promoting technological advances, research, and technology transfer related to the use and disposal of those material residues remaining after the combustion of coal to produce electric power.

Currently, there are less than 2 percent of the CCBs that are produced in the U.S. that are placed back at less than 2 percent of the mines sites where they originated. Most of the uses to date have been extensively researched. This research indicates that the placement of these materials on the mine site usually results in a beneficial impact to human health and the environment when it is used to mitigate other existing potential mining hazards. It can also be used to improve the economics of mining when used as a non-toxic fill within the spoil area prior to grading and final reclamation. Beneficial uses include: (1) a seal to contain acid forming materials and prevent the formation of acid mine drainage; (2) an agricultural supplement to create productive artificial soils on abandoned mine lands where native soils are not available; (3) a flowable fill that seals and stabilizes abandoned underground mines to prevent subsidence and the production of acid mine drainage; (4) a construction material for dams or other earth like materials where such materials are needed as a compact and durable base; and (5) a non-toxic, earthlike fill material for final pits and within the spoil area.

The recycling of these materials into useful products has attracted a great deal of interest as a raw material for basic construction products off the mine site. Concerning CCB placement at coalmine sites, some environmental groups believe the use of these materials places an unacceptable risk on public health and environmental quality. This paper will attempt to provide a response to public criticism concerning the relative adequacy of SMCRA programs that protect public health and the environment when CCBs are placed at a SMCRA permitted mine site.

A Brief History of U.S. Environmental Protection Agency (EPA) Rule-making on CCBs Related to Their Use and Disposal on Coal Mine Sites.

In October of 1980, Congress temporarily exempts from regulation, under Subtitle C of the Resource Conservation and Recovery Act (RCRA), certain large volume fossil fuel wastes (FFW) and then directed the U.S. EPA to conduct a detailed and comprehensive study of fossil fuel wastes based on 8 study factors.

On August 9, 1993, the U.S. EPA made a regulatory determination that the four large volume FFWs do not warrant regulation as hazardous under Subtitle C of RCRA. EPA commits to a schedule to complete the report to congress for the remaining wastes.

In its decision on May 22, 2000, the U.S. EPA determined that national regulations under subtitle D (Solid Waste) of the Resource Conservation and Recovery Act (RCRA) [and/or possible modifications to regulations under the Surface Mining Control and Reclamation Act (SMCRA)] were warranted when these wastes are used to fill surface or underground mines. EPA believes this is necessary so that CCBs will be consistently managed across all waste scenarios. EPA expects to have a proposed rule out under Subtitle D of RCRA (Solid Waste) in 2003 and a final rule by 2004.

Purposes of SMCRA

The purposes of SMCRA are given in the Act as follows, 30 U.S.C. 1202:

- Establish a nationwide program to protect society and the environment from the adverse effects of surface coal mining operations.
- Assure that the rights of surface landowners and other persons with a legal interest in the land or appurtenances thereto are fully protected from such operations.
- Assure that surface mining operations are not conducted where reclamation as required by the Act is not feasible.
- Assure that surface coal mining operations are so conducted as to protect the environment.
- Assure that adequate procedures are undertaken to reclaim surface areas as contemporaneously as possible with the surface coal mining operations.
- Assure that the coal supply essential to the Nation's energy requirements, and to its economic and social well-being is provided and strike a balance between protection of the environment and agricultural productivity and the Nation's need for coal as an essential source of energy.
- Assist the States in developing and implementing a program to achieve the purposes of the Act.
- Promote the reclamation of mined areas left without adequate reclamation prior to the enactment of the Act and which continue, in their unreclaimed condition, to substantially degrade the quality of the environment, prevent or damage the beneficial use of land or water resources, or endanger the health or safety of the public.

- Assure that appropriate procedures are provided for the public participation in the development, revision, and enforcement of regulations, standards, reclamation plans, or programs established by the Secretary or any State under the Act.
- Provide a means for development of the data and analyses necessary to establish effective and reasonable regulation of surface mining operations for other minerals.
- Encourage the full utilization of coal resources through the development and application of underground extraction technologies.
- Stimulate, sponsor, provide for and/or supplement present programs for the conduct of research investigations, experiments, and demonstrations, in the exploration, extraction, processing, development, and production of minerals and the training of mineral engineers and scientists in the field of mining, minerals resources, and technology, and the establishment of an appropriate research and training center in various States.
- Wherever necessary, exercise the full reach of Federal constitutional powers to insure the protection of the public interest through effective control of surface coal mining operations.

Response to Concerns about the Placement of Fly Ash, Bottom Ash, Flue Gas Desulfurization Material, and Fluidized Bed Combustion Ash at SMCRA Mine Sites

Concern #1: Mine filling (with CCBs) is not adequately addressed by SMCRA.

RESPONSE: There is no exemption for any coal combustion by-product placed at a SMCRA mine site from any of the permitting requirements and environmental performance standards contained in SMCRA. When the use or disposal of coal combustion by-products happens at surface coal mines, State and Federal coal mining regulators are involved to the extent that SMCRA requires[2]:

- the mine operator to ensure that all toxic materials are treated, buried, and compacted, or otherwise disposed of, in a manner designed to prevent contamination of the ground or surface water;
- making sure the proposed land use does not present any actual or probable threat of water pollution; and
- ensuring the permit application contains a detailed description of the measures to be taken during mining and reclamation to assure the protection of the quality and quantify of surface and ground water systems, both on and off-sites, from adverse effects of the mining and reclamation process also to assure that rights of present users of such water are protected.

Any disposal of coal combustion by-products at mine sites must be in accordance with SMCRA standards, State and Federal Clean Water Act requirements, and with applicable State solid waste disposal requirements. The States differ in their regulatory requirements for disposal of coal combustion by-products as solid waste. Trace element concentrations in coal combustion by-products vary according to where the coal was mined and how it was processed. Chemical and physical site characteristics differ by region. Accordingly, State regulatory programs that allow use or disposal must be

designed to handle those differences.

Based on the extensive body of research [1,3] that has been focused on this issue over the last 20+ years that has shown many positive environmental effects and no negative effects, the author concludes that SMCRA is providing adequate protection of public health, safety, and the environment.

Concern #2: These materials (CCBs) are wastes containing significant quantities of hazardous constituents.

RESPONSE: Research[4] has shown that less than 1 percent of these materials have the potential to leach hazardous constituents (According to Nationwide Analysis by the U.S. Department of Energy with only 2 out of 288 sources, or 0.7 percent, of the CCBs tested demonstrated the potential to leach trace elements at levels that would be classified as hazardous).

Concern #3: Only RCRA has the authority to address the problems presented by solid and hazardous waste.

RESPONSE: Although no regulatory authority can contradict RCRA, many other State and Federal regulations can and do apply to the handling of wastes or recycled materials. RCRA is not exclusive. It is interesting to note that all of the few examples of potentially hazardous constituents contaminating ground or surface water produced from these materials were produced under the regulation of the U.S. EPA that implements RCRA and none under the U.S. OSM that regulates SMCRA.

Concern #4: These materials, when exposed to ground water, leach hazardous constituents.

RESPONSE: Research[4] has shown that less than 1 percent of these materials have the potential to leach hazardous constituents based on laboratory testing with the TCLP method. Based on U.S. EPA ground water monitoring of over 1,000 wells at electric utility CCB disposal areas nationwide, the data has demonstrated that only 12 of those wells have produced water at levels considered hazardous and none from SMCRA mine sites. All of the SMCRA water monitoring data I am aware of to date, indicate that placement of these materials at SMCRA mine sites does not produce ground water that has hazardous constituents and in most cases is environmentally beneficial.

Concern #5: The leaching process may take decades, but significant quantities of toxic constituents will exit a deposit of these materials, often severely impacting ground and surface water.

RESPONSE: The SMCRA permitting process is designed to prevent both the acceptance of any CCB materials that have the potential to harm public health or the environment and the placement of materials in such a manner on the mine site that they would have the potential to leach toxic levels of constituents. The SMCRA mining and reclamation

plan is designed to ensure that the placement of the material will not have the potential to contaminate either the ground or surface water. The SMCRA water-monitoring plan is designed to demonstrate that the SMCRA permitting and planning process has been successful in protecting the environment both during and after mining.

The author would agree that in some hydrogeologic settings it may take decades to restore the long term water table at a mine site (specifically in the arid Western U.S.). The chemical nature of these CCB materials, however, is such that any constituents leached from them will leach very rapidly at first and then be reduced to barely detectable levels. This means that water-monitoring data will quickly identify the worst possible leachate characteristics that could be expected from placement of these materials at a mine site. Based on the extensive body of research [1,3] that has been focused on this issue over the last 20+ years that has shown many positive environmental effects and no negative effects, the author concludes that SMCRA is providing adequate protection of public health, safety, and the environment.

Concern #6: The use of these materials as mine fill threatens to cause problems more severe than the conditions it was intended to ameliorate (i.e. reduce acid mine drainage).

RESPONSE: Recent studies by the U.S. Geologic Survey[5] have successfully utilized magnesium to calcium ratios and sulfur-isotope ratios as tracers on Pressurized Fluidized Bed Combustion (PFBC) by-product placed in an abandoned coalmine to mitigate the effects of acid mine drainage. The study demonstrates that the application has been environmentally beneficial both in dramatically decreasing the effects of acid mine drainage and that any remaining trace elements in the ground water are due to acid mine drainage and not leachate from the PFBC.

Concern #7: The standard leaching test on a typical sample of these materials yields results indicating that these materials meet SMCRA's definition at 30 CFR 701.5 of a "toxic forming material" which means "earth materials or wastes which, if acted upon by air, water, weathering, or microbiological processes, are likely to produce chemical or physical conditions in soils or water that are detrimental to biota (life) or uses of water." Yet nowhere in SMCRA, its regulations or in OSM guidance is there any explanation or numerical standard that can be used to apply this definition in the field. Furthermore, SMCRA regulations employ confusing language that requires "contact (of water) with toxic producing deposits" to be either "prevented," removed," or "minimized" without explaining what such deposits are or which of these directives should be applied in any particular case. The result is mine filling programs throughout the U.S. that range from those isolating these materials many feet above water tables to those allowing millions of tons of toxic forming materials to be dumped directly into groundwater aquifers that are being used for private and public water supplies.

RESPONSE: Most of these materials would not meet the SMCRA definition of toxic forming material because most of them have leachate characteristics in the same range as

non-toxic native soil materials. Less than 2 percent of these materials have the potential to produce toxic levels of leachate. Because leachate tests are required as part of the SMCRA permit applications, the permit can not be approved until the operator demonstrates that the placement of the material in question on the mine site will not cause or contribute to contamination of the ground or surface water.
SMCRA language is not confusing. SMCRA requirements differ from RCRA requirements however because they are based on performance standards rather than design standards. By using performance standards, which are minimum levels of environmental protection, SMCRA allows for each State Regulatory Authority to develop methods and techniques which are most appropriate for the climate, geology, geography, and other site conditions that occur locally. It also allows the operator to design the site-specific mining and reclamation techniques that maximize the operator's efficiency and still insure the appropriate level of environmental protection. The result is that each State is allowed to develop a program specifically suited to its needs to protect the environment based on local conditions while maintaining a uniform national level of environmental protection. This result is supported by all existing scientific research and water monitoring which finds no evidence of damage to public health or environment due to the placement of these materials at SMCRA mine sites and in most cases actual improvement of ground or surface water quality. In those cases where they are used as soil amendments on abandoned mine projects, both researchers and State AML programs report improved plant growth.

Concern #8: Ground water monitoring programs at active and inactive mines in Indiana, Illinois, Ohio, Kentucky, West Virginia, Pennsylvania, Texas, North Dakota, and New Mexico have been reviewed and found that, without exception, none of the ground water monitoring at these sites approaches the standard level of ground water monitoring undertaken at RCRA solid or hazardous waste disposal facilities.

SMCRA is different from RCRA in that SMCRA using minimum environmental performance standards that allow adaptation to site specific conditions while RCRA applies uniform engineering design standards without regard for local site conditions. Each uses different methods to achieve the same end of protection of public health and the environment. SMCRA requires that water monitoring plans at a SMCRA mine site, including those where placement of these materials takes place on the mine site, must be designed to protect the current and approved post-mining land use and to protect the hydrologic balance and to comply with existing State and Federal Water Quality laws and regulations. The final proof is that there is no credible evidence that SMCRA has not protected the public or the environment where these materials have been placed at a SMCRA mine site. All of the scientific evidence to date shows that placement of these materials at SMCRA mine sites has either been environmentally beneficial or has had no negative effect.

Concern #9: At many inactive mines used as fills for these materials, there is no monitoring at all because OSM and the States fail to require such monitoring at abandoned mine reclamation projects.

RESPONSE: At SMCRA abandoned mine land projects, the State Regulatory Authority is required to apply for a NPDES permit under the Clean Water Act. If the State Clean Water Authority requires an NPDES permit, then the project must obtain the permit and comply with any applicable monitoring or water quality requirements. A recent study by Ralph Haefner of the U.S. Geologic Survey [5] conducted testing and monitoring to determine the impact of placing CCBs at an abandoned mine land reclamation site contaminated by acid mine drainage. This study proved that water quality after application of the CCBs was greatly improved following CCB placement at this site and that any remaining potentially toxic elements were a result of the historic acid mine drainage and not due to leachate from the CCBs.

Concern #10: In EPA's May 2000 Determination on Wastes from the Combustion of Fossil Fuels, the agency expressed concern over the lack of groundwater monitoring at (*ELECTRIC UTILITIES NOT COVERED BY SMCRA*) CCW landfills and surface impoundments. EPA pointed out that 62 percent of (*ELECTRIC UTILITIES NOT COVERED BY SMCRA*) CCW surface impoundments lack ground water monitoring systems. The commenter supports EPA's concern about the lack of monitoring and liners at (*ELECTRIC UTILITIES NOT COVERED BY SMCRA*) CCW landfills and surface impoundments and the need for RCRA controls. The commenter believes it follows logically that this concern should extend to the much greater quantities of these materials placed in mines, sometimes in direct contact with ground water.

RESPONSE: It is not valid to compare utility fossil fuel waste disposal sites where toxic leachate has occurred with SMCRA mines sites where toxic leachate has not occurred, as they differ significantly in terms of regulatory requirements, geology, geography, hydrology, characteristics of materials placed, and reclamation practices.

ELECTRIC UTILITY CCB DISPOSAL FACILITY

Electric utility disposal sites where toxic leachates have occurred are typically characterized by:

- geographic placement in a floodplain;
- a geologic setting of alluvial sand and gravel usually close to a river;
- ground water that is plentiful and of high quality;
- all types of fossil fuel wastes are placed in these facilities in a wet slurry without any chemical characterization of the material;
- reclamation is accomplished with a shallow layer of fill over the area and revegetated; and
- the Clean Water Act usually covers the area during operation and State Solid Waste regulations at disposal (Figure 1).

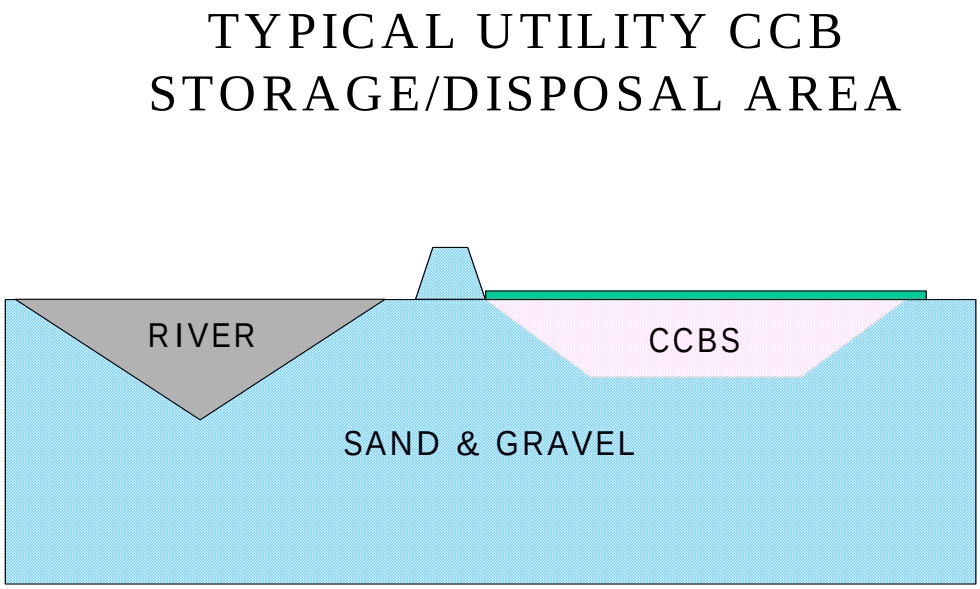

Figure 1. Typical cross-section of an electric utility disposal site where toxic leachate has occurred.

SMCRA MINE SITE CCB PLACEMENT

CCB placement at mine sites typically is characterized by:

- a geographic placement in an upland position;
- a geologic setting of bedrock sandstone, shale, and limestone underlain by an impermeable fire clay below the lowest coal seam that was mined;
- ground water is limited and of poor quality;
- only those CCBs that are leachate tested and approved in the SMCRA permit are allowed for placement on the mine site;
- reclamation is accomplished with a deep layer of spoil over the area followed by topsoil and then revegetated; and
- at all phases, the placement is regulated by the environmental protection permitting and performance standards of SMCRA, which include the requirements of the Clean Water Act and applicable State Solid Waste program requirements (Figure 2).

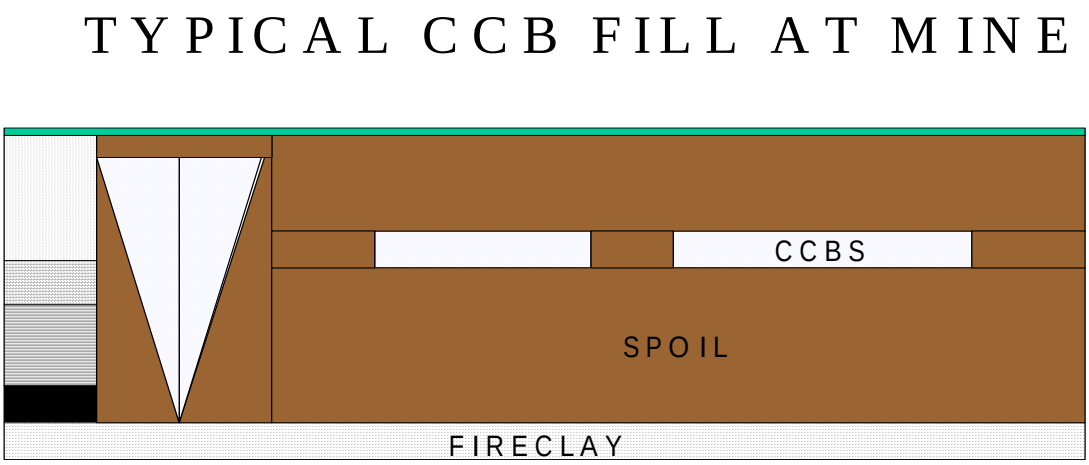

Figure 2. Typical cross-section of CCB placement at a reclaimed coalmine site.

According to the U.S. Geologic Survey and the American Coal Ash Association [6], in 2000 the total production of these materials was 98.2 million metric tons. Of that total, 29.1 percent was recycled as commercial products and 1.55 million metric tons or 1.6 percent was placed at mines sites. The remaining 69.6 million metric tons or 70.9 percent was placed in surface impoundments of landfills under the control of the electric utility industry. Neither logic nor simple arithmetic would support the claim that much larger quantities of these materials are placed at mine sites than by electric utilities in surface impoundments or landfills.

Concern #11: Without exception, OSM and State mine regulatory officials interpret the requirements of SMCRA to mean that groundwater monitoring at mine fills need only take place through the final release of mine reclamation bonds. This typically occurs within 3 to 8 years after mining when surface revegetation is met and mine operators have demonstrated that the post-mine groundwater recharge capacity exists. Thus, given the slow and usually unpredictable rate of groundwater re-saturation around mine fills, monitoring is stopped many years if not decades before down gradient flows of groundwater, much less plumes of fossil fuel waste contaminants, would even be detectable from these sites. Without the bonds being held for much longer periods, no financial assurance is available. Furthermore, the commenter has yet to find a mine reclamation bond valued at a level that would cover the costs for post-closure monitoring or maintenance of a mine fill placement site nor has the commenter found a ground water monitoring program at such a site with a numeric standard or concentration of pollution that could constitute a corrective action standard.

RESPONSE: OSM has not provided any interpretation of the SMCRA requirements for duration of performance bonds other than the plain language of 30 CFR 800.13(a)(1) that performance bond liability shall be for the duration of the surface coal mining and reclamation operation and for a period which is coincident with the operator's period of extended responsibility for successful revegetation provided in 816.116 or until achievement of the reclamation requirements of the Act, regulatory programs, and permit, whichever is later. At a minimum, 30 CFR 816.116(c) requires the period of extended responsibility for successful revegetation after the last year of augmented seeding…. And in areas with more than 26 inches of annual precipitation for 5 full years and in areas with less than 26 inches of annual precipitation for 10 full years. In practice, OSM has found that most operators do not achieve a phase III release until long after this minimum time period. In the year 2000 OSM annual report, OSM records that there were 4,530,710 acres under SMCRA permit. In that same year 63,071 acres, or 1.4 percent of that acreage, received a full Phase III bond release. At that rate of release, it would take almost 72 years to release the remainder of the acreage currently under permit.

What is important, concerning SMCRA performance bonding duration, is that SMCRA requires that the bond not be released until all of the reclamation requirements of the SMCRA, including protection of water quality, is achieved. To date, there has been no scientific evidence to support the claim that water monitoring, where these materials are placed at a mine site, needs to be longer than that required for proof of revegetation success. If such evidence were eventually produced, then SMCRA would require that the bond be maintained until the minimum performance standards were met regardless of the time it took.

The argument that a determination of potential water quality contamination cannot be determined until the volume of ground water has reached complete re-saturation is not scientifically valid. Research to date [1,3], indicates that release of leachable trace elements from CCBs placed at mine sites: (1) is not at levels that threatens public health or the environment, (2) takes place very quickly when placed in contact with water, (3)

that most elements leached from these materials are usually quickly absorbed by the surrounding spoil materials (usually dominated by clay and silt sized particles produced by shale rock in the overburden), and (4) that any long term leachate from these materials at SMCRA mine sites does not pose any threat to public health or the environment.

Concerning the bond amount, no value for post closure monitoring and maintenance of the placement sites can be assessed when the best science available indicates that none will be necessary. Concerning a numeric standard for water quality, SMCRA requires that water monitoring plans at a SMCRA mine site, including those where placement of these materials takes place on the mine site, must be designed to protect the current and approved post-mining land use and to protect the hydrologic balance and to comply with existing State and Federal Water Quality laws and regulations. SMCRA is based on performance standards rather than design standards. By using performance standards, which are minimum levels of environmental protection, SMCRA allows for each State Regulatory Authority to develop methods and techniques which are most appropriate for the climate, geology, geography, and other site conditions that occur locally. It also allows the operator to design the site-specific mining and reclamation techniques that maximize the operator's efficiency and still insure the appropriate level of environmental protection. The result is that each State is allowed to develop a program specifically suited to its needs to protect the environment based on local conditions while maintaining a uniform national level of environmental protection. This result is supported by all existing scientific research and water monitoring which finds: (1) no evidence of damage to public health or the environment due to the placement of these materials at SMCRA mine sites; (2) in most cases, actual improvement of ground or surface water quality; and, (3) in the cases where they are used as soil amendments, improved plant growth on the surface.

Concern #12: In contrast to (RCRA) landfills, there are no on-site restrictions for future use of mine fill properties. Placement of these materials at mine sites can cover large areas up to several thousand acres. The commenter has yet to find a State mine fill program or OSM requirement that obligates a mine operator to post a notice that disposal of fossil fuel waste has even occurred at a mine fill, no matter how large the scale.

RESPONSE: SMCRA requires mining and reclamation plans, including those incorporating placement of these materials at the mine site, to be proposed, reviewed, and approved as a part of the permitting process. SMCRA requires at 30 CFR 773.13 that all permit applications, significant revisions, and renewals of all permits be advertised in local newspapers and copies of the application materials be made available to the public. All SMCRA permitting documents, except for certain proprietary information, are a matter of public record. Since SMRCA also requires that the pre-mining capability of the land be restored following mining and reclamation, there is no need for on-site restrictions.

Conclusion

OSM has been extensively involved with the development and distribution of technical information related to the beneficial placement of CCBs at coal mine sites. Because of the complexity of the issues involved and the importance of protection of public health and the environment during surface coal mining and reclamation, OSM is very supportive of additional research into the potential environmental effects of CCB placement at coal mine sites. The author's assessment of the 20+ years of research on the subject to date indicates that the placement of these materials on SMCRA mine sites usually results in a beneficial impact to human health and the environment when it is used to mitigate other existing potential mining hazards or as a non-toxic fill to reduce reclamation costs. Any additional Federal regulation of CCB placement at SMCRA mine sites, however, should be based on sound scientific evidence that the existing regulatory framework is not adequate.

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