DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Mining Programs

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TITLE:	Guidelines for Beneficial Use of Coal Ash at Coal Mines
EFFECTIVE DATE:	Upon publication of notice as final in the *Pennsylvania Bulletin*
AUTHORITY:	Pennsylvania's Solid Waste Management Act (35 P.S. §§ 6018.101 et seq.), 25 Pa. Code Chapter 290; Clean Streams Law (35 P.S. §§ 691.1 et seq.), Surface Mining Conservation and Reclamation Act (52 P.S. §§ 1369.1 et seq.), and Noncoal Surface Mining Conservation and Reclamation Act (52 P.S. §§ 3301.1 et seq.).
POLICY:	It is the policy of the Department of Environmental Protection (DEP or Department) to assure that coal ash, which may be beneficially used at mine sites for reclamation, will not cause pollution to the waters of the Commonwealth and will meet reclamation objectives.
PURPOSE:	This document explains some new requirements for the beneficial use of coal ash put in place as a result of amendments to Chapter 287 and the development of the new Chapter 290. It clarifies implementation of the new requirements and various items identified through research and/or monitoring data.
APPLICABILITY:	This guidance applies to generators of coal ash, mine operators, consultants, reclamation contractors, and Department staff who are involved in the beneficial use of coal ash at active surface and deep coal mines, coal refuse reprocessing sites, coal refuse disposal sites, and abandoned coal and noncoal mines.
DISCLAIMER:	The policies and procedures outlined in this guidance document are intended to supplement existing requirements. Nothing in the policies or procedures shall affect regulatory requirements. The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of DEP to give these rules that weight or deference. This document establishes the framework within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.
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I. BACKGROUND

The Pennsylvania Solid Waste Management Act of 1980 was amended in December 1986 to allow for the beneficial use of coal ash. The amendments to the Act authorized the Department to certify coal ash that could be beneficially used. In July 1992, standards for the beneficial use of coal ash were promulgated as part of the Department's residual waste regulations. These regulations were revised in January 1997. These revised coal ash regulations in § 287.663 (Beneficial use of coal ash at coal mining activity sites) and § 287.664 (Coal ash beneficial use at abandoned coal and abandoned noncoal surface mine sites) required the development of guidance to facilitate review of beneficial uses of coal ash for coal mining activities. Guidance documents were developed in 1998 to address coal ash certification standards and the mine site approval process. 25 Pa. Code §§ 287.661-666 were the specific regulations pertinent to the beneficial use of coal ash at mine sites until 2010. In December of 2010, 25 Pa. Code Chapter 290 replaced these sections.

This new guidance clarifies topics in Chapter 290 and replaces all previous guidance documents on the beneficial use of coal ash at mine sites.

This guidance applies to active coal mine sites and the reclamation of abandoned coal mines only. The use of coal ash at active industrial mineral mines is not authorized under Chapter 290. The reclamation of abandoned coal or abandoned industrial mineral mines is carried out by contract at the Department's discretion and under the conditions of the contract.

II. PROCESS

Authorization of the beneficial use of coal ash at mine sites is essentially a two-step process. The first step involves the certification of the coal ash generated by a facility. The second is beneficial use of approved coal ash at the individual mine site through a permit authorization.

A. Coal Ash Approval

1. Testing and Certification

Coal ash must be certified by the Department before it can be beneficially used at mine sites [§ 290.201]. The certification process helps to assure that placement of the coal ash at a mine site will not cause pollution. This is primarily accomplished by evaluating the chemical properties of the coal ash.

A coal ash generator may apply for ash source certification approval by completing the forms Coal Ash Beneficial Use Certification Application (5600-PM-BMP0011) and Coal Ash Quality Assessment for Beneficial Use (5600-PM-BMP0012), which request information on coal ash chemistry, fuel sources, combustion processes, and air pollution control devices. These forms should be submitted to the Bureau of Mining Programs, Rachel Carson State Office Building, P.O. Box 8461, Harrisburg, PA 17105-8461. If approved, the Department will send a certification letter with a designated CA ("certified ash") number for the source. That CA number is the exclusive means of identifying the source and should be included in all correspondence about that source.

Bottom ash and fly ash are often handled in different plant-specific ways. It may be prudent for the generator to treat these coal ash streams as separate sources for certification depending on how variable they may be and how they are used at the mine site. For example, if the bottom and fly ash are mixed for use at a mine site, then one certification covering this mixed source is appropriate. If the bottom ash is segregated and used separately, a separate approval number for each should be obtained. The Department can help generators determine if multiple source certifications are necessary depending on the circumstances.

The samples collected for the initial certification evaluation and for subsequent regular quarterly monitoring should represent the material that will be shipped to the mine site. The Department may require additional sampling of the "as delivered" coal ash at the mine site, especially in the early stages of a project. If sampling shows little variation between the material sampled from the plant and the material sampled at the mine site, then the Department may waive the requirement for sampling coal ash at the mine site and allow for sampling of coal ash only at the generation site.

2. Additives

The only materials allowed to be added to the coal ash after it is produced are water, lime and cement for dust control and pH adjustment [§ 290.201(a)(5)]. If any other product, coproduct or chemical is mixed with the coal ash, it will no longer meet the definition of coal ash, and the source will not receive a certification under § 290.201. Approval for beneficial use would then need to be obtained through a General Permit issued by the Department's Bureau of Waste Management [§ 290.2].

Additives may be used for air quality control or other purposes during the combustion process as long as the process has been approved in the certification documents. Additives should not result in a substantial increase in the volume of coal ash produced.

3. General Permits

Coal ash-like materials proposed for beneficial use at mine sites need to be permitted under a General Permit from the Bureau of Waste Management. There are additional approvals needed for each mine site where it will be used.

Coal ash that has been stored or in place for a year or more does not qualify as "coal ash" and will be treated as residual waste for purposes of beneficial use permitting. (See 35 P.S. § 6018.103 "It shall be presumed that the containment of any waste in excess of one year constitutes disposal".) For these materials to be beneficially used at a mine site, a Bureau of Waste Management General Permit may be obtained as appropriate.

Removal of coal ash that has already been placed does not constitute beneficial use and would require a General Permit approval.

4. Alternate Fuels

Alternative fuels can be used in addition to coal as a fuel within the limits outlined in § 290.2(c). The material used as a fuel should contain at least 5,000 BTU/lb. as described under "coproduct" in § 287.1. Any operator requesting use of this fuel should supply the documentation required under their air quality permit to the Bureau of Mining Programs when requesting use of this fuel to produce certified coal ash.

5. Hydraulic Conductivity Testing

Hydraulic conductivity testing is required for all beneficial use purposes. This testing requires a larger sample of the coal ash than standard chemical testing. The coal ash sample should be an undisturbed sample having not been previously compacted. Coal ash generators should contact the test laboratory for instructions on obtaining a proper sample for this test.

Testing for hydraulic conductivity should be done quarterly (every three months) if the ash is used as a low-permeability material. If the coal ash is beneficially used for another purpose, quarterly samples should be collected during the first 12 months. When four samples have been collected, analyzed and reported and it is demonstrated that the results are consistent, hydraulic conductivity sampling can be reduced to once per year. Reporting must be in units of cm/sec and the laboratory results must be attached [§ 290.201(b)(7)].

The purpose of this testing is to obtain the hydraulic conductivity of the coal ash as it is being generated; it is not intended to be used for onsite field compaction testing [§ 290.105(e)(6)]. The certified ash sample is required to meet the 1.0×10^{-6} cm/sec or lower limit only if used for low permeability material. This limit does not apply to other beneficial uses.

There are two methods that can be used to determine maximum dry density and optimum moisture contents: ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort and ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.

In ASTM D698, the "standard effort", the degree of compaction achieved is notably less than the "modified effort" of ASTM D1557. With the modified ASTM D1557, the Department has noticed that a greater effort is needed to prepare the sample (both in terms of time and care). This can lead to more errors and an inability to properly conduct the testing. ASTM D698 is easier to perform and reflects a more conservative degree of compaction, which will better represent field compaction conditions as opposed to ASTM D1557. For these reasons, ASTM D698 is the preferred method for obtaining the compaction characteristics necessary to prepare samples for hydraulic conductivity testing.

For the ASTM D698 process, a graph similar to what is illustrated in Figure 1 will be produced. The lab should plot at least five points on the graph. Even if a point

is an outlier, it must be plotted. From this graph, the lab should prepare the specimen for hydraulic conductivity testing, that is, the coal ash is brought to optimum moisture content and compacted at 99% of the maximum dry density. Using Figure 1 as an example, the sample should have an optimum moisture content of 12% and a dry density of at least 108.9 pcf. This level of precision is necessary for laboratory testing and will not be used to determine conditions for field placement, which usually is a *range* of optimum moisture for coal ash placement.

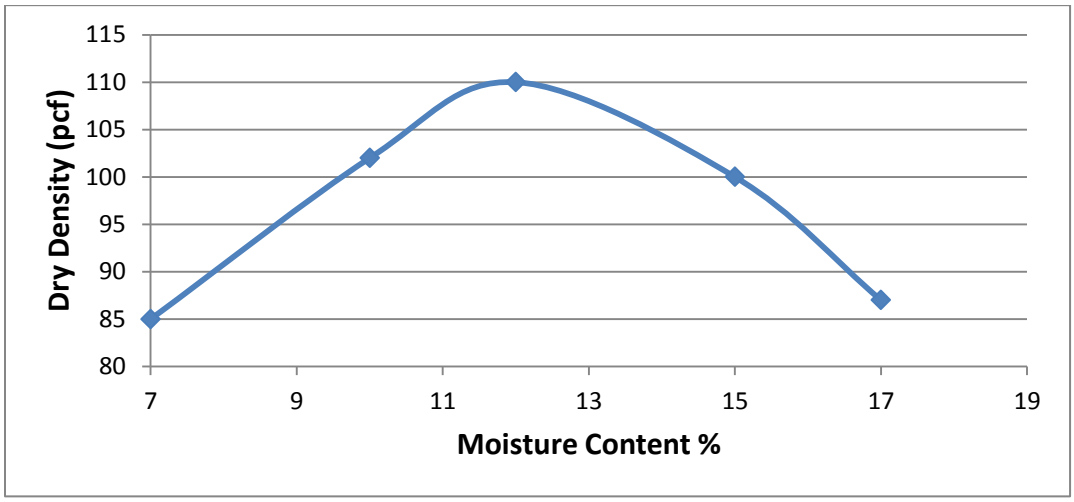


Figure 1: Typical display of laboratory proctor density test data

Once the sample is prepared at optimum moisture content and compacted at 99% of the maximum dry density, the compacted sample should be wrapped in plastic wrap and placed inside two bags that are then sealed and allowed to sit undisturbed for 10 days.

The reasoning behind allowing the sample to cure for 10 days is based on research that strongly suggests the hydraulic conductivity will change as curing time progresses. Figure 2 illustrates the hydraulic conductivity of fluidized bed combustion (FBC) and pulverized coal (PC) ash and the amount of time the sample was cured prior to testing. From the graph, the majority of change will occur between the first 7-10 days. The reason for this is the expected change in the void ratio of the material from curing. Figure 3 demonstrates the change in void ratio from initial preparation to 180 days of curing. Void ratio greatly impacts the mechanics of saturated fluid flow. Allowing time for this potential change in void ratio to occur is important for understanding the behavior of this material.

NOTE: Pulverized coal power plants produce Class F coal ash and fluidized bed combustion plants that burn waste coal produce FBC ash (Braun, 2012[1]).

[1]Braun, Greg (2012) Characterization of Coal Combustion Products for Beneficial Use in Mine Land Reclamation. M.S. Thesis, Pennsylvania State University, 192 p.

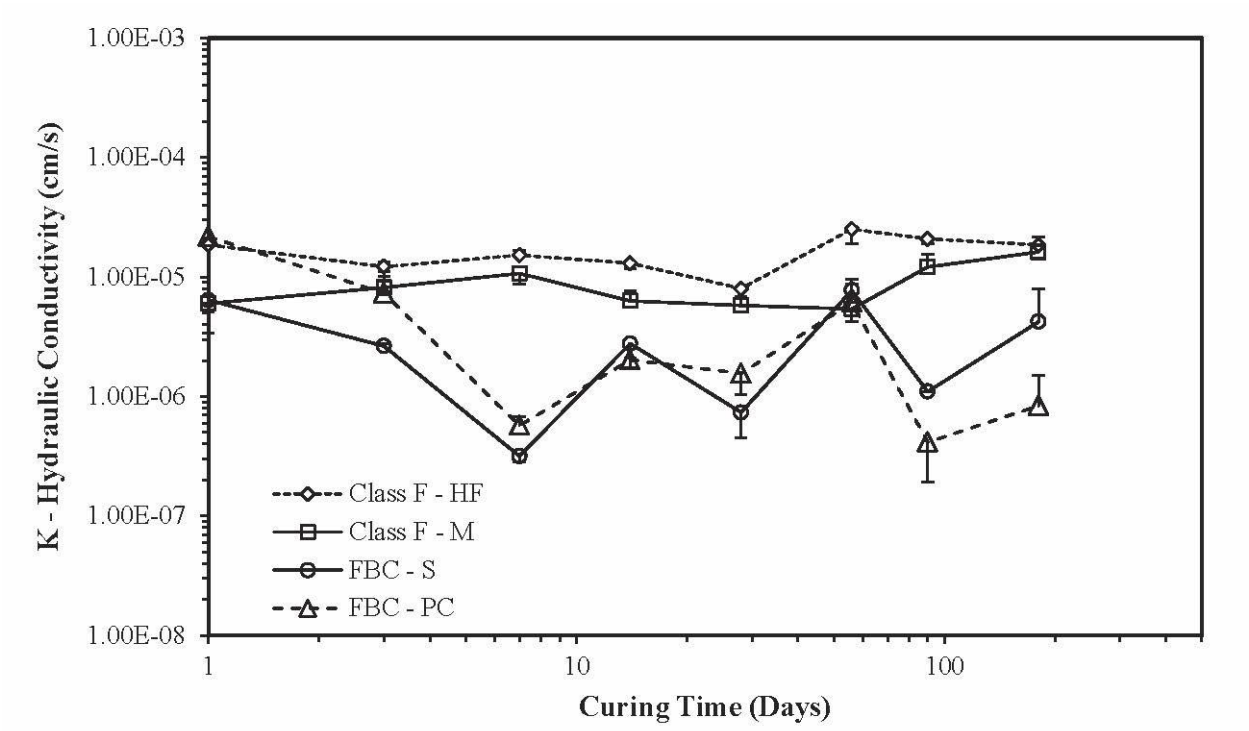


Figure 2: Change in hydraulic conductivity with respect to curing time (Figure from Braun, 2012).

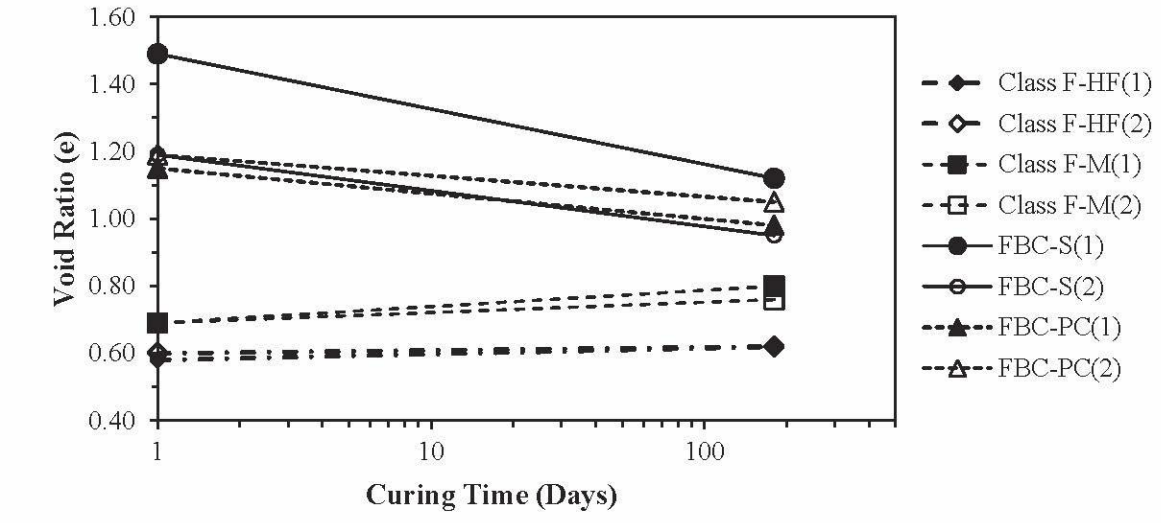


Figure 3: Change in void ratio with respect to curing time (Figure from Braun, 2012).

Once the compacted sample has been allowed to cure for 10 days, ASTM D5084 "Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter" can be performed. To ensure standardization among the various labs performing this test, Method A "Constant Head" is the recommended test method to measure the hydraulic conductivity. Because of the wide variation in the type and amount of data submitted with the hydraulic conductivity results from different labs, the Department has created a sample data sheet illustrating the tables and graphs that should accompany the hydraulic conductivity results when submitted (see

Appendix to this document). The Bureau of Mining Programs can also supply a template spreadsheet file for this purpose upon request.

6. Post-Approval Quality [§ 290.201(d)(2)]

The coal ash should be sampled and an analysis submitted to the Department for review whenever there is reason to question if the coal ash chemistry may no longer meet the certification guidelines.

Additional sampling is required when changes are made to the coal ash generation process that may result in a change to the chemical constituents of the coal ash or its physical properties. Examples of changes that may affect the coal ash include changes in fuel source (such as anthracite to bituminous coal, use of coal from a different geologic area or an alternate fuel), combustion process, air quality control process, or use of an additive. Generally, resampling is needed anytime the ash generating facility's air quality permit is revised.

Changes in coal seam from the same geographic/geologic region will not require additional sampling. For example, a change from the Upper Freeport coal to the Lower Kittanning coal where both coals are from the northern Appalachian Basin, would not require additional sampling. But, a change from northern Appalachian Basin coal to Powder River Basin or anthracite culm would require additional sampling due to the significant differences in characteristics of the fuel.

The District Mining Office may require additional sampling directly from the beneficial use site as appropriate. Sampling requirements will be listed in the mine site permit special conditions or through compliance directives such as inspection reports or compliance actions.

7. Exceedance of Certification [§ 290.203]

The coal ash generator is required to notify the Bureau of Mining Programs upon knowledge that a sample has exceeded criteria levels and automatically begin the evaluation process to determine the cause. The generator <u>should not wait</u> until submission of the regular quarterly submittal package to notify the Department. If the Department becomes aware that a sample has exceeded criteria levels, the Department will take immediate action and notify the generator. This may result in disruption of the source authorization at designated mine sites including the action of temporarily ceasing beneficial use approval of the source or removing the source from the approved certification list altogether. If the generator identifies a problem, notifies the Department, and commences an investigation to find the cause, the Department may allow the coal ash to continue to be used at previously approved sites while the investigation is ongoing, depending on the potential of the ash to cause a pollution event. The ash generator is expected to follow a contingency plan included in their certification documentation for storage or removal of coal ash that does not meet certification standards. When a source exceeds a certification standard, it will be "flagged" until resolution is determined.

8. Flagging

A source may be *flagged* on the certification list if a problem is present in the chemical or physical properties of the coal ash. This can happen when an exceedance has occurred, an anomalous sample is submitted, a constituent is missed during sampling, or any other situation that may result in the need for additional testing or clarification. The flagged status is temporary and means that the source can continue to go to approved mine sites but *cannot* be approved at any new mine sites until the issue is resolved. The Bureau of Mining Programs tracks flagged sources to ensure the problems are resolved in a timely manner or appropriate action is taken regarding a certified source.

9. Temporary Shutdown or Temporary Removal from Certification

Because it is a requirement to submit samples each quarter [§ 290.201(d)], failure to submit a sample can result in the source losing certification status. If a certified source generator anticipates a shutdown (of 60 days or more) where coal ash is not being produced or no samples will be available for required quarterly monitoring, the generator should notify the Department. Updated sample results will be required before beneficial use can recommence. Recertification may be required [§ 290.202(c)] if significant changes have been made to the facility during the shutdown.

The Department can place the generator in "on hold" (temporary non-production) status if the following information is submitted to the Bureau in lieu of the quarterly monitoring submittal:

- Notice of temporary shutdown
- Approximate dates of shutdown and anticipated startup date
- Plan for retesting upon startup (collect representative grab samples to ensure coal ash still meets certification standards).

If a source approved for a mine site is temporarily removed from the certification list for any reason, the Bureau of Mining Programs will notify the District Mining Offices. Use of that coal ash at all sites will then cease. If a source is only temporarily removed from the certification list (given a designation of "on hold"), the permit approval for the source is not revoked. Once the source is reinstated from "on hold" to "approved," then beneficial use at previously approved sites may resume.

10. Recertification

If a source is permanently removed from the certification list, then use of that coal ash at all sites must cease and the source is removed from authorization at all sites. It may be reinstated via a permit revision only if recertification is approved. Recertification involves updating the documentation on file with the Bureau of

Mining Programs and providing one or more recent samples to ensure the coal ash still meets certification standards.

The process of recertification is described in the regulations [§ 290.202(c)]. Please note that a coal ash source with a major quality problem or a potential for future exceedance of certification standards (such as a pattern of exceedances) may not be reinstated.

11. Notification [§ 290.201(e)]

The source generator is required to notify the Bureau of Mining Programs whenever there is a change in ash quality, an exceedance noted, or when there is a change in any information in the certification documents. This is critical when the change is the contact person at the generator facility. An updated name, email address and phone number is always required. Any changes, questions or requests should be emailed to ra-coalash@pa.gov.

B. Types of Beneficial Uses

1. Coal Ash Characterization and Categories

Four types of beneficial use are approved for coal mine sites: (1) coal ash placement for reclamation (filling pits and incorporation into coal refuse piles), (2) coal ash placement for alkaline addition, (3) coal ash placement as low-permeability material and (4) coal ash used as soil additive or soil substitute.[2]

Coal ashes vary considerably in their chemical and physical properties depending on the fuel source, the combustion technology used, air quality control processes, and ash handling procedures. These factors must be carefully weighed when evaluating the appropriateness of using a particular coal ash for a specific purpose at a given site. For example, a use, such as alkaline addition, that is appropriate for a highly-alkaline, pozzolanic ash from a Circulating Fluidized Bed (CFB) boiler may be inappropriate for a neutral-pH ash from a conventional coal boiler. Both coal ashes may have legitimate beneficial uses at mine sites, but it is not a given that they are interchangeable. While certification requirements address the acceptable physical and chemical characteristics of a particular coal ash for beneficial use (source approval), it is imperative that those proposing and reviewing proposals for a specific mine site consider the interplay between site-specific factors and ash-specific factors.

Coal ash that is used as a structural fill, not part of active or abandoned mine reclamation, is covered under § 290.102 and managed by the Department's Bureau of Waste Management in accordance with the Solid Waste Management Act and residual waste regulations. This includes fill used at mine sites *after* mine reclamation requirements are met.

[2] Regulatory citations: Placement (§ 290.104); alkaline addition (§ 290.201(a)(3)); low-permeability material (§ 290.201(a)(4)); and soil substitute (§ 290.103).

2. Appropriate Locations

Coal ash beneficially used for reclamation on mine sites typically occurs in areas where groundwater quality has already been impacted by historic mining. Coal ash placement in close proximity to public or private water supplies will not be permitted unless it can be demonstrated that groundwater uses will be protected and groundwater quality will not be degraded [§ 87.101]. Use of coal ash will typically not be approved within special protection watersheds unless it can be demonstrated to the Department in the mining permit application that the use of the coal ash will significantly improve water quality. Special protection watersheds include those with streams classified as High Quality and Exceptional Value, watersheds with streams used for public water supplies, and watersheds with streams that support native trout [Chapter 93].

3. Specific Uses for Coal Ash

Coal ash needs to be suitable for whatever use is proposed. Particular uses such as alkaline addition and low permeability material have additional specific requirements. When requesting beneficial use certification, the generator must specify which uses are suitable and demonstrate through testing or documentation that each use meets the following specified requirements [§ 290.104].

a. Mine Land Reclamation

Generally, the volume of coal ash used at a mine site must not exceed the volume of coal removed. However, this can be flexible provided that a demonstration is made that reclamation with coal ash will result in an overall improvement in water quality.[3] The final surface configuration must comply with the reclamation plan including determinations of approximate original contour.

Where coal ash is used to fill pits because of an absence of available spoil, as is commonly the case in the Anthracite Region, best management practices suggest that at least four-feet of cover material above the coal ash works best to support plant growth. The lower three feet of this cover material should be composed of spoil or other suitable, non-acidic material. The upper one foot should consist of the best available material to promote plant growth. This upper material should consist of rock and soil predominantly 6-inches across or less in size and supplemented, if necessary, with other approved additives (such as biosolids) to assure successful revegetation.

b. Alkaline Addition

Coal ash used for alkaline addition must have a calcium carbonate equivalency of at least 10% (neutralization potential of 100 tons/1,000 tons $CaCO_3$) on a dry weight basis [§ 290.201(a)(3)]. The

[3] Regulatory citation: § 290.104(b) and (e).

equivalency is to be determined by the Neutralization Potential test (Overburden Sampling and Testing Manual, Noll et al., 1988) or other test approved by the Department.

The beneficial use of coal ash as alkaline addition must be approved by the Department as part of the permitting process or as part of an abatement plan.[4] This use is described in the technical guidance "Alkaline Addition for Surface Coal Mines," (563-2112-217). The volume of coal ash imported to a site cannot interfere with the reclamation plan. The location and method of application of the coal ash will depend upon the location of the acid-forming materials.

Department experience has shown that coal ash is unreliable as a stand-alone alkaline additive. The Department will consider coal ash used in addition to more conventional alkaline additives, such as limestone, hydrated lime and quick lime. To ensure adequate reactive alkaline material is available, and meets the demonstrations required in § 86.37, any alkaline deficiency at a mine should be fully addressed using conventional proven alkaline materials. The Department will consider coal ash as a supplement to these proven materials.

Coal ash is not to be mixed with the conventional alkaline materials, but should be spatially separated from the conventional alkaline materials. Mixing may increase the likelihood of the coal ash becoming cementicious and reduce the neutralizing ability of the coal ash and the conventional material.

c. Use as Low-Permeability Material

For coal ash to be approved as a low-permeability material the hydraulic conductivity of the coal ash needs to be 1.0×10^{-6} cm/sec or lower based upon hydraulic conductivity testing (e.g., ASTM D 5084-10: Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter), or other test approved by the Department. Hydraulic conductivity testing should use compaction and other preparation techniques that will duplicate expected conditions at the mine site.

Coal ash used beneficially as low-permeability material at active coal mine sites has to be addressed as part of the mining plan in the mining permit [§ 290.201(a)(4)]. An example of a use of coal ash as low-permeability material includes using coal ash to isolate acid- and toxic-forming materials by preventing infiltration of surface water through these materials. Another low-permeability use would be capping a site to limit infiltration into an area that has produced or has the potential to produce acid mine drainage.

[4] Regulatory citations: 25 Pa. Code Chapter 86, Subchapter B and Chapter 290.104.

Coal ash used beneficially to provide a low-permeability layer should have a minimum thickness of two feet (0.61 meters), unless otherwise approved by the Department. The volume of coal ash and method of application must be described in the permit application, or if part of an abatement plan, must be incorporated into that plan and approved by the Department. If the coal ash is modified to achieve a lower permeability the modification needs to be described to the Department.

If coal ash is used as a low-permeability cap, consideration must be given to the final post-mining land use to ensure that it does not impede that land use.[5] To be effective long term it generally would not be desirable for the cap to be placed in the root zone of the post-mining vegetation. This would likely impede vegetation growth, increase the impact of drought conditions, and compromise the effectiveness of the cap. Applicants proposing capping a site with coal ash generally will need to plan their operations so as to reserve a minimum of four feet of cover material to go over the coal ash cap.

d. Use as Soil Substitute or Additive [§ 290.103]

Coal ash may be used as a soil substitute or as a soil additive to replace soil that is no longer available at the site, to enhance soil properties, or to enhance plant growth. The use must take into consideration the site-specific beneficial needs at the mine. The method of application, which includes the amount and type of equipment to be used, should be addressed in the reclamation plan of the mine permit. The applicant must demonstrate that coal ash chemical constituents will not cause pollution, adversely impact plant growth, but will enhance reclamation. If coal ash is used as a lime substitute or other nutrient substitute, the calcium carbonate or other nutrient of the coal ash should be based on the chemical equivalence needed to substitute for lime or other chemical constituents.

Coal ash used as a soil substitute should be mixed with other vegetative supporting material, such as spoil or DEP approved biosolids. The depth of this soil substitution layer should not exceed three feet (0.91 meters), unless otherwise approved by the Department.

Coal ash used as a soil additive should be mixed with existing soil to a depth not greater than one foot (0.30 meters), unless otherwise approved by the Department.

Coal ash used as a soil liming agent is required to have a calcium carbonate equivalency of at least 10% by weight (neutralization potential of 100 tons/1,000 tons CaCO3) [§ 290.201(a)(3)]. The equivalency is to be determined by the neutralization potential test in accordance with Overburden Sampling and Testing Manual (Noll et al., 1988) or other test approved by the Department.

[5] Regulatory citations; For example, see Chapter 87, § 87.75. Postmining land uses, and § 87.159. Postmining land use.

e. Loading Rates [§ 290.103]

The soil or best available material used for top cover must be sampled and analyzed to determine appropriate application rates for coal ash that will be used as a soil substitute or soil additive. These background analyses are also needed to characterize the soil or spoil top cover. Cumulative loading rates are given in § 290.103(e). The dry weight results of the coal ash are used to make the calculation. In most cases, arsenic will be the limiting factor for use of coal ash. The loading rate should be based on the highest value for each parameter for the past three quarterly samples. If concentrations increase for a parameter that has a loading rate, loading rates must be recalculated and application rates adjusted appropriately.

C. Site Approval (25 Pa. Code Chapters 86, 87 and 88)

Site approval requires a demonstration that the beneficial use of coal ash can be accomplished in an environmentally safe manner. The following sections indicate the kinds of information necessary in order for the Department to make this determination.

1. Permit Applications and Revisions

a. General

The beneficial use of coal ash for placement purposes at new mine sites (site approval) must be addressed as part of a permit application: either through a new permit or a modification to an existing mining permit. Adding coal ash placement to an existing permit is a major permit revision. Major permit revisions are subject to the requirements of 25 Pa. Code 86, § 86.32 (Opportunity for submission of written comments or objections on the permit application), and § 86.52 (Permit revisions). Coal ash used only as a soil substitute or additive is a minor permit revision.

Major revisions also include these examples: changing coal ash use from soil substitution/additive to placement uses, coal ash volume increases greater than 50% where coal ash is used for placement, and extending placement use to other watersheds that were not originally identified or described in a permit application and public notice. These changes would also be reflected in a revised reclamation plan that requires public notice.

Minor permit revisions include these examples: coal ash volume increases of less than 50% of total volume to be used for placement, a change in the amount of coal ash to be used as a soil substitute or amendment, a change in or addition to the area to be affected by coal ash use (if it remains in the same watershed and there is no change to the reclamation plan), the addition of another beneficial placement use (such as adding alkaline addition as a use when use as fill is already approved), or addition of an certified coal ash source. Minor revisions most often do not require public notice.

Site approval is obtained by means of completion of Module 25 (use as placement material) and/or 27 (use as a soil additive or substitute) as part of the permit application that is reviewed by the District Mining Office. For all uses, the applicant must demonstrate that the coal ash use is being beneficially used under Chapter 290.

b. Coal Ash Approvals for a Site

Coal ash used at a mine site must be certified by source and identified by a certification number (CAxxx). This process is described in section II.A.1 of this document [§ 290.104(a)(2)].

Certification is a statewide approval; however, it is not a blanket approval. A site approval must be obtained before any coal ash can be brought to a beneficial use site to assure that the source is suitable at that site and for the proposed purpose. Site approval is done through a formal application to the District Mining Office with jurisdiction for the mine site.

c. Public Notice Requirements

Public notice, pursuant to §§ 86.31 and 86.54, is required when beneficial use of coal ash is proposed at a mine site. Coal ash beneficial use on mine sites for reclamation placement, alkaline addition, and low-permeability material must be advertised. A public notice is not required for the beneficial use of coal ash as a soil substitute or soil additive because of the minor volumes involved. Major permit revisions require public notice; minor revisions do not. The Department notifies local municipalities of new coal mining permits and major revisions; the notification to the local municipality will specify that coal ash beneficial use is proposed.

d. Landowner Consent

Proposals for using coal ash must include the consent of the owner(s) of the land where the coal ash will be applied [§ 86.64]. The Contractual Consent of Landowner for Beneficial Use of Coal Ash form (5600-FM-BMP0149) must be signed by the landowner and be recorded in the appropriate Recorder of Deeds office. This document should be complete or in the process of being recorded when the site approval application package is submitted to the District Mining Office.

e. Bonding Requirements

Applicants should refer to TGD 563-2504-001 “Conventional Bonding for Land Reclamation - Coal,” including the section “Coal Ash Placement,” which deals with costs associated with final cover materials and revegetation. Typically, there will be no additional bonding requirements for coal ash that is beneficially used for mine land reclamation. Additional bond may be required if, for example, coal ash beneficial use

requires long-term appurtenances, such as a stationary pug mill, that would require demolition costs.

2. Groundwater Table and Water Monitoring

a. Eight-Foot Isolation [§ 290.101(e)]

The regulations require the isolation distance between the bottom of coal ash and the top of the groundwater table elevation to be at least eight feet (2.44 meters). Exceptions are for subsidence control, mine sealing, or mine fire control in which case the eight-foot requirement can be waived due to the environmental and safety trade-offs in remediating imminent hazards.

b. Water Monitoring Plan [§ 290.301]

Water monitoring, described in § 290.301, is required where coal ash is used for placement material, alkaline addition and as low-permeability material. Because of the small volume of coal ash usually used as a soil amendment, water monitoring specific to coal ash parameters is *generally* not required for that beneficial use. Frequently, monitoring points required for the coal mine activity are located such that they can provide accurate information on the effect of coal ash placement. However, if existing monitoring points are not sufficient to characterize effects from coal ash placement, additional monitoring points will need to be established prior to coal ash use in order to prevent undue costs and time delays. The location and adequacy of monitoring points should be discussed with and approved by the Department.

Groundwater monitoring must be sufficient to verify any influence of the coal ash on water quality. Up-gradient groundwater monitoring points will normally be required. Up-gradient monitoring is especially important if up-gradient groundwater is contaminated or may become contaminated via some other source or activity.

Typically, at least three groundwater monitoring points down-gradient from the active mine site are necessary. The number of down-gradient monitoring points and their locations will depend upon the configuration of the coal ash placement area, the volume of coal ash placed, the size of the coal ash placement area, and the hydrogeologic conditions at the site. Groundwater discharges such as springs, seeps and mine discharges located directly down-gradient of the coal ash utilization area can make excellent monitoring points. In some cases monitoring of surface water, such as small tributaries may be appropriate, but the influence of dilution on such monitoring points should be considered. In many cases, installation of monitoring wells will be necessary to adequately characterize the site. Because groundwater flow in Pennsylvania's coal fields is often controlled by fractures, applicants may find that they need to drill at multiple locations before finding good monitoring wells. Wells

that are dry or that contain such small volumes of water as to make data collection and interpretation difficult will not be accepted as monitoring points. If a monitoring point goes dry, a replacement point must be found or installed.

Where sites are underlain by or adjacent to deep mine pools, the monitoring plan should consider the horizontal and vertical location of the deep mine and associated mine pool, the flow path through the mine, location and influence of barrier pillars, and mine pool discharge points.

To establish pre-ash groundwater conditions, a minimum of twelve (12) background samples from each monitoring point should be collected to be fully representative of conditions. A sample is to be collected monthly for each monitoring point until at least twelve samples have been collected. The samples must represent a full water year, and must be recent, i.e., at least one sample completed within six months prior to submittal of the application. Background and monitoring samples at sites that receive coal ash for placement must be sampled for the same parameters as given in the regulations.

Additional parameters may be required by the Department on a case-by-case basis.

Monitoring will continue at coal ash sites for ten years after the operator submits a notice to the Department that coal ash use has ceased. Monitoring will be quarterly for the first five years and annually by approval of the Department for the following five years.

After five years following the notice of completion of coal ash beneficial use, the quarterly monitoring can be reduced to annual by request from the operator. A request for monitoring reduction is contingent on a demonstration in writing to the District Mining Office that there is no evidence of degradation of groundwater and no sign of increasing trends in contamination.

After ten years following the notice of completion of coal ash beneficial use, monitoring may cease contingent on a demonstration in writing to the District Mining Office that there is no evidence of degradation of groundwater and no sign of contamination such as an increase in concentration of parameters that may be indicative of coal ash leaching.

At any time, if there is evidence of water quality degradation or increasing trends in parameters that may indicate future contamination, the Department may require an increase in monitoring rate to better define the pollution event or to evaluate corrective actions.

c. Sampling Procedures and Analysis [§§ 290.301(g)-(j)]

All sample collection and analysis should be in accordance with EPA's Test Methods for Evaluating Solid Waste, SW-846.

The background and monitoring data is to be provided on form No. 5600-PM-MR0014 "Coal Ash Water Quality Monitoring Report." If the site is approved for beneficial use of coal ash, monitoring data with corresponding lab results must be submitted quarterly to the Department, no later than 30 days after the end of the previous quarter [§ 290.201(d)]. Applicants should check all submissions for missed results, errors or anomalous data points prior to submission to the Department.

Detection limits for each chemical parameter should be listed on the lab reports. Detection limits should be the lowest practical detection limit using standard laboratory testing methods. Detection should be below drinking water standards, unless the lowest practical detection limit is the drinking water standard (e.g., mercury at 0.002 µg/L). If there is no drinking water standard, the detection limit should be no greater than half the coal ash certification value. If a detection limit exceeds the above criteria, due to factors such as dilution or interference from other ions, an explanation should be provided to the Department. If reporting non-detected values on Department forms, use the detection limit value with a "<" symbol. Do not use N.D., 0, or another abbreviation.

Monitoring wells are to be purged at least three well volumes or until specific conductance and pH stabilize before taking a sample.

Since "dissolved" metals are defined as those that pass through a 0.45 µm filter before "fixing" with acid, samples for dissolved constituents must be field filtered through a 0.45 µm filter prior to "fixing".[6]

3. Coal Ash Monitoring

a. On-Site Monitoring [§ 290.104(i)]

If the permittee utilizes a "closed loop" system, a reduced frequency of testing may be approved by the Department. This is because the single coal ash source would not be expected to appreciably change from the generation site to the beneficial use site. The generator would be providing a regular sample through the certification process instead. In this case, the certification sampling is considered adequate to characterize the coal ash used at the site.

[6] See EPA Method 3005A. Acid Digestion of Waters for Total Recoverable or Dissolved Metals for Analysis by FLAA OR ICP Spectroscopy; and Collecting Water-Quality Samples for Dissolved-in-Water (U.S. Environmental Protection Agency, Region 6 Compiled by Forrest B. John, 2000).

Permits which accept multiple sources or do not have a "closed loop" system of coal ash delivery have a requirement for coal ash testing as part of their mining permit approval to use coal ash. A representative sample must be taken of the coal ash material used each quarter and submitted to the District Mining Office identified by permit. If a permit area contains multiple coal ash uses or coal ash placement areas, each must be sampled individually. This testing is in addition to the certification testing done by the generator. It ensures that no other material is being mixed with the coal ash after it leaves the generation site; it serves to determine that the coal ash quality does not appreciably change en route; and it demonstrates that mixtures of coal ash sources are within the parameters of certification to ensure pollution is not occurring.

The permittee should notify the Bureau of Mining Programs if the sample results on site differ from the sample results sent quarterly for certification monitoring. Coordination will occur between the Bureau and the District Mining Office to examine the discrepancy.

b. Field Density Tests [§ 290.104(f)]

Semi-annual (or more frequently if requested by the Department) field density tests are required to be performed by the permittee in order to ensure that proper field compaction is being achieved within the coal ash use area. If multiple coal ash sources are used, the sampling must be representative of the coal ash being received at the site in total. Field compaction testing is not required when coal ash is used for soil substitute/amendment and in some cases of alkaline addition where compaction reduces the effectiveness of the coal ash for beneficial use.

The results of these tests are to be submitted to the Department with the second and fourth quarter water monitoring reports. More frequent testing may be appropriate for sites that are experiencing problems with achieving compaction guidelines or sites receiving a variety of coal ashes with varying compaction properties.

Regulation [§ 290.104(f)(4)] requires that field compaction results achieve 90% of the maximum dry density when using the Modified Proctor Test and 95% of the maximum dry density when using the Standard Proctor Test. Once the maximum dry density range is known, the acceptable moisture range needed in order to achieve the required compaction can be calculated.

D. Coal Ash Volumes and Annual Report

Reporting the amount of coal ash beneficially used is an important component in the program that allows the DEP to show the results of the program and to track reclamation progress. Both generators and site operators submit reports detailing amounts of coal ash as specified below.

Generators report the tonnages they send to each mine site for the year specific to each certification number. That is, if they produce both bottom and fly ash, for example, under different CA numbers, the amount must be reported separately for each. Generators are required to list the site and site identifier (permit number) where each source is delivered and the amount of coal ash. This information is to be provided on the form 5600-PM-BMP0012 with the 4th quarter results of the previous calendar year submitted to the Department by January 31 of the next year [§ 290.201(d)].

The site operator must report the weight (in dry tons - subtracting the percentage of water added for optimum moisture) and volume (in cubic yards) for each source received that year. The certification number for each source must be specified and source amounts cannot be combined. Coal ash reporting is required as part of the permit and must be submitted by January 30 unless a land survey is required to obtain the results [§ 290.104(j)]. In that case, an estimate of amounts may be provided based on delivery records with the adjusted amounts provided at a later date agreed to by the District Mining Office that issued the permit. Form 5600-FM-BMP0116 is used to provide the data.

Along with the coal ash amounts, the site operator is also required to provide their yearly fee for coal ash use with the annual report. Fees are described in § 290.104(c).

E. Due Diligence on Site

The mine permittee is responsible for verifying that all coal ash delivered to the site is from the source(s) approved for beneficial use at the site and for keeping records of delivery. If the origin of the source the load cannot be verified by the permittee or his representative as the certified source, it cannot be accepted and should be removed from the site to an authorized disposal area as documented in the contingency plan in the approved certification documentation.

Where an operator notices a problem with the coal ash being delivered to the mine site, either through visual inspection or testing, whereby the coal ash would no longer meet the certification requirements or that of beneficial use for the particular site, the permittee should contact the mine inspector and report it [§ 290.201(e)]. All records of such events should be retained. Examples of such problems are: the coal ash contains non-ash materials, does not look typical or suitable, or a lab result indicates exceedance of certification parameters. Failure to immediately address such problems with the coal ash may result in costly remediation. Any questionable loads should be refused by the operator in order to ensure pollution does not occur. Once the material is placed on the mine site, the operator is liable for any violations and for any abatement that is required under Chapters 87 and 290.

In the case of multiple sources accepted at one site, the operator should have knowledge of where each source is placed for testing purposes, in case of a problem with the properties of the coal ash and if the coal ash from a particular source must be remediated or removed.

F. Corrective Actions

Corrective action involves two phases: assessment and abatement. These procedures are described in § 290.304 and § 290.305, respectively.

G. Site Closure

Stage III reclamation bonds will be held for ten years following the completion of vegetative planting on the site to correspond with the groundwater monitoring required in § 290.301(h). In the normal course of operations, planting will occur after final placement of coal ash. If pollution of groundwater is not observed at the end of this 10 year period, bonds may be released and the site will be considered closed.

H. Reclamation of Abandoned Mine Areas Using Coal Ash

The reclamation of abandoned coal mine areas is carried out by contract at the Department's discretion under the conditions of the contract and must be consistent with the requirements of § 290.105. To the extent practicable, the beneficial use of coal ash at abandoned mines should conform to the guidelines for active mines.

The items below address some differences in procedure between approvals for active mines versus contracts for abandoned mines.

1. Contracts

The beneficial use of coal ash for placement purposes at abandoned mine areas will be addressed as part of the mine reclamation contract. This guidance can be used for abandoned mines and may be incorporated, as appropriate, in the reclamation contract.

2. Landowner Consent

All proposals for using coal ash must include the consent of the owner(s) of the land where the coal ash will be applied [§ 290.103(a)(7) and § 290.104(b)(3)]. The Contractual Consent of Landowner for Beneficial Use of Coal Ash form (5600-FM-BMP0149), or similar form appropriate for mine reclamation contracts, must be signed by the landowner and be recorded in the appropriate Recorder of Deeds office.

3. Coordination of Permit Review with Local Authorities

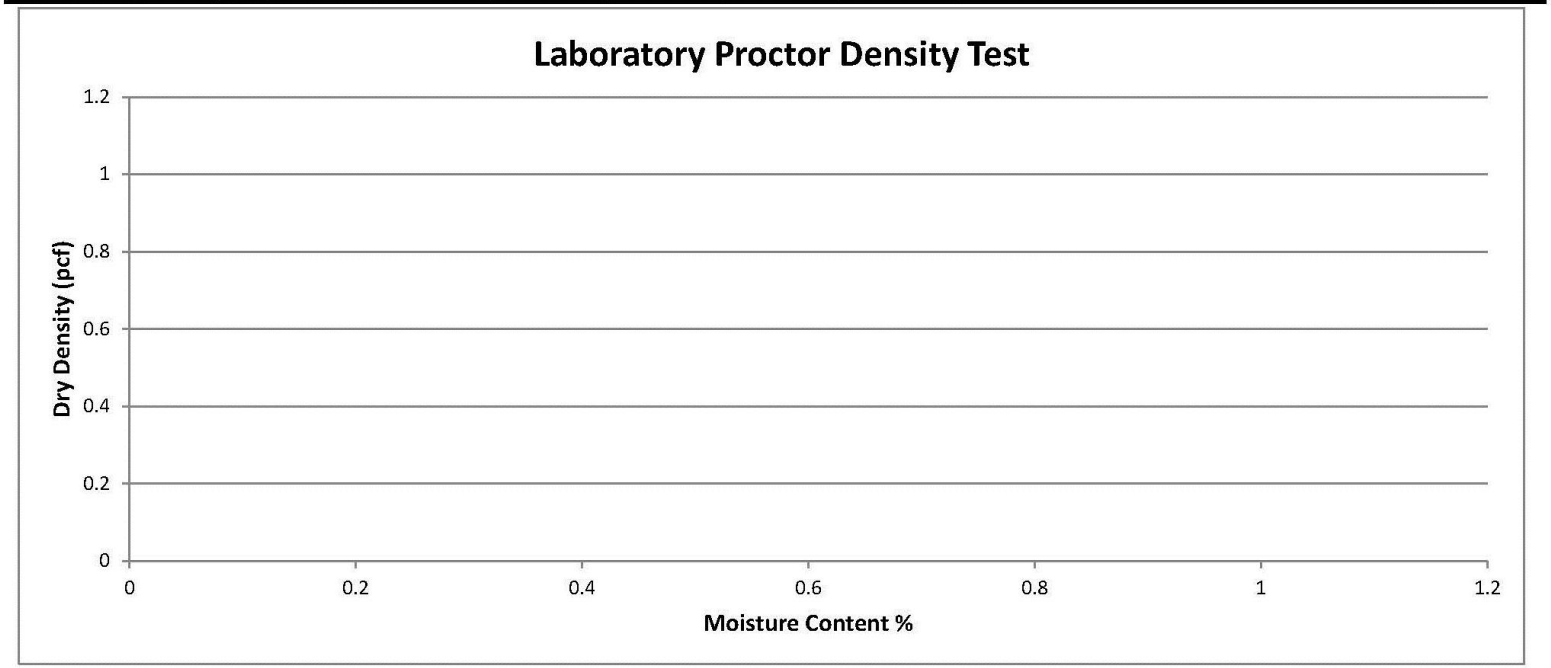
The host or local municipality will be notified by the Department and given an opportunity to review and comment on the proposed beneficial use of coal ash with the exception of use as a soil substitute/ amendment.

4. Bonding Requirements

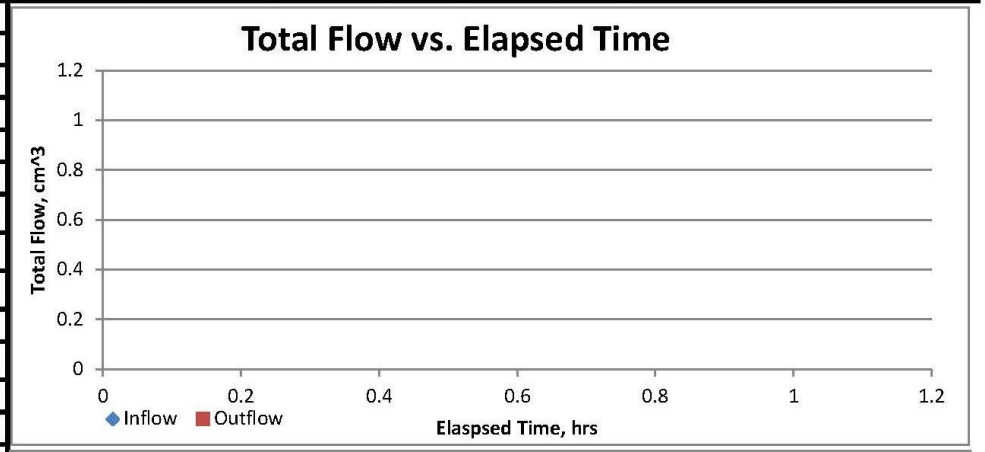
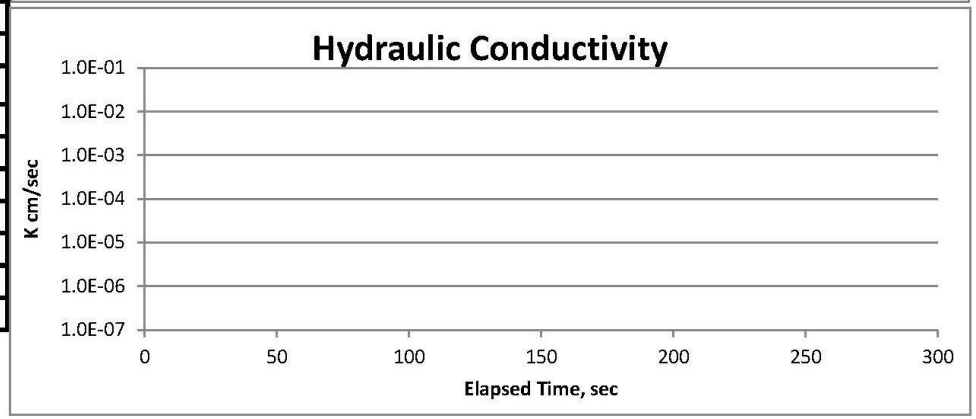
Bonding for coal ash placement on abandoned coal mine reclamation contracts will be included in the performance bond for the contract as established in the contract conditions.

APPENDIX

WET DENSITY						TEST INFORMATION	
Compaction Point #	1	2	3	4	5	Type of Proctor (Modified or Standard)	
Weight of Mold & Wet Sample (g)						Hydraulic Conductivity Method (A-F)	
Weight of Mold (g)						Mold Diameter (in.)	
Weight of Wet Sample (g)						Compacted Layers	
Mold Volume (cm3)						Blows/Layer	
Wet Density (g/cm^3)						Rammer Weight/Drop	
Wet Density (pcf)						Size of Material Used	
MOISTURE CONTENT						Mold Volume (cm^3)	
Tare Number						Mold Weight (g)	
Weight of Tare & Wet Sample (g)						SIEVE TEST RESULTS	
Weight of Tare & Dry Sample (g)						Percent Retained 3/4"	
Weight of Tare (g)						Percent Retained 3/8"	
Moisture Content (%)						Percent Retained #4	
DRY DENSITY VS. MOISTURE CONTENT						Percent Retained #10	
Moisture Content (%)						Percent Retained #40	
Dry Density (pcf)						Percent Retained #200	



SAMPLE CONDITIONS	INITIAL	FINAL
Tare Number		
Weight of Tare & Wet Sample (g)		
Weight of Tare & Dry Sample (g)		
Weight of Tare (g)		
Moisture Content (%)		
Weight of Mold & Wet Sample (g)		
Weight of Mold (g)		
Weight of Wet Sample (g)		
Length 1 (in.)		
Length 2 (in.)		
Length 3 (in.)		
Top Diameter (in.)		
Middle Diameter (in.)		
Bottom Diameter (in.)		
Average Length (cm.)		
Average Area (cm^2)		
Sample Volume (cm^3)		
Unit Wet Weight (g/cm^3)		
Unit Wet Weight (pcf)		
Unit Dry Weight (g/cm^3)		
Unit Dry Weight (pcf)		
Specific Gravity		
Void Ratio, e		
Porosity, n		
Pore Volume (cm^3)		
Saturation (%)		
TEST PRESSURES		
Location	**PSI**	**CM**
Top (Outflow)		
Bottom (Inflow)		
Cell (Confining)		
Pressure Head		

FLOW DATA

Date (mm/dd/yy)	Time (hr/min/sec)	Elapsed Time (min)	Total Inflow cm^3	Total Outflow cm^3	Total Head (cm)	Status (Start, Flow, Stop)	Temp. °C	Hyd. Cond. @ 20°C (cm/sec)