CHAPTER VII

GEOLOGIC REQUIREMENTS FOR ANCILLARY FACILITIES

The recommendations and procedures, established in this handbook, were written primarily for mining operations. However, there are certain categories of mining-related activities to which these types of information may not apply in their entirety. Since the West Virginia Surface Mining Reclamation Regulations do not specifically address how geologic information required for ancillary facilities differs from that of a mining permit, additional guidance is needed to determine which geologic requirements are actually applicable under a non-mining situation. This chapter describes the most common types of non-mining activities encountered by the WVDEP and the types of geologic information that may be required.

A. HAULROADS

For most haulroad-only permit applications, the only geologic information needed is a general geologic description identifying the geologic setting in which the road will be located. In steep slope areas, a foundation study may be required for the cut-and-fill sections to determine depth of bedrock, location of seeps and springs, and the dip of area strata. Geologic logs and chemical analyses of strata are not normally required unless coal removal is proposed. However, a geologic waiver request should be included in the application, according to the guidance given in Chapter VIII. Geologic cross sections and maps are not subject to geologic waivers, although the level of detail for these type of drawings would be very generalized.

Should coal removal or significant geologic disturbance be proposed, during haulroad construction, the applicant should include the same types of information described in the previous chapters. Examples of significant geologic disturbances would be a cut-through or an abnormally large cut-fill section.

B. TIPPLES AND PREPARATION PLANTS

The geologic requirements for tipples and preparation plants depend primarily on the types and amount of disturbance proposed. Normally, existing facilities would only need generalized geologic information collected from logs of ground-water monitoring wells, soil maps, and published geologic maps and reports for the area. Such is also the case for a new facility where site preparation is accomplished through simple grading and facility construction. However, the amount of geologic information must still be sufficient to determine the site-specific hydrology.

For new facilities that propose significant disturbance, such as blasting, spoil storage and disposal, etc., the same type of information described in the previous chapters for coal-removal operations, would be required. Some modifications can be considered on a site-by-site basis. The following sections describe types and levels of detail that may be applicable to these type facilities.

1. Geologic Logs

The requirement for geologic logs can normally be waived if sufficient information is available to determine the site geology and hydrology without site-specific drilling. However, in areas of significant geologic disturbance or coal removal, logs will be required as outlined in Chapter III. When required, geologic logs should extend to a minimum depth of 20 feet below the lowest level or bench proposed for disturbance, or the first potentially impacted aquifer. Lesser depths may be allowed if the applicant can demonstrate that the permeability of the strata is sufficient to prevent the downward migration of contaminants.

2. Geologic Cross-Sections, Maps, and Plans

Geologic cross-sections, maps, and plans are required of all mining and mining-related operations, regardless of type or size of operation. However, the level of detail for these type facilities will vary based on the type and amount of disturbance, and the site-specific conditions and needs. For tipples and preparation plants the cross sections should characterize the material from the upper limit of disturbance down to a minimum depth of 20 below the site, or where it cannot be demonstrated that contamination will not occur, down to and including the first potentially affected aquifer below the site. Where multiple levels or benches exist on the site, the lower limit of the cross section should be based on the lowest bench elevation. Each geologic cross section should be drawn from a minimum of two data points. It is recommended that the section(s) be drawn to represent surface features and geology through the areas of primary hydrologic concern such as coal stockpile areas, sediment basin(s), refuse storage areas, and etc. Other mapping requirements are similar to those described in Chapter V.

3. Chemical Analyses of Strata

In general, a geologic waiver of analyses of samples can be made at tipple and preparation plant sites where there is no proposed disturbance of strata. However, if coal removal or significant disturbance of strata is proposed, chemical analyses for acid- or toxic-forming, or alkalinity-producing, materials should be conducted as described in Chapter 4.

4. Chemical Analyses of Coal Stockpiles

Typically, chemical analyses of coal from stockpile areas are unnecessary because the coal is usually moved quickly and the geochemical properties of coal are such that short exposure to weathering processes will produce little, if any, acid or toxic drainage. Also, the coal source may change frequently, thus invalidating previous analyses. However, in areas considered sensitive, because of hydrologic considerations (e.g., close proximity to ground-water users), or where high-sulfur coals (e.g., total sulfur > 2.0%) are involved, a requirement for coal analyses will be determined on a case-by-case basis.

5. Geologic Description

A description of geology in the proposed permit and adjacent areas will be similar to the procedures described in Chapter VI for coal-removal operations. A geologic description should be site-specific and representative of the permit and adjacent areas. However, because of the small area, which might be associated with some tipples, a generalized geologic description covering a broad area (such as that found on a geologic quadrangle), including areal and structural geology, may be necessary to assist in determining the potential hydrologic impacts.

The geologic description should include all strata down to and including any aquifers below the site that may be adversely impacted by the proposed operations. Of primary concern is the thickness, lateral continuity, and extent of the underlying strata and its ability to preclude the downward percolation of ground water. Therefore, the strata below a tipple area should be sufficiently described to allow a determination to be made as to whether or not any aquifer below the site will be adversely impacted.

C. BARGE-LOADING FACILITIES

Barge-loading facilities are restricted to the navigable waterways of West Virginia, such as the Kanawha, Ohio, and Monongahela Rivers. Geologic requirements are essentially the same as those previously described for tipples and preparation plants. However, because of the high infiltration rates often associated with the alluvial and/or colluvial deposits common along these river bottoms, a waiver of geologic logs is unlikely.

If, during the construction of barge-loading facilities, coal is proposed for extraction, all previously described collection and analytical techniques apply. This is also true for loading facilities that require a significant disturbance of in-place geologic strata. Soil, colluvial, and alluvial materials will normally create little acid or toxic drainage problems, therefore analysis of such material is not normally required.

Geologic maps, cross sections, and descriptions are essentially the same as described in Chapters V and VI, with emphasis on the thickness and areal extent of the alluvial and colluvial materials, along with their effect on ground- and surface-water impacts.

D. REFUSE DISPOSAL AREAS

Refuse disposal areas are those sites where coal processing and underground development wastes might be deposited. Most refuse disposal sites are on-going facilities directly associated with a preparation plant. Refuse disposal may also occur as part of the normal backfilling and grading operations at a surface mining operation or by disposal in abandoned workings at an underground mining operation. Where small amounts of refuse are being buried in a mine backfill, the only additional geologic requirement associated with its disposal may be geochemical analyses of the

refuse material. For more complex refuse disposal, such as slurry impoundments, refuse fills, or underground disposal, the following additional guidance is recommended.

1. Geologic Drilling and Sampling

Because of the requirements relating to foundation studies and ground-water monitoring, some drilling and sampling will probably be required. If coal removal or significant disturbance of in-place geologic strata is proposed, then drilling and sampling should be performed as described in the previous chapters. When such drilling occurs, geologic logs should be constructed for each site.

In addition to overburden and foundation drilling and sampling, samples of refuse material must be collected to determine the chemical and engineering properties necessary to assess the hydrologic impacts and the stability of the fills. Refuse samples must be collected from enough sources to be statistically valid and representative of the refuse materials. The actual numbers of samples required to qualify for a representative sample will vary from site-to-site, so it is recommended that the WVDEP be contacted to prior to sample collection.

2. Geologic Cross-Sections, Maps, and Plans

Cross section and map requirements do not significantly deviate from those described in Chapter V of this handbook. However, special emphasis of the location of seeps, springs, and underground workings is needed, along with the depth to bedrock. Locations of all coal seams within the proposed fill area should also be marked.

3. Chemical Analyses of Strata

If no coal removal or significant disturbance of geologic strata is proposed, no chemical analyses of these types of materials are required. However, if any coal removal is proposed prior to, or as part of, the construction of the refuse fill, geochemical analyses should be performed on all affected strata as described in Chapter IV, Section B.

4. Chemical Analyses of Refuse Material

To determine the potential water quality impacts resulting from the disposal of coal refuse, a background geochemical character of the material must be established. This is accomplished by analyzing refuse material using standard acid-base accounting techniques described in Chapter IV, Section B. l. In some instances, where the acid-base account is inconclusive, the "simulated weathering" test may be required.

When characterizing the refuse material, samples should be analyzed from both the fine and coarse fractions, and from all known coal sources. The number of samples that can be

considered representative must be determined on a site-by-site basis. Therefore, it is recommended that WVDEP personnel be contacted prior to initiating a geologic sampling and analysis program for a refuse disposal area, so that a minimum standard for that site can be established.

Once the geochemical character of the refuse has been established, an on-going sampling and analysis program will be required to monitor changes in refuse quality over time. This will also allow the acid/toxic material handling or treatment plan to be revised as necessary.

5. Geologic Description

The geologic description of a proposed refuse disposal area should follow the same procedures outlined in Chapter VI of this handbook. Special emphasis should be placed on the occurrence of underground mine workings beneath the fill area, along with a discussion of any potential subsidence-related effects. The description should also include information on the depth to bedrock and a discussion of the types and sources of any material to be used in the construction of the fill, such as durable rock underdrains. For impounding structures, the geologic description should describe the potential for landslides into the impoundment, effects of joint and fracture systems, effects of bedding, and effects of any faults or incompetent zones on the impoundments ability to function.

6. Engineering Applications

Analyses of engineering properties of the refuse and foundation materials should be performed to allow proper design and to ensure the stability of the proposed fill or impoundment. For impoundments, the coarse and fine refuse should be analyzed separately, while combined refuse fills can be analyzed in the same sample. Also, tests may be required on all foundation and embankment materials, unless it can be demonstrated that these requirements are unnecessary based on design. Tests may include shear strengths, as determined through the consolidated, undrained-triaxial shear test, Atterberg limits, and grain size analyses, collected from a sufficient number of samples to represent the refuse material and the foundation area. Additional tests for foundation and embankments areas include: soil classification through hydrometer analysis, density, water content, compaction tests, permeability, and liquefaction potential.

Test results should be used to determine the internal friction angle, cohesion, and unit densities of these materials. A detailed description of engineering analyses for these disposal areas is beyond the scope of this handbook. Information on these testing procedures, and others that might be required under regulations promulgated by the Mine Safety and Health Administration, are available in engineering-related texts.

7. Underground Disposal

All underground disposal of coal processing and underground development wastes must first be approved by the Mine Safety and Health Administration. Underground disposal could be accomplished by manually stacking or gobbing this material into abandoned workings, or by injecting it through vertical wells from the surface or pipelines from the portal area. Geologic requirements, relative to any underground disposal of these type materials, are addressed in the following section on underground injection.

E. UNDERGROUND INJECTION

Underground injection of materials into underground workings is restricted by the West Virginia Surface Mining Reclamation Rules to be limited to coal processing wastes, coal-fired boiler ash, inert materials used for stabilizing underground mines, underground development wastes, and sludges from water-treatment or flue-gas desulfurization facilities. All such operations must be first approved by the Mine Safety and Health Administration. Also, permits are required through the West Virginia DEP's Division of Water Resources.

Disposal by underground injection is only allowed when it can be demonstrated that it will not result in damage to the hydrologic balance or contribute to a violation of water quality standards. Geologic procedures and information, described in the previous chapters, should provide adequate information to determine the potential for adverse hydrologic impacts. However, the following sections briefly clarify some modifications or geologic requirements, that might be applicable to underground injection sites.

1. Geologic Cross-Sections, Maps, and Plans

To help determine the movement of ground water and leachates in the underground workings, additional cross sections and maps should be constructed that will show probable flow paths. These should include, at a minimum:

Underground Workings Map

> A map should be constructed of the underground workings that show the outlines of all airways, crosscuts, gangways, breasts, etc. The map should also show any areas that are currently flooded and the area(s) of containment of mine water/sludge, points of entry of mine water/sludge, and all points of discharge.

Geologic Structure Map

> A geologic structure map should be constructed on the base of the coal seam in the area of the workings, into which the injection will take place (See Chapter 5, Section B.5 for

construction details). The map should be drawn on the same scale as the underground workings map and show all control point elevations used to construct the map. The map should show all points of entry of mine water/sludge and points of discharge. It may be combined with the underground workings map as long as the resultant combination is easily discernable and legible.

Surface Contour Map

A surface contour map (topographic map) should be drawn using a maximum contour interval of 20 feet. The map should be on the same scale as the previous maps so that an overlay can be constructed. The map should show the location of all wells, boreholes, and all injection points of mine water/sludge. The map should also show the area strike and dip, along with any anticipated or proposed discharge points. This map may be combined with the aforementioned maps as long as the resultant combination is easily discernable and legible.

2. Chemical Analyses of Injection Materials

All materials that are to be injected into underground workings must be analyzed for geochemical characteristics. The types of tests that are required depend on the types of materials being disposed. Coal processing and underground development wastes can normally be analyzed using standard acid-base accounting methods. Other wastes may require EPA tests such as the Toxicity Characteristic Leaching Procedure (TCLP), the Synthetic Precipitation Leaching Procedure (SPLP), or other similar leaching tests. Section F of this chapter briefly describes the types of analyses that might be required for each waste type allowed for underground injection.

3. Geologic Description

The previous discussion on procedures for developing a geologic description (see Chapter VI) will be adequate for most underground injection disposal permits. However, emphasis should be placed on the quality and quantity of wastes to be injected and the potential movement of the materials and their leachates in the underground workings. The description should identify the locations and extent of any known subsidence, and it should detail the potential effects that this disposal will have on the ground-water quality in the mine and adjacent areas.

F. OTHER WASTE DISPOSAL AREAS

The following section briefly describes additional geologic requirements that might be associated with disposal of several of the more common noncoal-type wastes. Most of these types of waste materials are disposed of within the boundaries of a surface mine permit area. Therefore, the descriptions are generalized, and intended primarily to acquaint both the West Virginia coal industry and the WVDEP technical reviewers of additional geologic requirements that might be

required for these types of disposal operations. Any additional information would require a site-specific knowledge of the quantities and nature of the disposal operation.

1. Sediment Pond Materials

No special geologic requirements are normally associated with the disposal of sediment pond wastes. These wastes are normally disposed of during the mining process and are accomplished by burying it in the backfill. No geochemical analyses are usually required. However, if a disposal area is proposed outside the mine plan area, a geologic characterization of the disposal site would be necessary. The level of detail would depend upon the site-specific conditions, the types and amounts of disturbance involved, and the types and amount of waste materials.

2. Coal Ash

Proposals for the disposal of coal-fired boiler ash has become relatively common in West Virginia. However, although the WVDEP recognizes that this type of material has some beneficial value as a soil amendment, it also has the potential for ground- and surface-water impacts. Currently, WVDEP only considers the use or disposal of this ash within an actual surface mining permit area. Therefore, geologic information required for the mining application should be sufficient to address the area hydrology and geology. Actual handling and disposal procedures for coal ash is beyond the scope of this document.

Unless otherwise available from geologic information gathered for the actual mining operation, standard acid-base accounting information should be provided for all soil, spoil, or refuse material, which will be associated with the coal ash once disposed (See Chapter IV, Section B.1). Also, acid-base accounting information, or other lime equivalency test, should be provided for the coal ash itself to determine the pH and neutralizing capacity of the material.

Once the standard acid-base account is performed, the TCLP or the SPLP test, established by the U.S. Environmental Protection Agency, should be performed. The test should be run on the coal ash, the material that the coal ash will be blended with, and a composite of the two materials mixed in a ratio representative of the expected field conditions. The test involves leaching of the materials using deionized water. If the pH of the resultant slurry is greater than 5.0, it is adjusted to pH 5.0 ±0.2 pH, with 0.5 normal acetic acid. The mixture is maintained at a pH of 5.0 for 18 hours, while being agitated. The SPLP test uses a mixture of both sulfuric and nitric acid to adjust the slurry to a pH of 4.2 ± 0.05 (for sites located east of the Mississippi River), which is suppose to simulate the acid rain conditions associated with natural precipitation. The resultant leachate is subsequently analyzed to determine if the samples are classified as hazardous materials. A detailed description of the procedure is described in detail in Federal Register 40, part 261 (Appendix II). The leachate analyses for all materials should include:

1. pH
2. Alkalinity (mg/L)
3. Hardness (mg/L)
4. Antimony (mg/L)
5. Arsenic (mg/L)
6. Cadmium (mg/L)
7. Copper (mg/L)
8. Lead (mg/L)
9. Nickel(mg/L)
10. Chromium (mg/L)
11. Mercury (mg/L)
12. Selenium (mg/L)
13. Thallium (mg/L)
14. Zinc (mg/L)
15. Manganese (mg/L)
16. Iron (mg/L)
17. Aluminum (mg/L)
18. Silver (mg/L)
19. Boron (mg/L)
20. Barium (mg/L)
21. Sulfate (mg/L)

Depending upon the amounts and type of disposal proposed, additional "simulated weathering" or leaching tests may be required (See Chapter IV, Section B.2). This is because both the TCLP and SPLP tests are generally designed to determine the potential for hazardous concentrations of various pollutants, contained or disposed of in a "non-hostile" environment, such as a landfill. The disposal of coal ash in a mining environment, especially areas involving acid-forming spoil or refuse, is far from a non-hostile environment. Therefore, additional testing may be required to determine potential water quality problems resulting from the use of this material in areas of acid-forming spoils and refuse.

Reporting of analyses should be performed according to the procedures outlined in Chapter IV, Section B.2. In addition, include all information listing the names, addresses, and telephone numbers of the individuals, firms, or laboratories performing the analyses. Also include information on the date of collection, methods of collection, methods of compositing samples, methods of analysis, and dates of analysis.

The WVDEP has specific guidance information for the use and disposal of coal-fired boiler ash, including information related to other State and Federal laws pertaining to this subject. It is recommended that the WVDEP be contacted prior to any contractual agreement between a coal operator and an coal end-user, to determine the current regulatory requirements.

3. Water-Treatment Sludge

Most water-treatment sludge is generated from the neutralization of acid mine drainage. These sludges are normally disposed of within the permit boundary of a surface mine operation, although they will occasionally be gobbed back into abandoned underground workings. Any additional geologic requirements related to its disposal will depend primarily on the amount of waste and the size and type of operation, at which it will be disposed. However, for the purposes of this handbook, the geologic requirements for disposal are essentially the same as those previously described for coal ash. Because most water-treatment sludges are soluble in low pH waters, disposal of such materials should be in a location that either prevents contact with water,

or where the water is of a sufficiently high pH value to prevent the remobilization of the various metal precipitates. In large quantities, this type of material might also affect the stability of backfill areas. Any disposal outside of a mine permit boundary would require all the geologic site information described in the previous chapters.