

Remining Best Management Practices

Remining Information Series

Best management practices (BMPs) are pollution abatement techniques that are performed during the mining and reclamation phases of a remining operation. BMPs are proposed during the permitting process and are approved by the reviewing officials. BMPs are employed to reduce the concentration of various pollution parameters (e.g., acidity, iron, manganese, aluminum) and/or to decrease the amount of water entering the mining operation in order to lessen the subsequent discharge out of the mine. The impact of pre-existing acid mine discharges in terms of a loading rate is defined by a unit of mass or weight over time, generally expressed in pounds per day. Both the concentration of the parameter and the flow rate of the discharge are used to determine the loading rate. Studies have conclusively shown that if the discharge rate can be reduced, the loading rate will almost always also be reduced, even if the concentration increases. Typical conditions at remining sites in Ohio usually include unreclaimed remnant highwalls and water-filled unreclaimed pits that need to be treated and pumped to a nearby sediment control structure prior to advancing the highwall during the remining operation.

Previous mining operations often involved the use of augers to extract additional coal reserves after termination of the last cut into the highwall. These perched water-filled impoundments combined with past auger mining are often the source of acid mine drainage (AMD) and sedimentation in the watershed. The previously mined porous spoil material creates discrete paths for surface and ground water to flow. These seeps of water exit on the outslope of the previously mined spoil banks contributing to instability of the slope and water yield containing various mine drainage constituents. In addition, the last cut of pyrite-rich materials are often exposed to weathering processes and they can be found close to the surface because these layers are generally located by the coal seam and end up near the top of the generated spoil. These pre-existing auger areas, interconnected pits, and pyrite-rich materials near the surface act as a continuing source of AMD discharge into the watershed.

The more commonly used BMPs on remining operations include:

1. **Regrading of unreclaimed abandoned mined land (AML) spoil piles** reshapes spoil piles gaining positive drainage, allowing water to run off the site rather than infiltrate into and flow through the spoil.



Unreclaimed AML spoil sites in Noble County, Ohio

Regraded spoil at B&N Coal Co. remining site in Noble County, Ohio

2. **Revegetating regraded areas** will prevent a portion of the water from infiltrating spoil and prevent erosion of piles by planting vegetation in regraded areas. The soil absorbs atmospheric oxygen infiltrating into the subsurface.



B&N remining operations at Permit D-1038, near Middleburg, Ohio.

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3. Daylighting (surface mining through abandoned underground mines) removes most of the coal, which is often acid-producing. It also reduces the space for large amounts of mine water to be stored and contact acid-forming materials, and can use alkaline overburden for acid neutralization.



Abandoned and underground room and pillar mine map.



Coal pillars exposed by a surface mining daylighting operation.

4. Daylighting of auger areas (surface mining through past coal auger mining) removes most of the coal ribs and holes created by past auger mining, which are often acid-producing and are the conduits for flow of contaminated groundwater after contact with acid-forming materials.



Bank of legacy auger holes in Gallia County, Ohio.



B&N Coal Company daylighting of legacy auger mines at its remining operation in Noble County, Ohio.

- 5. Special handling of acid-forming materials (AFMs)** reduces the acid production by preventing groundwater contact. AFMs are commonly placed in pods above the projected post-mining water table and are capped by a low permeability material (e.g., clay). The key is to prevent groundwater from contacting the AFMs.
- 6. Alkaline addition less than 100 tons/acre (low level)** adds alkalinity to slightly marginal spoils to neutralize acid.
- 7. Alkaline addition greater than 100 tons/acre (high level)** adds considerable alkalinity to sites where there is insufficient naturally-occurring alkaline material. Alkaline addition may not be an option at sites with high concentrations of AFMs and the operation may be denied a permit.
- 8. Water handling systems** prevent water from reaching AFMs in a variety of procedures that include keeping water from infiltrating into the spoil, channeling surface water away from the site, and rerouting groundwater in the spoil. These methods aim to direct water from the site as quickly as possible to minimize AFM contact time.
- 9. Coal refuse removal** removes coal refuse to eliminate the contamination source of acid and metals. There are numerous historic coal refuse piles that continue to yield AMD and some of the sites are viable sources of fuel for co-generation electric power plants.
- 10. Bio solids (composted sewage) addition** encourages vegetative growth where the soil is thin, poor, or essentially nonexistent by adding fertilizer.

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11. **Mining of highly alkaline strata** removes extra overburden to access alkaline strata that is located above AFMs.
12. **Alkaline material redistribution** moves alkaline material from one part of a site to another where it is needed to improve water quality.
13. **Reconstructing streams during remining** reconnects the headwater streams above the remining site to the receiving streams located below the mine site, which increases the base flow and restores the hydrologic balance.



Surface water trapped in highwall pit complex in Noble County, Ohio.



Remined area in Noble County, Ohio, with a reconnected stream.

Summary

A typical remining operation in Ohio involves advancing remnant highwalls and removing overburden with several cuts into the contour using a “box cut” method of contour mining of the hillside and employing many of the BMPs described above. Strategically-placed sediment control structures are situated throughout the permitted area prior to the start of remining to control and treat all surface water to EPA mining standards, or modified remining standards. Designated topsoil and subsoils are removed and stored for subsequent resoiling operations.

The spoil generated by the cuts is placed into the unreclaimed pits; this eliminates perched water collection areas. The newly generated spoil material is generally blended with the existing spoil banks, creating a stable configuration and a proper slope (usually no greater than a 3:1) that reconnects surface water directly into the adjacent streams and watercourses. A lower permeability layer of topsoil and subsoils is applied to the graded spoil material providing a medium for revegetating the affected areas. As remining progresses, the area where the coal has been removed is backfilled and graded, resoiled, seeded, and mulched. In previously mined areas, there is a minimum maintenance period of two years to assure that the vegetation is established to adequately control erosion.

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The following references are provided to the readers who desire further information on this topic:

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