NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

Land Reclamation, Toxic Discharge Control

(No.)

Code 455

DEFINITION

Control of acid or otherwise toxic aqueous discharge from abandoned coal mines or coal-mine waste.

PURPOSES

- Improve water quality;
- Eliminate unsightly residues;
- Reduce erosion; and
- Restore areas to beneficial use.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to locations where acid or toxic drainage is degrading water quality and the environment in and adjacent to streams, lakes, reservoirs, or wetlands.

CRITERIA

There are four primary methods for controlling toxic mine drainage: (1) mine sealing, (2) infiltration control, (3) "daylighting," and (4) neutralization and precipitation.

Mine sealing. This method is usually used to reduce the amount of water entering or to promote inundation by water of underground mine workings to reduce or prevent oxidation of pyritic materials.

In the locations where air and surface water enter underground mines, the measures used for Indiana (IN) Electronic Field Office Technical Guide (eFOTG) Standard (457) Mine Shaft and Adit Closing can be used. Other practices such as diversions or drains can be used to keep water from entrances. Reducing the amount of water entering the mine may solve the problem.

In the inundation process, physical barriers are constructed in the mine opening to control the escape of water. Sealing mines to reduce acid mine drainage by constructing wet seals at the mouths of mine portal drain ways provide air locks while allowing water to discharge. These seals must be designed to withstand maximum expected hydrostatic heads and be constructed of suitable materials such as masonry, concrete, grouted limestone, or clay.

Infiltration control. This method is designed to reduce the amount of water entering toxic surface materials. Strip mine overburden and deep mine refuse can be reshaped for better surface drainage and blanketed with compacted, slowly permeable soil materials to deter infiltration. Diversions, underground outlets, lined waterways, and grade stabilization structures can be used to control surface runoff or divert clean upslope runoff. All surfaces should be left with positive grades. Blanketing with pulverized limestone before revegetating may increase the pH of the infiltrate. Surface soils shall be amended as necessary to promote a healthy root environment for planned vegetation.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service State Office, or download it from the electronic Field Office Technical Guide for your state.

Another method of infiltration control is designed to prevent or reduce surface water from entering deep mines. This condition usually occurs where the bedrock has been fractured due to underground mining, allowing stream flow directly into deep mine workings. Two methods frequently used to control this type of infiltration are grouting of the streambed and piping the stream through the affected area.

Daylighting. This practice consists of surface mining the existing underground coal, selectively placing toxic materials, regrading and vegetating the area, and diverting water to natural drainage ways. This method may work on surface mines if deeper coal seams are present that can be economically mined.

Neutralization and Precipitation. One method of treating acidic mine drainage is the chemical addition of alkaline material. By selecting the proper alkaline agent, many metal cations can be removed during neutralization as insoluble hydroxides. Several alkaline materials are available, such as hydrated lime (CaOH), caustic soda (NaOH), and limestone. A properly sized settling basin shall be provided to allow for the precipitation of metals. Chemical treatment is the least desirable measure for long term treatment of acidic water because of the long-term nature of the action and the excessive operation and maintenance costs involved.

Passive treatment is the most frequently used longterm method for treating acidic mine drainage. Vertical flow wetlands and anoxic limestone drains are two commonly used passive systems to neutralize acidity and provide collection of precipitated metals. Both of these systems use long term contact with high calcium carbonate limestone. The type of system used is based on the chemistry of the raw mine water. The size of each component within the treatment system is based on the design flow rate.

Alkaline discharges can usually be treated by providing adequate detention time to precipitate contaminating metals.

CONSIDERATIONS

1. Mine water quality and flow rates.
2. Geologic environment of the immediate area, including characteristics of overburden such as lithology, faults, joints and attitude.
3. Surface and subsurface hydrologic conditions.
4. Mining history.
5. Land use.
6. Post mining history and conditions.
7. Soils investigation.
8. Topography.
9. Spatial and stratigraphic location of pyrites and other sulfides
10. Availability of high quality limestone or other alkaline material.
11. Availability of blanketing materials.
12. Use of water.

PLANS AND SPECIFICATIONS

Plans and specifications for toxic discharge control shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. As a minimum, the following shall be included:

- Layout of the planned treatment system showing location of all practices.
- Specific alkaline agent to be used for neutralization.
- Details for handling, disposal/utilization of precipitated metals.

OPERATION AND MAINTENANCE

A specific operation and maintenance plan shall be developed for each long term treatment system. The plan will outline the flushing sequence to allow removal of accumulated metals and inert material.

A monitoring plan shall be developed to assess the efficiency and performance of the treatment system. It is recommended that water samples be taken monthly for one year after the system is in operation and quarterly thereafter. Flow rates at all measuring points shall be recorded when samples are collected.

Accumulated precipitate shall be removed from the treatment system components when capacity is reduced by one half.

REFERENCES

Pennsylvania Department of Environmental Protection, Bureau of Abandoned Mine Reclamation. "The Science of Acid Mine Drainage and Passive Treatment." 1999.

Kepler, D. A., and E. C. McCleary. 1994. Successive alkalinity-producing systems (SAPS) for the treatment of acidic mine drainage. pp 195-204 *in* Volume 1 of Proceedings of the International Land Reclamation and Mine Drainage Conference and the Third International Conference on the Abatement of Acidic Drainage, Pittsburgh, PA, April 24 – 29, 1994.

Skovran, G. A. and C. R. Clouser. 1998. Design Considerations and Construction Techniques for Successive Alkalinity Producing Systems. pp 235 – 242 *in* Proceedings of the American Society for Surface Mining and Reclamation Annual Conference, St. Louis, MO, May 17 – 21, 1998.

Pennsylvania's Efforts to Address Operation, Maintenance and Replacement of AMD Passive Treatment Systems. Milavec, P.A. and D.R. Seibert. Proceedings from National Association of Abandoned Mine Land Programs Conference in Park City, UT, Sept. 15-18, 2002.