

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

LAND RECLAMATION, SHAFT AND ADIT CLOSING

(No.)

CODE 452

DEFINITION

Closing vertical and horizontal underground mine openings.

contains guidance on investigation, safety, design, and construction and is to be used as a procedural guide with this standard.

PURPOSES

This practice may be applied as part of a resource management system to support one or more of the following:

- Close mine shafts and adits to reduce subsidence problems, hazards to humans and animals, the emission of hazardous gases, and the pollution of surface and ground water.
- Protect other resources; to improve the environment.
- Provide for beneficial land use.
- Improve the environment.

Designed filling

All debris and material not meeting backfill material specification should be removed, leaving the clean, solid material that existed prior to beginning of backfill operations. Material remaining should be compacted, if necessary.

Vertical shafts should be filled to about 1.5 m (95 ft) from the surface with a properly designed filter consisting of nonacid-forming, free-draining materials. The remainder of the shaft should be filled with random fill materials interspersed with layers of clay, approximately 0.6-m (2 ft) thick, or other impervious materials that would retard the passage of water or gas. The opening should be overfilled to allow for settling. Normally, this should be 10 percent of the depth of the shaft, or 1.5-m (5 ft), whichever is less. The surface should be rounded and vegetation established in accordance with appropriate NRCS standards.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to abandoned mines and shafts and adits to underground mines that are being treated as a part of surface reclamation. It also applies to sinkholes and pits caused by collapse of underground mines.

To locations where vertical shafts, sinkholes, adits, and drift openings to underground mines have been left open. The practice would normally be associated with some type of surface treatment to reclaim the affected area.

Sinkholes that are open, active, and/or passing a significant quantity of water require a properly designed filter of nonacid-forming, free-draining material. Sufficient soil covering shall be placed to sustain planned vegetation. Sinkholes that are closed, inactive, and not passing a significant quantity of water may require only backfilling with suitable soil material. The allowance made for settlement should be 10 percent of the fill depth, and the area should be overfilled accordingly.

CRITERIA

Agricultural Engineering Note 1, January 1981,

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

**NRCS, WA
September, 1999**

Caps

Caps are constructed of reinforced concrete or steel beams and grates or solid steel plates. Bedrock must be at or near the ground surface if shafts are to be closed by caps. Caps must be designed and supported by the bedrock with sufficient bearing surface to prevent caving or burrowing into the shaft. The surface of the cap must be raised not less than 0.3 m (1 ft) above the surrounding terrain to provide good visibility and positive drainage away from the cap installation. Caps must be designed as a two-way slab or beam with sufficient strength to support anticipated loads. The cap and fitting, access holes, and vent pipe should be reasonably vandal proof. Adits and drift openings should be sealed in a similar manner by walling up the entrance securely to the roof.

Plugs

Plugs are to be used only if no other practical solution is available. Installed at substantial distances below the ground surface, they are used where the shaft is to be filled to the surface (see "Designed filling"), but the shaft below is to remain open. Plugs should be made of properly designed reinforced concrete and placed in firm bedrock to ensure against failure.

Plugs are to be designed and located in the shaft where an adequate bond with the original bedrock can be obtained on the sides of the shaft, with sufficient strength to support the backfill to be placed. They can be designed with small weep holes to allow free drainage. Filters may be needed to prevent soil from seeping out weep holes with water.

Barriers and dams

Barriers are built in adits to prevent humans and animals from entering the tunnel, and if near the bottom of a shaft, may be used to prevent lateral spreading of backfill material and to support filling of the shaft. Barriers are constructed of stones, crushed rock, quarry run rock, gravel, shale, or similar nonacid-forming, free-drainage materials. The barrier is to be at least three tunnel diameters thick. If a concrete or masonry wall is not used to support the barrier, it should be three diameters thick at

the top of the tunnel with at least a 3:1 side slope to the bottom. If barriers are to extend to the ground surface, the surface must be at least 1.2 m (4 ft) of soil materials and established to vegetation in accordance with appropriate SCS standards. If needed, a permanent drainage system using pipe or rock toes should be installed through this covering. Traps to prevent air or gas passage may be necessary.

Dams are constructed the same as barriers except they are designed to be essentially watertight and to withstand a known hydraulic head. They must be constructed of impermeable materials or be sealed.

Enclosures

Enclosures should be used only where it is essential to occasionally enter or gain access to shafts or adits for pumping or other reasons. Enclosures may be made of concrete, masonry, or "anti-intruder" chain link and barbed wire fences. Enclosures can be used only where periodic inspection and maintenance is ensured. In all cases, enclosures should be constructed to keep humans and animals out and should be located so that no subsidence or caving can break the integrity of the enclosure.

Safety precautions

When the presence of harmful amounts of gas is evidenced or suspected and work involves shafts or adits, tests are to be made to determine the presence of gas that could be harmful to human, animals, the use of equipment, or that could cause a fire or an explosion.

If hazardous gas is present, ventilation and safety precautions are to be taken as necessary for the closing operation, and permanent ventilation measures are to be installed if needed. Only persons experienced and trained in this activity are to provide guidance on measures to be taken.

Extra precaution must be taken when searching for concealed shafts and adits. At least two persons should conduct a search,

leaving their specific schedule with others. Extra care must be exercised when the ground is unstable or if gas may be present. Safety barriers, ropes, safety belts, gas detectors, and other equipment must be used as necessary during site reconnaissance, surveying, and foundation investigation and construction activities. A collapse zone should be established, clearly marked with fencing and warning notices, and no person should enter this zone without wearing a proper safety harness. Sturdy bumper blocks or other devices must be used to keep machinery and trucks from falling into shafts and subsidence pits. Whenever possible, bulldozer blades and other items should be larger than the hole being filled.

CONSIDERATIONS

1. Mine depth, slope, and layout.
2. Geologic strata where the opening and mine are located.
3. Presence of additional openings to the same or adjacent mines.
4. Land use, dwellings, roads, and other structures nearby.
5. Water level, quality, and flow rates, including water moving from connecting mines.
6. Associated surface subsidence.
7. Hazardous gases present or being released.
8. Potential for combustion.
9. Location and condition of proposed fill material.
10. Topography.
11. Drainage patterns.

Water Quantity

1. Effect on the components of the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, flowthrough soil openings, and ground water recharge.

2. Effects of the transfer of water from one aquifer to another aquifer through soil openings, shafts and bore holes.
3. Effects on the ground water, spring, and seep flow network.

Water Quality

1. Effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances carried by surface runoff or by seep water.
2. Effect on the visual quality of downstream and onsite water resources.
3. Short-term and construction-related effects of this practice on the quality of the surface and ground water.
4. The potential for uncovering toxic materials.
5. Effects on the movement of dissolved substances below the root zone and toward the ground water.
6. Effects of water release and management on the quality of downstream waters to prevent undesired effects on aquatic and wildlife communities.

The effects on wetlands and water-related wildlife habitats.

Environmental

All disturbed areas shall be reshaped and regraded to blend with surrounding land features. Visual resources must be given the same consideration as other design features in planning, design, and installation. Exposed areas of earth shall be covered with soil materials and established with vegetation or protected by other means. Access roads must be maintained and foot and vehicular traffic controlled to protect the work.

PLANS AND SPECIFICATIONS

Plans and specifications for closing mine shafts and adits shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

Maintenance activities must be outlined in the reclamation maintenance plan. Maintenance is essential because of the strong likelihood of additional subsidence, water drainage, failure

of vegetation, and other problems associated with mine reclamation. Restrictive barriers, fences, and covers are to be maintained to accomplish their purpose. Regular periodic inspections must take place and prompt repair and follow-up is carried out.

**NATURAL RESOURCES CONSERVATION SERVICE
GENERAL SPECIFICATIONS**

LAND RECLAMATION

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Cleaning

Shafts shall be cleaned of all trash, debris, metal, timber, wire, and other refuse in the hole that could hinder an effective design filling. Adits shall be cleaned of the same materials, if present, plus all earth and rock materials that must be removed to permit the planned treatment.

All materials removed shall be disposed of by burning or burying at approved sites or transported to sanitary landfills. Soil or rock materials to be used in the filling operation shall be stockpiled and protected until used.

Filling shafts

The ground near the shaft must be stable enough to support machinery and materials, or provisions must be made for safe operations. All needed safety barriers and warning devices must be present and operating before work starts. Materials that are to be placed later with a front-end loader or crane are to be stockpiled at a safe distance from the shaft entrance. This distance should normally be 10 m (30 ft) from the collapse zone.

The materials shall meet the quality requirements specified in the plans. The material should be placed in the center of the hole and dropped vertically to prevent damaging the shaft wall or bridging, causing improper filling or excessive voids. The individual types of materials shall be graded as specified. Different gradations or types of soil and rock materials shall not be intermingled and shall have a generally smooth interface between the different zones. The top layer shall be placed as specified and graded to

provide positive drainage away from the filled shaft entrance.

Closing adits

The fill or concrete shall be placed to line and grade in the manner specified in the plans. Materials shall be compacted as necessary to achieve the required density. Any filter and drain material shall meet required gradation and be placed to line and grade as shown on the drawings. Any bare earth shall be covered with soil materials, graded to provide positive drainage, and established to permanent vegetation. If climatic or other conditions preclude vegetation, materials such as gravels or other mulches can be used.

The completed job shall be clean and neat and present a workmanlike appearance. Any required protection and warning measures and signs must be installed as specified