



Reclamation and Closure: Parts 5 & 6 of a Six-Part Series

Reclamation and Closure: Final Stages of the Life of a Mine

At the end of mine life, two major components of the mining life cycle begin. Reclamation is the physical process of reclaiming a mine site based on the recontouring and revegetation of all areas that were disturbed during the mining process. Closure is the process by which the mine facilities are dismantled, removed, or demolished. Because these two processes are intricately intertwined, they will be discussed together in this, the final paper in the Mining Process series.

Reclamation

Reclamation is an integral part of the mining process and, as such, reclamation plans are developed during the initial mine planning and engineering work. Once mining operations have ceased, the reclamation process can begin although sometimes concurrent reclamation has been completed while the mine is in operation if a facility is no longer needed. Depending on the size of the operation at the end of mine life, it can often take several years to completely reclaim the site. A primary goal of the reclamation process is to return the disturbed ground to productive use(s) as defined by the regulatory agency.

A reclamation permit is required before mining begins. Since this is part of the mining process, the permit is a major part of the Mine Plan of Operations approval that an operator must acquire before mining can begin. A reclamation permit defines the reclamation methods that will be used to reclaim different parts of a mine site, such as roads, waste rock storage facilities, leach pads, maintenance areas, office and lab facilities, and all other site-specific facilities. The plan discusses such details as when an area is to be scarified (ripped by equipment to better accept seed and moisture); regrading to specific slopes based on location, material, and stability requirements; placement of growth medium on graded waste rock storage facilities; need for soil amendments (such as fertilizer); and the seed mix to be applied and at what application rate.

A common permit condition requires that, when possible, an operator conduct concurrent reclamation, which simply means that if part of a mine site can be reclaimed while mining operations are actively being conducted, the operator is encouraged to do so.

Each reclamation plan must also calculate how much it will cost to reclaim the mine site. This is often determined by means of a model which requires site-specific input data. The model will then produce the projected cost for reclamation, which in turn determines the amount of the reclamation bond, or financial surety, that an operator must post before mining begins. This bond is re-visited periodically (agencies may vary as to timing), at which time adjustments are made, and the financial obligation is updated.

Closure

As indicated above, the closure process deals more with the mine facilities. A closure plan should identify potential sources of pollutants at a mine site and then determine the appropriate methodology by which to close each facility. This methodology will be based on site details such as material characterization work and will require engineered designs that must be updated as circumstances change during the mining process. This information will also be used in the site's bond calculations to determine estimated closure costs.

Certain facilities, such as buildings and their foundations, waste rock storage facilities, and roads are straight forward. Buildings will be dismantled and either removed, or sometimes, a local government or community might ask that a building remain for the use of the community. Concrete building foundations, which are inert, may be broken up and buried in place. Waste rock storage facilities are designed to be regraded to appropriate slopes at the end of mine life to ensure stability and to blend with the local topography as closely as possible. Roads, including haulroads and small vehicle access roads, usually must be scarified to break up the soil consolidation that has occurred over time.

For other facilities, such as heap leach pads, tailings storage facilities, and mill facilities, closure is a more in-depth process. The closure of a heap leach pad for example, must consider the characterization of the material on the pad; how long it will take for draindown of the residual leachate in the pad to occur; if there is a need for a soil or other type of cover over the pad; and how to handle stormwater on and around the pad. Tailings storage facilities are similar to heap leach pads as far as leachate draindown concerns, the control of stormwater, and the determination of cover options. For mill facilities, which are an assemblage of highly specialized equipment used to break down and separate the ore from the waste, it is often desirable to disassemble equipment so that it can be used at another operation.

As long as closure activities are occurring at the mine site, that portion of the financial obligation bond will be retained by the agencies involved. Only when all activities have been completed to the agencies' satisfaction based on regulatory requirements will the final bond be released.

The intertwined processes of Reclamation and Closure are important aspects of the mining life cycle. The completion of both processes is intended to return mined lands to productive and beneficial land uses.

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