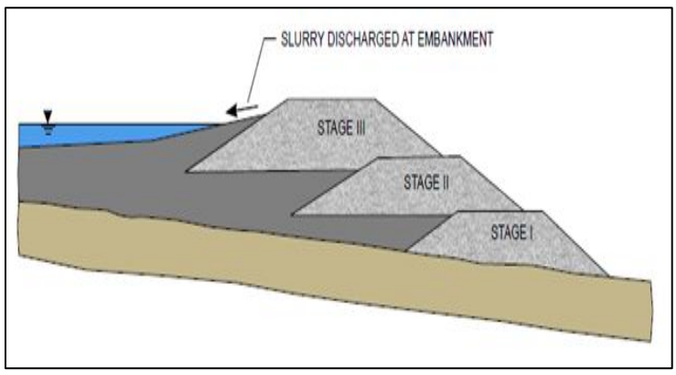
U.S. Department of Labor
Mine Safety and Health Administration
Protecting Miners' Safety and Health Since 1978

Coal Impoundment Construction using the Upstream Method

What is the Upstream Construction Method?

Fine coal refuse is transported to an impoundment in slurry form and discharged along the upstream toe of an existing embankment. The deposited fine refuse eventually forms a beach near the existing embankment and above the pool elevation. In upstream construction, this beach is used as the foundation for subsequent embankment stages.

Hydraulically placed material may require time to develop full strength. Due to this characteristic, upstream construction presents potential hazards related to ground stability and working near water. Examples of past accidents include mobile equipment being driven into the water and personnel being caught in ground failures that carried them into the water.



What are warning signs of potential ground failure?

- Cracks developing parallel or perpendicular to the shoreline in the pushout material.
- High pore water pressure readings in instrumentation installed beneath pushout.
- Excessive pumping of material used for pushout construction.
- Excessive bulging of slurry in front of pushout.
- Excessive bubbling in the water or rapid material movement ahead of the pushout.

How do you manage the risks?

- Keep pool levels as low as practical.
- Discharge slurry along the upstream toe of existing embankment to create a uniform beach.
- Construct pushouts on exposed and established fine refuse beaches.
- Conduct pushout work during daylight hours or with proper lighting.
- Install instrumentation to monitor pore water pressure beneath the pushout and establish allowable pore water pressure values.
- Evaluate pushout stability using the low and time dependent strength of foundation material.
- Raise embankment at a rate that keeps pore water pressures below maximum allowable.
- Use low ground pressure dozers and keep all other equipment out of the highest hazard zones.
- Operate dozers perpendicular to the shoreline and double push when necessary.
- Provide task training for miners working around impoundments.
- Equip dozers with two types of communication equipment and life jackets.
- Have a spotter constantly examine the work area and observe equipment.

Once the pushout is completed, are the dangers eliminated?

No. The fine coal refuse needs to consolidate (drain and densify) in order for it to gain strength to support the additional embankment material. A slow rate of construction and monitoring the instrumentation is very important to maintaining a safe work environment.

More information can be found in Chapter 11 of the second addition of MSHA's "Engineering and Design Manual for Coal Refuse Disposal Facilities" located at
http://www.msha.gov/Impoundments/DesignManual/ImpoundmentDesignManual.asp