

Foam Mine Fill - Overview by Dan Vatne

Foam Mine Fill (FMF) is an innovation in mine backfill developed at McGill University under the supervision of Professor Ferri Hassani. FMF reduces fill density by replacing some mix water with Stable Air® foam.

Current mine backfill practice involves mixing tailings with cement and water to produce paste that is transported by pipes underground to fill in mined voids. Cemented Paste Backfill (CPB) is a highly viscous and abrasive material resulting in rapid pipe wear which necessitates regular mine shut downs for pipe maintenance and replacement.

Water Savings - All mines that use CPB will save water by upgrading to FMF. Mines operating in water scarce regions will save on water trucking/pumping costs. A mine producing 500,000 cubic meters of CPB will save 23,275,000 liters water annually.

Cement Savings - CPB uses excess water to make the tailings more flowable in the pipes. As with conventional concrete, excess water in CPB causes loss of strength in the cured material. This requires extra cement to achieve the specified strength. FMF reduces water content by 46 liters per cubic meter of CPB resulting in cement savings. Another factor affecting strength is that Stable Air® bubbles surround each cement grain reducing contact with other cement grains. The result is 100% availability of each cement grain for hydration. Total cement savings is 4%.

Reduce CO2 - It takes one tonne of CO2 emissions to produce one tonne of cement. 4% reduction in cement consumption yields an equivalent 4% reduction in CO2.

Reduce Paste Friction - FMF produces a more fluid mix as cement grains are not attached to each other while transiting the pipeline. The measure of fluidity used in mining is yield stress. When 50 liters of water is replaced with 50 liters of Stable Air® foam, paste yield stress is reduced by 25%! This not only reduces pipe wear and extends maintenance/replacement intervals, it also allows mine engineers to increase the paste delivery radius reducing pumping costs.

Summary - By replacing 50 liters of mix water with 50 liters of Stable Air® foam, underground, hard rock, cut and fill mines can:

1. reduce water consumption by 4%
2. reduce cement consumption by 4%
3. reduce CO2 footprint by 4%
4. reduce yield stress by 25%
5. reduce mine shut downs for pipe maintenance and replacement

Above discussion based on gold mine tailings with 5% Stable Air®.
FMF is patented in Canada and Australia; USA pending