IHI Excavate and Quench Project
Rifle, Garfield County, Colorado

Haas Canyon is the location of five underground coal mines, and the Haas Canyon area has been the site of nine coal mine fire mitigation projects totaling in excess of $1 million. The projects were conducted by: the US Bureau of Mines; Office of Surface Mining; and Colorado Division of Reclamation, Mining and Safety, (formerly the Division of Minerals and Geology). These projects included: installation of a fire barrier; removal of burning coal waste; several soil seal projects; and two drilling and grouting projects. As is the case with most burning coal mines, repair and maintenance are required occasionally to reduce the amount of air circulating through the abandoned underground coal mine.

Problem
The purposes of the IHI Excavation and Quench Project are to: restrict air from entering the fire; to cool the fire to protect human health and safety and prevent injury caused by burns, smoke inhalation and/or from suffocation caused by falling into or being near the venting openings; and to prevent the fires from heating further.

Solution
The steps in the project included; repair the existing road, identify and seal all air intake sources, using polyurethane foam followed by backfilling and soil sealing a subsidence feature near the portal, excavate the hot zones using an excavator, spread the hot soil and clinker, quench the hot soils, quench the bottom of the excavation, then compact the cooled soils back into the excavation.
Installation
Frontier Environmental Services, Inc. mobilized a Frac Tank to store water, a water pump and pipeline and a 325 Caterpillar Excavator with a thumb. They utilized the services of an oil-field water hauler to keep the frac tank filled so the excavated material could be quenched.

The excavator began to excavate a subsidence feature located over the main entry, near the portal, while the rest of the crew utilized spray polyurethane foam to fill small cracks and small subsidence features that demonstrated air intake. The bottom of the excavation was found to have temperatures of 300°F to 400°F, so it was decided to dump two water truck loads into the subsidence prior to filling it. This resulted in a much better backfill, and cooled this area.

The main part of the excavate and quench project was located on a bench above the portal area, where 1,000°F temperatures were exhibited. These areas were excavated and the soil quenched to reduce the temperature below 200°F prior to replacing the soil. A lower bench was created in this way, allowing the excavator to sit lower and excavate deeper into the fire.

In one location in the fire, a temperature of 2,162°F was shown on the thermocouple. This is partly born out by the excavator bringing up melted rock from this location.

QA/QC
CDRMS employed a full time project engineer to monitor the progress of the job, with occasional visits from the Project Manager. The project engineer tracked the project costs, water usage, and other project parameters.

Conclusion
The project addressed two of the three constituents of the fire triangle, air and heat. The contractor closed many air intakes that were feeding the fire, both by excavating and by sealing with polyurethane foam. Significant hot vents that were exhausting were excavated and quenched, then the quenched material was compacted back into the excavation to better seal the fire exhaust. In all, 180,600 gallons of water and 4,500 cubic yards of hot soil were excavated and cooled from 1,000°F to below 200°F.