

Underground Problem

Second Biennial Collegiate MERD

Problem Background

The Edgar Experimental Mine was opened the week before the SME National Conference, as CSM welcomes visitors from the industrial and academic communities. Tour groups were brought underground as groups of five; one CSM student tour guide and four visitors. Tour groups participated in various activities around the mine, with equipment demonstrations, drilling, and other fun activities for those involved in the industry.

The Event

At the beginning of events this morning, a total of 6 groups were underground, with a few people still at the surface. At 0730, a group walking into the Army portal with an LHD, and proceeded down the drift, where, two minutes later, the LHD struck an overhead power line, breaking it open, and causing a power surge in the mine's electrical system. The LHD then proceeded to catch fire, engulfing the vehicle in minutes. The driver attempted to escape (unsuccessfully) and the professor with them attempted to assist him (unsuccessfully). The remaining three proceeded to take cover in the old refuge chamber.

Mine Manager's Statement

Good morning,

My name is [Fill in], and I am the manager of the Edgar Mine.

At 0730 this morning, a total of 6 groups of 5 people have gone underground as a part of tours for the SME conference this next week.

At about 0735, a major power surge happened, with no real cause that we could determine out here. Mine power experienced the fluctuation, and the office power experienced no change. I left the office and went to see if anything was out of the ordinary, and light smoke was emanating from the Army portal and some dark smoke was exiting the ventilation raise. At that time mine general emergency procedures were initiated.

CSM Police and Idaho Springs PD have secured the perimeter around the mine, and will contain the media until they are ready to be briefed. Clear Creek EMS is already on-scene, with more ambulances en route from Gilpin County and the Denver Metro Area. Clear Creek Fire is already on-scene, and is staged to be helpful on the surface if needed, but will not go underground.

The main fan is on in the low setting, exhausting air out of ventilation raise. Both the direction of the fan and speed can be changed as needed. Mine electricity is still on, with mine water on as well. Compressed air is not on yet, but the startup is in process and will be on shortly. The mine is equipped with one permanent refuge chamber and one older one that is no longer stocked, but still has air, water and power in.

At this time, I'm happy to answer any questions you may have

[Q&A]

If you are willing, I ask that you establish a fresh air base, then begin exploration underground; rescuing any survivors as you are able, extinguishing any fires and clear as much of the bad air as you can. Any information you can relay back to the incident command post would be greatly appreciated.

Thank you, and good luck.

Mine Information and Status

Utilities

Power	ON
Water	ON
Compressed Air	ON
Radio System (Leaky Feeder)	<i>Uncertain</i>

Notifications and Emergency Responders

All state, local, and federal officials have been notified. Idaho Springs PD and CSM PD are on scene and has locked down the perimeter and is holding the media at bay until statements are ready from incident command. CSM PD has relinquished command of the incident to the established IC, but remains as oversight on behalf of the school. Clear Creek Fire is on scene and available, but the captain has already stated that their firefighters will not go underground. Clear Creek EMS has staged their one ambulance, and a mutual aid call for additional resources has been made. An ETA is not yet available for these crews.

Adjacent Mines

The Edgar mine is near to many older mines, none of which are operational today. The only potential access between the present Edgar Mine and these older mines is down the Edgar Mine Drift, inby on the Miami, past D-Right. As shown on the mine map, this is blocked and sealed, to prevent access from older workings and to isolate the ventilation.

Backup Teams

Backup teams from Front Range and Henderson are on scene, with additional resources en route from Barrick and Newmont in Nevada. Their ETA is unknown, but enough teams are present on scene to begin rescue work.

Gas

This mine is not historically known to be gassy and is not classified as such, but occasional pockets of rock strata gas are liberated when veins are worked. Due to the geology, radon is slowly liberated from the rock, but only builds to detectable concentrations over substantial periods of time, and can be considered irrelevant for your purposes today.

Explosives

Explosives are stored on the surface, in an ATF approved explosives magazine, and are used for blasting underground and for blasting and experimentation at the surface explosives research lab. If explosives are used underground, they are brought underground only as needed and are used promptly. If deemed needed, explosives are available for use in the completion of this problem.

Fuel and Oil

Fuel and oil are stored on the surface, as indicated by the mine map.

Communications

Communication underground is achieved by a leaky feeder radio system (Pyott-Boone), and by a page phone system. There is Wi-Fi in the USGS Room (which works occasionally), and regular surface phones in certain locations.

Refuge Chambers

This mine has two refuge chambers. The first and oldest refuge chamber is at the intersection of the mainline Army drift and the Spencer crosscut. It is equipped with the basic equipment, but has not been inspected or brought up to date recently. There is *no airlock* on the door to enter this refuge chamber. The second refuge chamber is located along the Spencer crosscut, outby of the ventilation raise, but not too far away. This is a MineARC permanent chamber, completed recently and is fully equipped and up to date. This chamber does have an airlock on the door.

Ventilation

The Edgar normally uses a natural ventilation scheme, where air intakes through the Army and Miami portals, and is exhausted via the ventilation raise in the Spencer Crosscut. When natural ventilation is deemed insufficient, the ventilation fan at the surface of the ventilation raise can be operated, only able to exhaust. Additional ventilation equipment, such as brattice cloth and frames, booster fans, vent tube, etc. can be found underground.

Guards and Gases

Guards have been posted at all mine entrances (including vent shaft collar), and have been making routine gas tests at 10 minute intervals. They took bag samples initially and are planning to do so at 30 minute intervals.

Most Recent Readings

Entrance	Miami Portal	Army Portal	Vent Shaft
Smoke	None	Light	Medium
Oxygen	20.9%	20.9%	14.7%
Carbon Monoxide	0 ppm	0 ppm	1206 ppm

Mining Techniques

Mining takes place using what is effectively room and pillar mining, in a fairly random arrangement, often following zones of mineralization. Due to various research or experimentation needs, the layout and design of the mine can change frequently. On the Miami side of the mine, rail equipment (both diesel and battery operated) are used to move muck and material, with some compressed air equipment as well. On the Army side of the mine, a variety of diesel and gasoline powered (rubber tired) equipment is used.

Roof Support

Roof support is most commonly done using Split-Set or Swellex bolts, but can use other types of bolts as well. The weakest areas are supported by strapping (bacon strips) and can also include roof screening. Shotcrete is rarely used, primarily in the new refuge chamber in the Spencer crosscut.

Mine Map

The mine map is fairly up to date, but, due to the nature of the mine, it is inevitable to have inaccuracies. The portable refuge chamber is not indicated on the map.

Water

This mine is not generally wet, with the whole mountain having a low water table (well drained by the large number of old mines draining out the Argo tunnel. Pumps are available as needed, and are located on the surface.

Geology

Structure

The local area is all Precambrian (early Proterozoic) metavolcanic and metasedimentary rocks, all with a felsic composition (generally a gneiss). The area was locally intruded in the early Tertiary/late Cretaceous with granitic igneous rock, and before that in the mesoproterozoic, with the Mount Evans batholith. The area is subject to substantial folding and faulting, and is considered part of the Idaho Springs-Ralston Shear Zone. Veins run through the mine most notably along the A and B drifts and are found in many of the other areas of the mine. These veins are hydrothermal in origin, showing typical concentric alteration about a center of auriferous pyrite.

Lithologic units

The mine is primarily driven into Biotite gneiss [Xgnb] —Dark-gray, fine- to medium grained, foliated, biotite quartz-plagioclase gneiss; locally garnetiferous and microcline bearing, and interlayered with hornblende gneiss, calc-silicate gneiss, and sillimanite-biotite- quartz gneiss. Patterned areas contain profuse lenses and layers of granite gneiss. Other rock is a Sillimanite-biotite gneiss [Xgns] —Banded light gray, very dark gray, or black; at some localities interlayered with biotite-quartz-plagioclase gneiss and layers and lenses of amphibolite, biotite gneiss, calc-silicate gneiss, and garnet-biotite gneiss. South of the Idaho Springs-Ralston shear zone, primary muscovite and trace amounts of cordierite present in unit. Pattern shows area that contains profuse pods and lenses of Silver Plume Granite (Ysp). Deeper areas may intersect areas of Feldspar-rich gneiss [Xf]—Light-gray, leucocratic, fine to medium-grained, microcline-plagioclase quartz- biotite gneiss. Conspicuously foliated; granitic in appearance. Locally garnetiferous and ubiquitously interlayered with conformable thin to thick layers and lenses of hornblende gneiss, amphibolite, biotite gneiss, and locally calc-silicate rock. The area is intruded by Monzonite, granodiorite, and syenite [TKi]— May include minor amounts of mafic rocks, such as pyroxenite.

[illegible]

Edgar Mine