Inside a toxic hellhole, Iron Mountain Mine

Peter Fimrite, San Francisco Chronicle, 8-29-10

REDDING -- A strange chemical smell lingered in the stifling heat as a group of environmental scientists groped in the darkness through one of the most polluted places on Earth.

The Iron Mountain Mine, outside of Redding, is a hellish pit where acid water sloshes against your boots, greenish bacterial slime gurgles out of the walls, and stalactites and stalagmites of acid salt, copper and iron jut out like rusty daggers.

"You don't want to splash this stuff," said Rick Sugarek, the U.S. Environmental Protection Agency's project manager for the Iron Mountain Superfund site. "This is the concentrated stuff."

The water - so acidic it could dissolve fabrics and burn skin - lapped against the rubber boots of the scientists, toxic-substance specialists, geologists and EPA officials who slopped in the dark toward the source of the toxic stew that created what experts describe as the "world's worst water."

"It's really kind of creepy," said Jane Vorpagel, a staff environmental scientist for the California Department of Fish and Game, who was seeing the slime-dripping cavern for the first time.

The recent mine tour was, in part, an attempt to familiarize Jared Blumenfeld, the Environmental Protection Agency's recently appointed regional administrator, with the worst of the 128 Superfund sites in his district.

But it was also a lesson on the extent of the damage humans are capable of inflicting on their environment and the innovative methods of resolving those problems.

The EPA has taken extraordinary measures to neutralize the toxic mixture that polluted the Sacramento River and its tributaries for more than a century.

The flow of pollution, which killed thousands of fish and did untold damage to the river habitat, is largely being held at bay and the damage has been contained. But the journey through the vile dungeon of the mine showed clearly that the danger will always remain.

Peak topped with rust

Iron Mountain, about 9 miles northwest of Redding, was once a majestic peak topped with red iron rust that suggested to miners in the 1860s that a little digging might reveal valuable copper.

A company called Mountain Copper established a 4,400-acre mine in the 1890s and began to supply sulfuric acid to refineries in the Bay Area. It became the largest copper mine in California by the turn of the century, and a small city of laborers lived on the mountain. Twenty cavities the size of office buildings were drilled into the rock.

The mining operation turned to rubble what was originally a 200-foot-thick by 3,000-foot-long underground deposit of pyrite, the metallic mineral known as fool's gold. The destruction of the mountain exposed the pyrite to oxygen, water and bacteria that combined to create poisonous runoff.

The result was the worst concentration of acid in the world, about 500 times more toxic than any other mine.

Today, dirt roads snake over and around the mountain. Treatment plants, holding ponds and dams are scattered about to catch the toxic runoff. The entire area is carved up. Rubble and large areas of bare reddish dirt pock the hills.

The primary source of the acid is inside a shaft on the side of a steep, barren hillside known as the Richmond Mine. The group that trekked into the bowels of this shaft was one of the first to ever go that deep; it included news media and other observers not directly involved in Superfund research.

Inside, the sound of bubbling and burbling is everywhere as water drips onto superheated rocks and turns into vapor. The chemical steam heats up the cavern and emits a strong odor. One visitor is told it might not be good to breathe the air there for extended periods of time.

This is what Sugarek calls "the belly of the beast," a place so hot and lacking in oxygen that it has to be pumped full of air so workers and visitors don't pass out.

Acid salts eat away

The Richmond tunnel is mostly covered with a fiber concrete that protects against collapse, but the acid salts eat away at the material deeper inside, exposing rotting old timber beams. Iridescent green copper stalactites jut down from above, and sparkling black mineral deposits known as Voltaite multiply over the rock walls, much of which is made of pyrite.

The tour group wore rubber boots and gear to protect against ever-present water that is so acidic even a droplet would eat a hole in blue jeans or dissolve the stitching on boots, much like battery acid. Splashing it on bare skin would cause "exfoliation," Sugarek said with a wry grin.

"This certainly seems like the mother lode of contaminated sites," Blumenfeld said. "It is our job to learn from this and make sure it never happens again."

Over the past year, workers dredged much of the 170,000 cubic yards of copper, cadmium, zinc and iron that had flowed out of the mine and accumulated for 50 years at the bottom of the Spring Creek arm of the Keswick Reservoir. The sediments were piped up to a newly built treatment facility that separated out the solids and neutralized the toxic metals, which were then dried out and secured in pits on nearby federal land.

98% of material contained

Sugarek, who has been in charge of the Superfund site for 20 years, said the management of toxic material will continue, but, to date, 98 percent of the toxic material has been captured and contained.

"Our main goal at the EPA was to protect the Sacramento River," Sugarek said. "A ton a day of copper and zinc used to hit the river. We have been able to reduce that to 2 percent of what it once was."

Chemical cauldron

The flow from this chemical cauldron into the Sacramento River and its tributaries was devastating, EPA officials said. Before the creeping acid was contained, it was as bad for the environment as 100 oil refineries pouring petroleum into a salmon spawning stream would have been, Sugarek said.

The Bureau of Reclamation built an earthen dam in 1963 to block the steady flow of sludge, but it would often

overflow during heavy winter rains and the copper and metals would get into the Sacramento River.

The mine was finally abandoned in 1966 and collapsed in on itself shortly after that, but the problem only got worse. By the time the EPA took over management of the area in the 1980s, a ton of acidic water a day was flowing into the river and the water in the debris dam was blood red from the mixture of iron and copper.

In 1988, a sudden surge of power at a U.S. Bureau of Reclamation plant sent 2,000 cubic feet per second of metal-laden water flowing out of the Keswick Reservoir, turning the Sacramento River red all the way to Hamilton City, 100 miles away.

The leftover mess

Desperate, the EPA built the Slick Rock Creek Retention Dam in 2004, which captured most of the red sludge. Now the EPA is concentrating on the leftover mess, which is expected to cost the government $200 million to manage over 30 years.

A federal court recently held the owner of the mountain, Ted Arman, and Iron Mountain Mines Inc. liable for nearly $27 million in past cleanup costs and some $30 million in interest accrued over the years. The former owner, Rhône-Poulenc, which later became Aventis CropScience USA Inc., agreed to pay the federal government $154 million over 30 years in future cleanup costs.

Sugarek said the runoff can be captured, cleaned and turned into landfill for up to 100 years if the money is available. The problem is that the toxic broth will continue pouring out of the mine for 3,000 years until the pyrite is used up or someone figures out a way to neutralize the chemical and biological reactions, scientists say.

No solution - yet

"There is nothing that we have in the world today that solves this particular dilemma," Sugarek said. "What we can do is collect it and treat it and hope that in the next 30 years we have come up with new technology or techniques to resolve it."

At one point during the mine tour several members began edging into a cavern and were quickly alerted by EPA officials that it was not safe to go any farther. A sudden increase in temperature was immediately apparent at the mouth of this cavity.

The shaft leads into a place deeper inside where researchers recently found six unique strains of bacteria living in a bed of pink slime that are part of a little-understood biochemical cycle that devours iron, produces sulfuric acid, and creates a nightmarish broth of copper, zinc and arsenic.

There, the chemical reactions drive temperatures up to 130 degrees and the puddled water is sulfuric acid, concentrated enough to melt an aluminum ladder. Sugarek said the rocks inside this noxious horror house have been known to catch on fire from time to time.

Robot vanished

NASA once sent a robot in - and nobody ever saw the machine again or collected any scientific data from it, Sugarek said.

Scientists at NASA and UC Berkeley have not given up. They are studying the pink slime and what they believe

is a primitive form of bacteria inside the mine, a substance so unusual that it can survive in laboratory-grade acid.

It is a measure of success, Blumenfeld said, that this toxic concoction is no longer pouring into the river.

"We've come across to the other side of the mountain," he said. "It is great to see that we can get back to a place where the water again runs clear. If you can clean up the Iron Mountain Mine, you can clean up anything."