***A View From the* Inside - a Second Look**

May 24, 2018

The Sunshine Mine Fire Disaster of May 2, 1972 had one unique feature, unlikely never to be repeated in a non-gassy underground mine fire. No one knew where the fire was located. Frantic efforts by supervisors and employees to locate the fire—a critical need before picking one of three escape routes from the mine—failed.

Smoke was first observed by electricians at their shop near the 3700 No 10 Shaft station at about 11:40 a.m. Four foremen and two electricians followed the smoke upwind about 900 feet to its source. Light smoke was leaking through a bulkhead at the bottom of the 910 raise that connected to the 3550 level. At the same time the men were evaluating the condition at the 910 raise, phone calls came into the Blue Room reporting smoke at four other locations within 1,000 feet of the 910 raise.

To their horror, the smoke grew darker with each passing second. The only known fact was that it came out of an area mined out a decade earlier. The interconnected mined-out area extended from 3700 level to the mine surface, 3,700 feet above. Without a clue about the location of the fire, and with smoke getting worse by the second, the foremen faced a horrible dilemma. They knew they had to order an evacuation, but could only guess about which escape route to take. They chose the 3100 level because smoke was lighter there than on 3700 level.

All fresh air from the mine surface passed under the 910 raise into No. 10 Shaft, t hen down through active mining areas. With no smoke visible in that airstream and increasing smoke flowing into the No. 10 shaft, a decision was made to stop that airflow by closing a steel fire door near the Jewell Shaft. Two men riding a Little Mancha locomotive went quickly to the fire door and closed it. Catastrophic results of that action will be revealed as this narrative goes on. Considering the speed of the locomotive and that of men walking back to the Blue Room, the door was closed before hoisting at No. 10 shaft began.

Gene Johnson left the very smoky 3700 level, up No. 10 Shaft to the 3100 level where he found smoke to be much lighter. Based on that finding, he initiated hoisting all men to the 3100 level with instructions to go to the smoke-free Jewell Shaft an on to the surface.

At about 12:00 noon, Gene Johnson phoned Tom Harrah, instructing him to contact me with instructions to activate the mine stench fire warning system and “bring the helmets” [self-contained breathing apparatus (SCBA)] to 3100 No. 10 Shaft.

Arson as the cause of the Sunshine fire quickly came into consideration, if for no other reason than it began at an unidentified inactive location. One disgruntled employee who made threats to get even with supervisors who “cheated him” over gypo work was the first person of interest until it was learned that he died in the fire.

The arson theory again gained momentum within weeks of the fire when law enforcement personnel raided a home in Wallace occupied by persons of interest. The suspects got wind of the raid and left in the middle of the night. Objects associated with arson were found in the basement of that home.

Still haunted by the possible arson threat, the USBM ordered that all ventilation doors providing access to inactive mine workers be chained shut and held by padlocks. The logic driving that commands was that the arsonist might have been a mine employee who escaped the fire and could return if/when the mine reopened.

In the interval between the time the fire was declared extinguished and a public hearing in Coeur d’Alene in May, 1973, knowledge of the extreme fire danger of polyurethane foam in largescale applications became known to Sunshine management.

At the public hearing in Coeur d’Alene in May, 1973, the Bureau was unable to pinpoint the location of the fire, but shifted causation to a non-human source. James M. Day’s book, *The Price of Silver,* stated this USBM conclusion on page 188: *“The ‘probable cause of the fire’ was the spontaneous combustion of paper, oily rags, garbage, and explosives abandoned near timbers in mined-out areas before the mining industry began sand-filling the cavities two decades earlier.”* The underlined verbage seems intentionally vague and a discredit to Sunshine’s focus on the 3400-09 bulkhead as the ignition point.

Just now, I recalled a scary incident early in the mine fire. A Hecla mine rescuer team lead by Glen Strand was the first to enter the 3400 level from No. 10 Shaft. They explored the mine exhaust circuit leading west to the 09 vein intersection. The PUF-covered ventilation control bulkhead was totally gone. The 09 vein was an empty void, even below the 3400 level.

To reach the 09 intersection, the team passed through the 08 vein intersection, a structure similar to 09—covered totally with PUF. Several days later, another mine rescue team attempted to reach to 09 intersection. That was impossible! The 08 vein intersection was then an empty void. It met the same fate as 09.

A logical mind must conclude the 3400-09 ventilation control bulkhead burned before 3400-08. I observed dense black smoke in the Sunshine Mine exhaust minutes after the 12:00 noon phone call from Tom Harrah. A similar observation was reported by men on the Bunker Hill Crescent Mine yard.

The Bunker Hill hotshot mine rescue team, the first outside team to arrive at the Sunshine Mine, observed heavy white smoke in the Sunshine Mine exhaust. PUF smoke is black; smoke mine timber fire is much lighter in color. Based on the test I supervised in the British mine fire test near Buxton, England in the fall of 1976, once ignited, the PUF on the 3400-09 wooden bulkhead was all consumed in less than two (2) minutes.

The ventilation circuit distance from the 3400-09 bulkhead to the mouth of the Sunshine Tunnel is about 5,000 feet. Assuming a velocity of 10 mph, it would take about six (6) minutes for smoke from initial burning at the 3400-09 bulkhead to reach the surface.

However, once the bulkhead collapsed—an event heard by Tony Sabala at the No. 8 pipe shop immediately before a door into old workings was blown open, followed by dense black smoke—the velocity would diminish as volume of flow was diminished.

And…when the 3700 level fire door near the Jewell Shaft was closed, intake airflow was drastically reduced. That fire door was reopened by men on 3700 level by three men operating a locomotive with a man coach. They entered the smoke zone and attempted to rescue men who had collapsed. Sadly, they too became victims.

George Clapp, Stan Taylor, and another mine rescue man whose name I cannot recall at this time, and I accessed No. 5 Shaft on 3700 level. I knew that 3100 level smoke was deadly. I needed to know if the same was true on 3700 level. Sadly, it was even worse than 3100.

I accompanied the Bunker Hill mine rescue team to No. 5 Shaft. They discovered five or six bodies, placed them in stretchers and brought them out of the mine. I remained on 3700 level, intent on using a Draeger tester to detect CO, if any, in the Jewell. I then ordered the mine closed until mine rescue crews had tested all connection from the Jewell Shaft to mine workings. They succeeded in sealing off smoke leaking into the Jewell Shaft.

My own investigation of the fire included entry into mined-out areas within the zone where smoke was first [within minutes of one another] observed between 11:40 a.m. and 11:45 a.m. Envision an elliptical path around a section of the mine with east to west having the greater length of about 1,000 feet. The 09 vein is southern-most; the 08 vein is next, with the Sunshine vein northern-most. The 3700 machine shop and pipe shop are on the Sunshine vein.

Wayne Baxter and I climbed a ladderway in the No. 8 Shaft from 3700 to 3550 level. The east end of the last mined-out 08 vein is about 100 feet from the shaft. Where a timbered tunnel with track in place and manways with chutes existed before the fire, a vast void beyond the reach of our cap lamps existed. All wood supports as well as waste wood used with gob for backfill burned. Remaining rock fell into the void that extended down to or close to the 4000 level.

Soot from at the end of that void was at last 6 inches deep. As we followed it to the east, it quickly diminished to a scarcely visible spotting, indicating very little lateral air movement during the fire.

In my examination of the 4000 level between the bottom of the 910 raise and No. 5 Shaft, soot deposits less than one-half inch deep covered the floor of the drift, walls and back, indicating fast and steady air movement. The soot had an oily feel to it and was black as coal.

I invited USBM personnel to return to that area to see for themselves, but their time was dedicated to other purposes. By the way, as my investigation continued for months on end, knowledge of a possible involvement of polyurethane foam emerged.

In 1976, I supervised construction of a replica of the 3400-09 bulkhead—rigid-sprayed-in-place polyurethane foam (PUF) included—in a British mine fire test facility near Buxton, England. D. Graham Wilde, ME was in charge of the test. Temperatures and air quality instruments located safely downstream revealed temperature about 2,500oF. CO2 at 15%; CO between 3% and 7% and O2 less than 1.0%.

Sunshine Mining Company filed suit against the U.S. Department of the Interior, Bureau of Mines, the Mine Safety Appliance Company, and a variety of chemical companies that produced the components in PUF. A trial over liability claims began early in January, 1978 and ended in mid-July.

Ruling from the bench, Judge Ray McNichols of the U.S. District Court for the District of Idaho announced his verdict. He began by stating his belief that combustion of polyurethane foam in the Sunshine fire contributed to the death of miners. However, the company failed to prove beyond a reasonable doubt that, but for the presence of polyurethane foam in the fire, the miners would not have died. That happened forty years ago.

A book about the Sunshine fire titled *The Price of Silver*, Copyright © 2007, was written by James M. Day. He was the solicitor for the U.S. Department of the Interior, Bureau of Mines in 1972. In May, 1973 he held a preliminary hearing in Coeur d’Alene. U.S. Bureau of Mines (USBM) personnel stated the theory that the fire was ignited by spontaneous combustion of oily rags and other combustible waste, left behind the bulkheads on 3400 level that burned for days, even weeks or months before reaching the 3400-09 bulkhead. Sunshine’s fire experts insisted that the fire was ignited shortly before the first smoke was observed on 3700 near No. 10 Shaft. The USBM’s final report on the Sunshine Fire Disaster was released February 14, 1973. Needless to say, disagreements over the cause of Sunshine’s disaster continue to this day.

The Sunshine Mine reopened early in December, 1973, confident that major changes in mine ventilation and employee safety and health training and testing were adequate to protect against another fire disaster. Never again would Sunshine Mine workers insist that a dangerous mine fire couldn’t occur in a hardrock mine—a belief shared worldwide prior to May 2, 1972.

The focus on polyurethane foam as an accelerant in the mine fire led to huge expenditures by Sunshine’s legal counsel. Sunshine’s safety director was “turned loose” to explore accessible mined-out areas within the mine fire zone. The quantity and makeup of soot deposits and direction of smoke movement provided evidence needed to determine the presence of PUF residues and the main recirculation pathway induced by the ventilation fans on 3400 level. The PUF effect on a wood fire were confirmed in the SMRI/Buxton test in October, 1976. Armed with the Buxton test data, attorneys for Sunshine Mining Company identified the 3400-09 intersection as the ignition point of the May 2 fire.

The rapid and toxic development of deadly smoke and fire gases in a fire involving PUF was more than adequate to explain a phenomenon recognized by all parties to the Sunshine Mine fire litigation: The fire developed more rapidly and with much deadlier concentrations of fire gases than “ordinary” timbered mine fires.

In a phone conversation with Harry Cougher on May 15, he mentioned an observation made by the Bunker Hill “hotshot” mine rescue team, the first team to arrive at the Sunshine Mine on May 2, early afternoon. They saw thick white smoke in Sunshine’s main exhaust.

I was surprised by Harry’s statement. The smoke they saw was unlike what I saw at about 12:03 p.m. when I rushed out of my office to dump the stench and arrange to get the SCBAs out of storage and on the way to 3100 No. 10 Shaft. I saw heavy black smoke boiling out of Sunshine’s main exhaust. Wood smoke from mine timber fires is white, perhaps influenced by high humidity in deep mines. Smoke from burning plastics such as PUF is black.

I would not have revisited the Sunshine Mine fire, had not the Mine Safety and Health Administration (MSHA) released the following promotional material: Mining Disasters - An Exhibition: Printed from United States Department of Labor - [Mine Safety and Health Administration –](https://arlweb.msha.gov/) <https://arlweb.msha.gov/disaster/disaster.htm>. Some of the narrative provided with enlarged photographs taken in or at the Sunshine Mine is incorrect or misleading.

Quoted from James M. Day’s book *The Price of Silver,* Copyright © 2007] *“The District Court’s decision was not the last word. In 1997, Robert Launhardt, Sunshine’s safety director, wrote The Sunshine Mine Fire Disaster: A View from the Inside “to correct the record for the sake of history.” His article is available on the web site of the United States Mine Rescue at* [*www.usmra.com*](http://www.usmra.com) *Launhardt challenged the Bureau’s and Court’s findings with scientific ignorance, bias, and untruths in an belated attempt to absolve Sunshine’s misfeasance. Its lack of values is admitted by Launhardt’s caveat: “Documents in my possession, in combination with my own observations, leave a gaping hole in story of May 2, 1972. I also acknowledge that some of my information may be incorrect.”*

To help those wanting to understand the cause of Sunshine’s fire disaster, information about the mine prior to the fire is needed. “Natural ventilation” of the Sunshine Mine induced about 30,000 cfm through the mine. Two 150 hp “booster fans” on 3400 level with help from exhaust fans at the upper end of the mine increased the natural mine ventilation to about 100,000 cfm.

Fresh outside air moved down the Jewell Shaft. About 30,000 cfm crossed the 3100 level until reaching a ventilation opening that carried it down to 3700 near No. 5 Shaft where it joined the intake airstream of about 70,000 cfm through the Jewell Shaft 3700 station.

About 100,000 cfm of intake air reached the 3700 No. 10 Shaft where it was carried down and divided among mining and development levels. A 48” diameter borehole from the 3700 level to 4800 level was completed several weeks before the fire, drilled as a pilot hole for No. 12 Shaft. Lagging was placed over the borehole on 3700 to limit the flow of air from the Jewell Shaft to a quantity adequate for the crew advancing the 4800 west lateral.

Now that a cursory summary of the fire and its legal aftermath has been presented, details that help to understand the conflicting speculation about the origin of the fire and unusually dangerous environment never before experienced in a hardrock mine fire—even in shaft fires such as in Butte in 1917—are presented.

The narrative is built around details available only within the USBM and successor Mine Safety and Health Administration (MSHA); details accurately provided in James M. Days book, *The Price of Silver.* Jim Day combined statements of survivors about location and movement of personnel with No. 10 double-drum hoist “tattletale” printouts, providing a reliable source.

Page 249: *“The principal source for the book The Price of Silver is a four-drawer file cabinet containing copies of the Department of the Interior’s official and non-official records of the Sunshine Mine disaster that has been waiting for me in my study for over thirty years. Included are depositions of Sunshine miners, rescue crews, and Sunshine’s management taken after the fire broke out; transcripts of public hearings conducted in Kellogg, Idaho between July 18 and 26, 1972, and in Coeur d’Alene, Idaho during May 14 through 16, 1973; and thousands of pages of exhibits, photographs, mine maps, and Bureau of Mines and Sunshine Mine Company memoranda. The Mine Safety Appliances and Westinghouse Electric Corporation official’s testimony and data were also available. Unofficial sources included Bureau internal reports and memoranda, personal log of Bureau Director Dr. Elburt F. Osburn, daily reports of Bureau Assistant Director for Metal and Nonmetal Mine Health and Safety Stanley M. Jarett, and personal copies of Deputy Assistant Secretary for Mineral Resources John B. Rigg, Sr.*

*“Extensive references were made to the Bureau’s “Final Report of Major Mine Fire Disaster Sunshine Mine, Sunshine Mining Company, Kellogg, Shoshone County, Idaho, May 2, 1972” released February 14, 1973; the Bureau’s “Preliminary Report” dated June 19, 1972; and the author’s “Report on the Sunshine Mine Disaster of May 2, 1972” issued by the Office of Hearings and Appeals, Department of the Interior, dated March 22, 1976.”*

Page 196: *“As usual, the courts have the last word. Chief Judge Ray McNichols of the U.S. District Court for the District of Idaho consolidated six cases in the case of Helen House, et al. v. Mine Safety Appliances et al., under CA 1-73-50 (October 19, 1978). In addition to MSA, the estates of the deceased miners and the Sunshine Mining Co. brought actions against six chemical companies for the negligent manufacture and installation of polyurethane, alleging it caused deaths of the miners and damage to Sunshine Mining Co. The U.S. was sued for [the Bureau] negligently permitting the use of polyurethane foam in the mine, negligence in conducting the ventilation survey, and negligently conducting inspections, all of which allegedly contributed to the deaths of the miners and damage to the Sunshine Mining Co.*

*“Of interest, the plaintiffs now agreed that the fire originated in the area of the 3400 level 09 bulkhead and the court determined “the evidence supports the view that spontaneous combustion occurred,” which agreed with the Bureau Final Report and author’s findings.*

*“The judge ruled that polyurethane foam was not the “proximate cause of any damage” and the plaintiffs failed to prove negligence on the part of the companies and the bureau.”*

Page 26: *“The experienced foremen knew that the vast amount of smoke billowing down [the 3700-910 raise] meant there was a major fire above the 3700 level, the normal way in and out of the mine, and it would soon be inundated with smoke and impassable. They feared the smoke would circulate with the ventilation airflow to the No. 10 shaft and down to the lower levels, contaminating the only source of fresh air and cutting off the only means of escape of the men below. There was no choice but to evacuate the mine through the 3100 level.”*

Based on consensus reached by four supervisors and two mine electricians gathered at 910 raise on 3700 level, two men were assigned to close the fire door on 3700 level near the Jewell Shaft. Then, the lagging over the borehole was removed, allowing free flow of air down to 4800 west lateral. Based on this information from Day’s book, it seems obvious that no-one challenged the decision to close the fire door.

Sadly, based only on hindsight, that decision cut off inflow of about 100,000 cfm of fresh air to No. 10 Shaft and below—inflow that would have diluted the ongoing recirculation of deadly smoke and fire gases induced by two 150 hp fans on 3400 upstream from the fire. Three of the six men gathered at the 910 raise survived the fire. They were beyond the area of smoke recirculation before the fire door was closed.

Pages 197-198: *Bureau List of Contributing Factors to the Sunshine Mine Disaster*: The list of seventeen factors begs the question of why the Sunshine fire was a disaster at all. All hardrock mine fire disasters prior to Sunshine involved shaft fires or fires in a steeply inclined timbered intake airway. Several of the seventeen demand response:

No. 2: *Delay in beginning mine evacuation*: That charge was refuted by James M. Day, as follows:

Page 199-200, Evacuation Orders: *“The Bureau concluded there was a delay by the foreman ordering the evacuation while they searched for the fire… The evacuation was delayed at least 20 minutes while an investigation was conducted…The Bureau’s findings cannot be substantiated… responded instantaneously by running into the smoke and following it to the 910 raise, a distance of about 900 feet. Around the same time, several men listening in on the phone heard Don Beehner call the Blue Room from the pipe shop and tell foreman Bob Bush that smoke was pouring from a bulkhead to old workings between the pipe shop and 08 machine shop. The listener heard Bob tell Don and the pipe fitters to go to the No. 10 station, the first order in preparation for evacuation, then call Pete Bennett in the 08 shop and tell him to check the area for fire. Bob left the blue room with his brother and foreman, Jim Bush, on a Mancha motor to locate the fire…Under Gene’s [Gene Johnson] leadership, the four foremen [next to page 200] immediately decided the fire was above the 3700 level and to evacuate the mine from the 3100 level. Considering the distance between the Blue Room and the 910 raise, the foremen’s decision to evacuate was made no later than seven or eight minutes after the smoke was detected. Bob Bush’s telephone order was instantaneous*.*”*

No. 9: *Failure to construct incombustible ventilation bulkheads*: Incombustible bulkheads were never required in hardrock mines. Timber products were used for nearly all ground support used in hardrock mines—not sure about coal mines. Unfortunately for Sunshine, PUF developed jointly by Mine Safety Appliance Corporation and the U.S. Bureau of Mines and certified as non-burning and self-extinguishing was installed to seal critical ventilation bulkheads. That product proved to be an accelerant in the Sunshine fire. It is likely that PUF caused fuel-rich combustion with CO at 3% to 7%--far different from the 0.3% to 0.4% reported in the first two (2) hours in a mine timber fire.

No. 11 & 12: *Failure to maintain* (unrequired) *self-rescuers in usable condition*: and *Failure to train underground employees in use of self-*rescuers: All the BM-1447 self-rescuers were in usable condition. Problems with “popping” the sealed cap were universal with those units. AND…Sunshine mine rescue personnel and all mine supervisors were trained in use of BM-1447 unit beginning in about 1963. NOBODY PAID ATTENTION BECAUSE NOBODY BELIEVED A DANGEROUS FIRE COULD OCCUR IN A HARDROCK MINE. New MSA W-65. A few mine rescue men, e.g., Don Beehner, knew how to hit the push button with a pipe wrench. He and others helped men use them.

Also - As a matter of record: Pilferage of self-rescuers occurred on a regular basis, reducing the stock in the mine. Jim Atha, mine safety engineer in 1971, ordered a large number of MSA-W-65 units to restock lower levels. MSA notified John B. Davis, Sunshine purchasing agent, that the order could not be filled because coal mines were converting to W-65 units, and Sunshine was a hardrock mine an didn’t need more self-rescuers. [Some W-65s purchased earlier were stocked in the 3100 No. 10 hoist cab].

No. 14*: Failure to designate anyone as being in charge of the entire operation in the absence of top mine officials*: That charge really doesn’t deserve an answer. By far, the supervisors on duty in the mine were most capable of making a decision. The only person at the annual meeting who might have had an opinion was Al Walkup, the new mine superintendent. He had less than six months experience at the mine and knew very little about response to a mine fire—especially one of unknown location.

Unlike all other hardrock mine fire disasters in recent history, Sunshine’s May 2, 1972 fire location remained unknown for months after the fire. Not surprisingly, its location was strongly disputed between experts representing Sunshine Mining Company and the U.S. Bureau of Mines.

The time at which initial combustion occurred was also disputed. Sunshine set the time of ignition as shortly before the first detectable smoke appeared at the 3700 Electric Shop near No. 10 Shaft. Based on months of post-fire investigation by Sunshine personnel and fire experts retained by Sunshine management, the polyurethane coated bulkheads sealing off the 09 vein intersection with the 3400 level main drift was identified as the source of ignition and initial combustion involving the polyurethane coated bulkheads and adjacent mine timbers.

Words of thanks are offered to James M Day for some of his candid comments in about the emergency response plan that was in effect at the time of the fire.

Page 200: *“Although Sunshine’s posted “Procedure to Follow in Case of a Mine Fire” was outdated and its methods and strategies incomplete, it contained the following basic rule: “Send first available shift boss to ascertain the exact location of the fire, by the safest possible route. Have him report immediately, either by phone or in person. No supervisor should order an evacuation until he has determined the safest route.”*

Page 201: *“No doubt, if Gene Johnson and the other foreman ordered an evacuation at the first sign of smoke, more men could have been hoisted in a 14 to 16-minute period. But whether they would have been evacuated to the 3100 level is conjecture. The 3700 level was the normal evacuation level, and no one, even the Bureau’s expected the speed in which the smoke and carbon monoxide inundated the mine. It has never been witnessed before, or since. If the foremen had not investigated the source of the smoke and determined the safest route was the 3100 level, dozens more men would have perished if evacuated on the 3700 level. It was a sound judgment only the foremen on the scene could have made under the conditions they were aware of at the time.”*

Pages 204-205: *“Sunshine’s “Fire Protection and Escape Plan” emphasized: IT IS OF UTMOST IMPORTANCE IN A MINE FIRE THAT THE VENTILATION IS NOT ALTERED AT RANDOM BY ANYONE. NEVER LEAVE A DRAFT DOOR OPEN OR TAMPER WITH A FAN DURING A FIRE. If changes in the ventilation will be of benefit to the men, the decision must be made by responsible management personnel who are thoroughly familiar with the ventilation system.”*

For reason unknown to me, the dynamics of ventilation change with the 3700 fire door closed also resulted in a reversal of airflow from 3100 to 3700 via the No. 5 Shaft circuit. Some of the smoke coming up No. 5 shaft from 4000 level—a circuit that opened when the 3400-09 bulkhead collapsed from the fire—flowed upward to 3100 level and east to No. 10 Shaft, causing death to men attempting to escape.

Page 208: **Self-Rescuers**: *“Sunshine took pride that it provided self-rescuers when they were not required under the 1966 MNM Act or Bureau regulations. However, its boasting was tarnished by its* [1] *failure to instruct the men in the use of the devices* [2] *and the company’s storage and maintenance practices.”*

[1] From June, 1961 through June, 1967, I was responsible for safety and health. John Brandon, mine manager, and a few in upper management heeded my request for self-rescuers. Others as Sunshine Mine and the Cd’A Mining District ridiculed me, sharing this belief: ‘This is a hardrock mine, not a <#@$^ coal mine. We don’t need self-rescuers.’

[2] When I left Sunshine in June, 1967, each active level of the mine had self-rescuers stored in strong boxes with glass fronts like fire extinguishers—two self-rescuers for the number of men on each level. When I returned on Valentine’s Day in 1972, about half of the self-rescuers were pillaged. Mine workers told me, “They are really good for spray painting cars.”

The person in charge of safety when I returned had ordered replacement self-rescuers—actually the new MSA-W65 units. At that time, MSA was swamped with demand as coal mines replaced all old units. John B. Davis, purchasing agent, showed me a letter from Mine Safety Appliance Company, advising they could not fill our order. “Coal mines needed the units; hard rock mines don’t need self-rescuers.” Sunshine did its best to have self-rescuers for the newly developed lower levels.

Regarding training: The fact that a few knew how difficult it was to open a BM1447 and how to use them speaks for itself. All mine supervisors, all mine-rescue personnel, and all volunteers for advanced first aid training were trained in their use and ready to help the untrained (and those unwilling to be trained). I had my first mine rescue training in 1954 and was aware of the difficulty activing a BM1447. I also knew the hopcalite would reach 450o F. at 2% CO. Mouths could be burned at high CO. The fact that users in the 1972 fire suffered burned mouths says a lot about the nature of the fire AT ITS OUTSET.

CO levels in the first hour in mine timber fires usually produced up to 0.3% to 0.4% CO. Sunshine’s fire definitely involved polyurethane foam. Testing I supervised in England in 1967 involving polyurethane foam over mine timbers produced CO at 3% to 7%; CO2 at 13 to 15%, with oxygen less than 1%. Go figure!