CASE STUDY #11: CENTRALIA, PA UNDERGROUND COALMINE FIRE

The "Saga" of the Centralia, PA Underground Mine Fire

The following text was excerpted and modified from part of the book, Exploiting the Earth, currently in preparation by Richard Cowen.

“Coal mines were opened up in Centralia, Pennsylvania, when the railroad was built up the valley. Before long Centralia was like many other small Appalachian towns, with an economy depending entirely on the mines, and a population that consisted mainly of poorly paid, poorly educated immigrants from Ireland and Eastern Europe. The depression killed off some of the mines in the 1930s, and by the 1950s the rocks under and around Centralia contained a warren of old and new, legal and illegal workings, poorly mapped and completely unsystematic.

The crisis for Centralia began with an act of routine stupidity by the city council. The city dump was an old abandoned open-pit mine on the edge of town, just next to the cemetery. In preparation for the Memorial Day ceremonies, the council decided to "tidy up" the dump. In reality, this meant setting it on fire: it was done regularly in Centralia before Easter and before Memorial Day. It got rid of the smell and the rats for a while, and the Fire Department volunteers turned out to damp it down afterwards.

The fire was set in the normal way, on May 27, 1962. This time, however, the fire burned deep into the garbage, and was still smoking two days later, when the fire brigade doused it again. It flared again in early June, and the firemen now discovered that burning debris had fallen down an old shaft in the corner of the dump, into a labyrinth of abandoned mining tunnels. There was a clear danger that an underground coal fire would begin, if it had not already done so. A local contractor offered to dig out the burning debris for $175, but was turned down by the Pennsylvania Department of Mines, which had jurisdiction over the old workings.

By mid-July there certainly was an underground coal fire. The fire had plenty of fuel: not only the coal itself, but the old wooden gallery supports; and air reached it readily through all the old abandoned galleries. The fire soon reached 1000° F, and there was every danger that it could spread throughout all the old workings, which stretched for several square miles, including all the ground under Centralia. By 9 August, the last remaining coal mines around Centralia were closed down, because carbon monoxide levels were increasing as the fire continued.

Under instructions from the Department of Mines, a project began to dig out the burning coal. But as fast as the shovels tore into the old workings and excavated the burning material, the air rushed in and encouraged the fire. Essentially, the fire spread faster than the shovels could dig, and the project ran out of money at the end of October. Next, the Department of Mines tried pumping a slurry of water and waste rock into the galleries, to try to smother the fire. The boreholes to take this slurry, however, were drilled into the fire, rather than forming a seal around it. This project too was abandoned in mid-March 1963, with the fire still gaining. Next, a large trench was dug, to make a gap in the coal seam to contain the fire on its worst side. But by the time the shovels reached the seam, the fire was already past the planned gap: this project was abandoned in October 1963.

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In all of this there seems to have been little sense of urgency: neither lives nor valuable property seemed to be at stake. Nothing more was done, in fact, until 1967, when a new attempt was made to protect Centralia by pumping in slurry into the galleries under the edge of town. The galleries turned out to be larger and more numerous than expected, and once again, the project ran out of money before the seal was complete. By this time, there were serious questions whether the cost of stopping the fire would ever be worth it, in terms of property values: in 1967 the equation looked like $5 million to save property assessed at $500,000. But no-one said that publicly at the time.

In 1968 people in Centralia began to suffer from unexplained illnesses (headaches, nausea, drowsiness, asthma) that can now be understood in terms of gases leaking into their homes from the underground fires. Many of these mining families had continued the century-old tradition of keeping canaries, which the miners used as effective detectors of bad air. Now canaries began to die inside homes in Centralia. Test boreholes in the town gushed steam, and probes measured temperatures over 800° F, showing that the fire was well and truly within town limits.

In 1969 the Federal Bureau of Mines began a project to blow waste ash from power stations into the galleries, as a better and cheaper material than slurry for smothering the fire. A trench 800 feet long and 50 feet deep would also be dug to excavate the coal fire along one stretch. The excavators reached the fire, and inevitably it was larger and more advanced than they had anticipated. They simply filled in the excavation without cutting off the fire. The Bureau went ahead with the fly ash "barrier", even though it was clear the fire was already across the city boundary. The barrier slowed the fire, but did not put it out. The Feds essentially abandoned the problem, because they had no more solutions. Centralia was doomed.

Silence settled over town for ten years, with sporadic monitoring by government agencies. In 1979 carbon monoxide meters were provided to a few families, calibrated to set off an alarm if levels approached danger. Soon they were going off almost every day, especially in winter when windows were closed more often. On December 6, 1979, John Coddington's cellar floor was measured at 132° F, and the underground gasoline tank of his gas station was at 58°. The next day the cellar floor was at 136° and the gasoline was 64°. The gasoline was pumped out, and the gas station closed. But that was the last wake-up call for Centralia, because Coddington's gas station was right in the center of town.

There was little effort to educate the citizens about the health dangers they faced, and the citizens themselves were ill-equipped to find out for themselves. The Catholic school played down the danger to students from high levels of carbon monoxide in and around the building, and the nuns unplugged the carbon monoxide alarm. Astoundingly, hardly anything was done, either for the health hazard, or about the fire itself.

On February 14, 1981, a boy named Todd Domboski walked over to look at some smoke coming out of the ground in a neighbor's yard. Without warning the ground caved in and he found himself falling into a huge hot pit. He grabbed on to a big tree root and was hauled out within a few seconds by his 16-year old cousin. Without the tree root and the immediate help, Todd would have fallen 300 feet down an old abandoned mine shaft to his death. By coincidence this happened right across the street from a group of visiting dignitaries, so that the incident caught national attention. For the first time, inhabitants and outsiders alike realized that there was now serious personal danger to people in Centralia. The nuns began responding to the monoxide
alarm in the school, instead of ignoring it or unplugging it. New areas of subsidence affected the town, and on March 19 John Coddington was overcome by carbon monoxide in his home. He survived, but it was clear to everyone that drastic measures were now needed.

On March 30, the Federal Government and the State of Pennsylvania agreed to buy out at least some of the Centralia homeowners, and to relocate them away from danger zones. Along with that came news that there would be no more attempts to put out the fire: it would be allowed to burn itself out. In May, Centralia voters passed a non-binding referendum by a margin of two to one in favor of relocating the entire town: in other words, they wanted a complete rather than a partial buy-out, if the government was not prepared to attack the fire. But only a very local buy-out was authorized, and 27 families moved out in August and September 1981, even though they had been offered less than appraised market value for their homes.

In October 1982, monitoring showed that the fire was advancing further into town, and on its other edge, was sending steam out of the ground on both sides of State Highway 61 south of Centralia. Finally, on January 10, there was a collision as two vehicles ran through the clouds of steam into one another. The temperature under the highway was now 853° F. The highway was closed, and remained closed for five months. Once again, in August 1983, Centralia overwhelmingly passed a referendum in favor of relocation for anyone who wanted to leave.

By this time, every governmental body dealing with Centralia felt that relocation was the only viable option. In November 1983, Congress authorized $42 million for the relocation of Centralians, to be paid out of funds already allocated to Pennsylvania for cleaning up old coal mines. Although 2000 people left, some did not. The story was still evolving nine years later, when the State of Pennsylvania ordered the last 84 residents to leave within two years. "It's a grand place," said borough council president Molly Darrah, who had promised a long life for the town at its 125th birthday celebration in 1990. "If we're happy sitting on it, we should be allowed. It's a great little town.”
The dump in which the Centralia fire originated has been reclaimed. Vents, installed to release steam and gases from the burning coal seam, are now inactive as the fire has long since burned away from this area. Photograph by Melissa Nolter.

Steam rises from the ground above the active fire front in Centralia. Surface temperatures may reach or exceed 500° F. Photograph by Melissa Nolter.
Pennsylvania Route 61 has been extensively damaged above the mine fire. Steam and gases emerge from a collapsed section of pavement. Photograph by Melissa Nolter

Centralia, PA lies in Pennsylvania's Anthracite Region. All rocks, including the coals, have been extensively deformed here, primarily by a couple of generations of folding. Shown above is a photograph of a tightly folded coal seam at Shamokin, PA, north of Centralia. Dino, the 1 metre long dinosaur mascot, stands on the crest of a small anticline. The trough of the adjacent syncline and the crest of a second anticline are visible to Dino's right. The coal seam at Centralia lies along the limb of a syncline that intersects the surface near what was the town dump. When exposed coal and old mine timbers were set alight, the fire followed the coal seam down the dipping limb of the syncline.
Geology of the area around Centralia, PA (marked by red star) and partial stratigraphic column for the Anthracite Region of Pennsylvania. Taken from the 1:250,000 Geologic Map of Pennsylvania, 1980, Pennsylvania Department of Environmental Resources, Map 1.

Complete the exercises on the next page.
1. Draw a North Arrow on the geologic map of the Centralia area.

2. The distance between Centralia, PA and the small town of Lost Creek on the east edge of the map is approximately seven miles. What is the scale for this map?

3. Look at the geologic map and determine what rock unit or formation contains the coal at Centralia. What is the name and age of this unit?

4. Will the Centralia coal fire continue to burn southward until it goes underneath Ashland, PA? Why?

5. One of the products of the burning coal at Centralia is carbon monoxide (CO). What are the potential effects of breathing CO for an extended period of time? HINT: Visit http://www.inspect-ny.com/hazmat/asgasinf.htm.

6. Suppose the concentration of CO in your home is only 10 ppm. Should you worry about breathing this level of the gas for a long period of time (days or weeks)? Why?

7. Some people have suggested that after the Centralia coal seam burns itself out, it will be safe to rebuild new homes at the original site of the town. What do you think of this idea? Why?

8. Some people have suggested that the coal seam at Centralia would have never caught fire if it have been mined by open-pit methods. Do you think they are correct and if so, what impacts would this type of mining have had on the area?