News

Burning Records Caused Fumes After Derailment

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A new study shows that hazardous materials may come in harmless-looking packages and that toxic chemicals are not always to blame for environmental accidents.

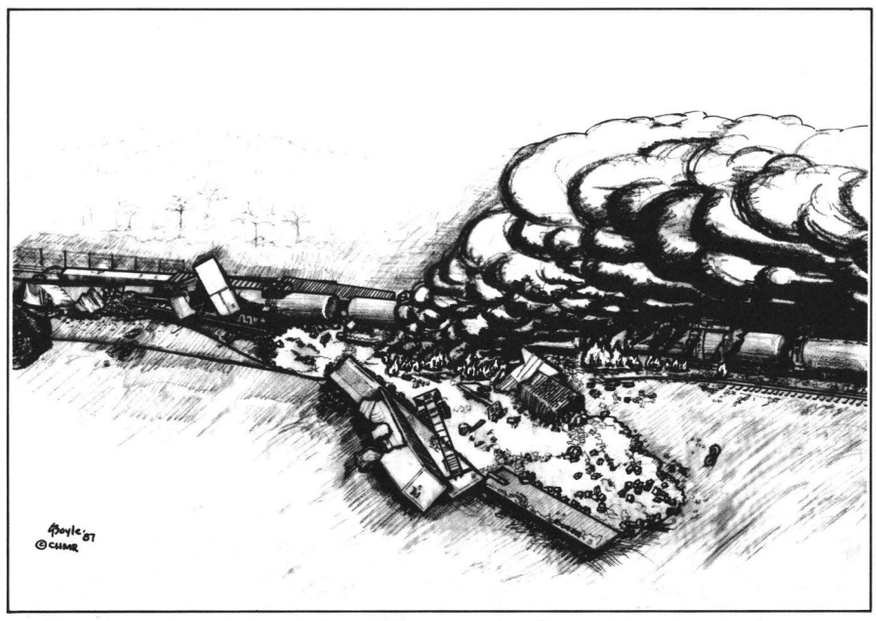
A Conrail train derailment April 11, 1987, in Bloomfield, Pa., led to a fire, the spill of phosphorus oxychloride, and a plume of smoke and hydrogen chloride gas that acutely affected nearby residents. An investigation of the accident just completed by the Center for Hazardous Materials Research (CHMR) at the University of Pittsburgh (Pittsburgh, Pa.) found that the fumes were entirely the result of burning phonograph records. In addition, calculations based on a computer model of gas emission and dispersion showed that community exposure was probably below dangerous levels throughout the fire.

CHMR did the study at the request of Bloomfield's State Representative Frank Pistella. Residents had complained of respiratory irritation soon after the accident and were concerned about possible long-term effects. Several suits have been filed against Conrail because of the mishap.

The derailment occured when two Conrail trains moving in opposite directions sideswiped each other on a curved section of track. Many cars from both trains were derailed, but several from the westbound train spilled their contents of paper, peanuts, and phonograph records down a hillside; the cargo quickly caught fire (see figure). In addition, ~100 gallons (~378.5 L) of phosphorus oxychloride, a toxic liquid used for chlorination, leaked out of a tank car in the eastbound train. This chemical reacts with water in air to form hydrogen chloride gas.

According to the study, emergency response personnel arrived quickly and identified the leaking tank car. By looking at writing on other cars on the eastbound train, they identified potentially greater danger: two tank cars carrying metallic sodium. Elemental sodium is a powerful reducing agent. The reaction of sodium with water is violent, and the hydrogen gas that it produces can explode easily. If any sodium had leaked, water used to fight the burning cargo might have led to a larger disaster.

Other cars close to the fire carried dichlorflouromethane and other explosive or toxic substances. All of these conditions led emergency response officials to quickly evacuate more than 16,000 people.



Sketch taken from photographs of April 11, 1987, derailment in Bloomfield, Pa. Two Conrail trains going in opposite directions sideswiped each other. Boxcar contents, including plastic phonograph records, peanuts, and paper, caught fire. (Drawing courtesy of the Center for Hazardous Materials Research, University of Pittsburgh, Pittsburgh, Pa.)

After they determined that none of the sodium had leaked, workers brought the fire under control and plugged the phosphorus oxychloride leak with a tennis ball. The next day, the liquid remaining in the tank car was pumped into trucks and taken away, and the crisis was over. The CHMR study found that most of the chemical that had leaked out was effectively neutralized by reacting with moisture in air and soil and with limestone ballast near the tracks, but that was not known at the time of the accident.

Initial reports of irritating fumes were attributed to the phosphorus oxychloride, but the study identified polyvinyl chloride (PVC) in the records as the source of the gas. The primary combustion products of PVC are carbon dioxide, carbon monoxide, and hydrogen chloride. CHMR used a chemical/meteorological computer model that it described as conservative to estimate the distribution and concentration of the gas. The calculations indicated that residents closest to the fire, about 100 m from the site, were exposed to a maximum dose of 21 mg/m^3, unpleasant but unlikely to cause permanent damage, even to people with minor respiratory diseases. Beyond 300 m from the fire, maximum concentrations were less than 7 mg/m^3, considered to be an upper limit for safe exposure by the American Conference of Governmental Industrial Hygienists, according to the model.

The actual cause of the irritating gas was a suprise to many, suggests Edgar Berkey, president of CHMR, because of the common conception that environmental disasters are caused by toxic, dangerous substances. "It's ironic because people consider hazardous materials to be unfamiliar, threatening chemicals, but under the right circumstances, many benign things can be hazardous," he said.—*WWM*

Predicting Snow Depth With People

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Meteorologists are using a technique based on human observations to calibrate a Doppler radar method of predicting how much snow will fall in major storms.

In a new program sponsored by the National Oceanic and Atmospheric Administration (NOAA), several dozen volunteers will record information about the shape and size of snowflakes and measure the depth of snowfalls in the Denver, Colo., area. Handheld microscopes will allow them to determine the type of snow falling as heavy storms develop. Because large dendritic snow crystals are usually associated with deeper snow, while crystals laden with frozen cloud water droplets called graupel are characteristic of lesser accumulations, the morphology of the crystals can be used to guess where more snow will fall.

The snowflake data will be compared with Doppler radar observations of the storms, and NOAA scientists will try to identify characteristic signals of different kinds of snow. "If, by using the radar, we can determine what kind of snow is falling and at what rate, we can better predict the accumulation," said John McGinley, head of NOAA's Program for Regional Observing and Forecasting Services in Boulder, Colo. "During snowstorms, the radar typically shows banding patterns a few miles wide," he said. "We'll try to determine whether a given pattern can be related to where snow is accumulating at the fastest rate." Timely, accurate snowfall forecasts would be of great value to schools, utilities, and businesses.—*WWM*