Elk River Chemical Spill Health Effects

Findings of Emergency Department Record Review

April 2014

Collaborative Investigation by the West Virginia Bureau for Public Health (WVBPH) and the Agency for Toxic Substances Disease Registry (ATSDR)

Background

On January 9, 2014, approximately 10,000 gallons of 4-methylcyclohexanemethanol (MCHM) leaked into the Elk River 1 ½ miles upstream from the water intake for West Virginia American Water (WVAW) in Charleston, West Virginia. WVAW supplies water to about 300,000 people living in 100,000 households in 9 counties in West Virginia.

At 6 PM on January 9, WVAW issued a 'do not use' order. West Virginia Poison Center started receiving phone calls from people reporting rashes, nausea, vomiting, diarrhea, and other symptoms. Emergency Departments (EDs) started seeing an increase in visits, and the WVBPH began counting the number of ED visits on January 10.

MCHM is a chemical that can form bubbles like soap to help separate coal from other rocks and minerals. This process reduces air pollution caused by burning coal. Few studies on MCHM exist and most have been conducted on animals. MCHM has been tested on rats and guinea pigs. Exposure to liquid MCHM can cause skin and eye irritation, vomiting, and diarrhea. MCHM vapors in the air can also irritate the eyes, nose, throat, and lungs. When laboratory animals are exposed at high doses, MCHM has been shown to cause problems with the liver, kidneys, blood, and the brain.

On January 21, 2014, state officials learned that another material was part of the chemical release that occurred on January 9, 2014. A smaller amount (7% by volume) of a second chemical -- propylene glycol phenyl ether (PPH) -- was in the same tank and entered the water system at the same time as the MCHM. Health effects of PPH are similar to those caused by MCHM.

Public Health Officials at WVBPH wanted to understand why people were going to the ED and whether any of the illness reported was serious. WVBPH asked epidemiologists at Agency for Toxic Substances and Disease Registry (ATSDR) to help with the investigation. An epidemiologist is a public health scientist who tries to understand how and why illness occurs so illness can be stopped.

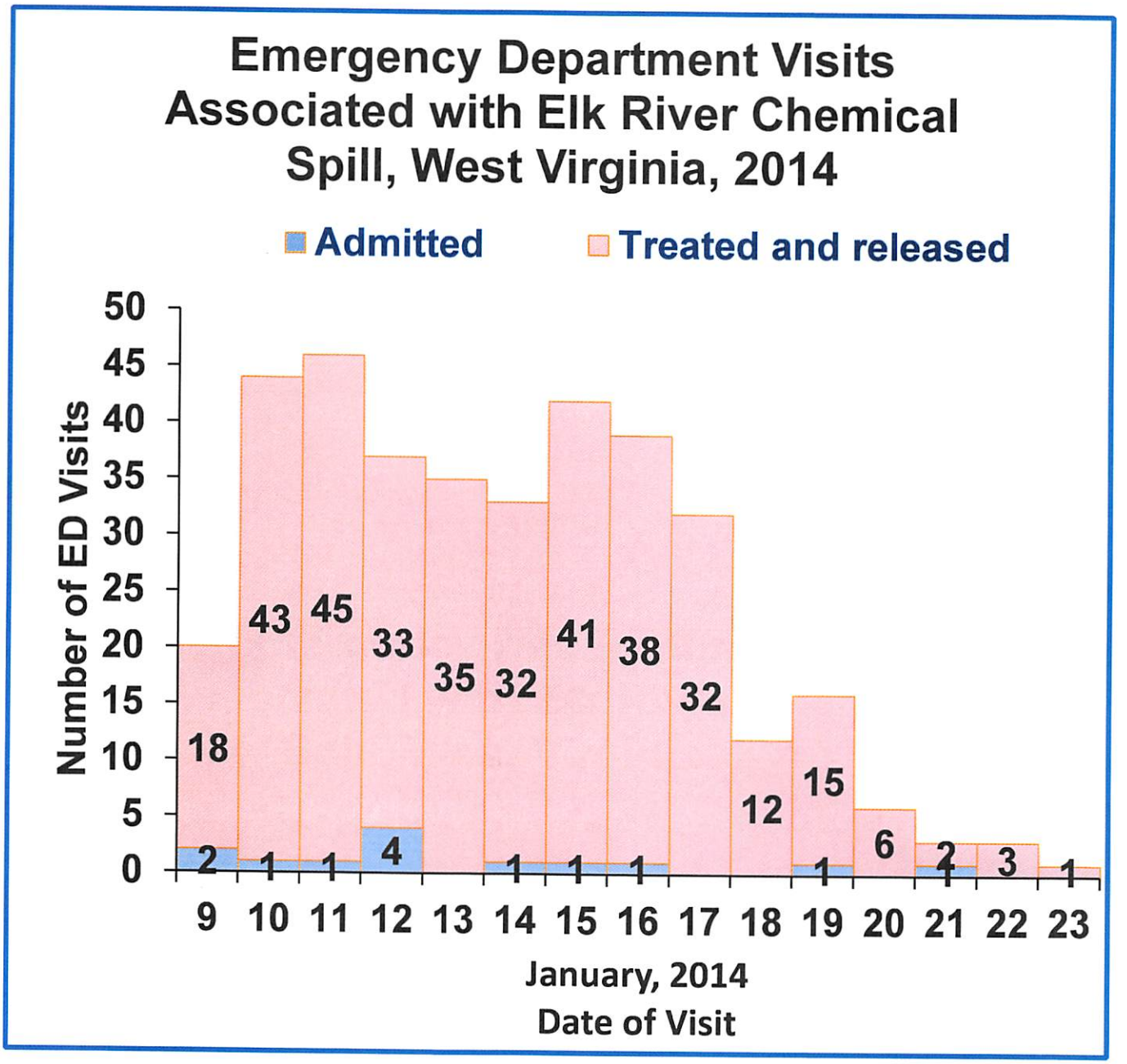
How the investigation was done

Epidemiologists from WVBPH and ATSDR put together a list of public health questions they wanted to answer. They wanted to know the kinds of symptoms people had and how they were exposed to the water. They also wanted to know what kind of treatment patients received and whether they had to be hospitalized. Epidemiologists listed all these questions on a form.

Hospitals were asked to release records for people who went to the ED between January 9 and 23, 2014, and reported illness related to the chemical spill. A total of 584 records were released to WVBPH for review. Using the form that included the public health questions, teams of WVBPH and ATSDR epidemiologists and nurses looked through each record to find answers to the questions.

What the investigation found:

- 369 records were included in the final analysis; these records were for patients who had symptoms and reported they were exposed to the water
- 215 records were ***not*** included in the final analysis because:
    - 41 people left the ED without being seen by a physician
    - 110 ED records did not record exposure to the contaminated water
    - 45 persons were given a diagnosis (e.g., influenza, strep throat, scabies, shingles, etc.) that was considered a more likely explanation for their illness
    - 3 persons had no symptoms of illness recorded in the record
    - 16 persons were duplicates, visiting the ED for the second or third time
- The number of ED visits went down during the second week after the chemical spill. In the graph below, the date of visit is shown on the 'X' axis along the bottom of the graph. The number of visits is shown on the 'Y' axis along the left side of the graph. Persons admitted to the hospital are shown in blue and persons treated and released are shown in pink.



- 13 (3.5%) of 369 persons were hospitalized. People who were admitted had chronic illnesses such as kidney, liver or lung disease.

- 356 (96.5%) of 369 persons were treated in the ED and released. Some treatments included IV fluids and/or medications for nausea or itching.

- The most common way people were exposed to the water was bathing, showering, washing hands, or other skin contact. (See Table 1.)

Table 1: Exposures to Water Reported by ED Patients, Elk River Chemical Spill, Charleston, West Virginia, January 2014

Route*	Number	(%)
Bathing, showering, other skin contact	194	(52.6)
Eating, drinking, swallowing	162	(43.9)
Breathing mist or vapor	54	(14.6)

*Patients could have more than one route of exposure recorded in the ED record.

- The most common symptoms reported were nausea, rash, vomiting, abdominal pain, and diarrhea. (See Table 2.)

Table 2: Most Commonly Reported Symptoms in ED Patients, Elk River Chemical Spill, Charleston, West Virginia, January 2014

Symptom*	Number	(%)
Nausea	141	(37.9)
Rash	105	(28.5)
Vomiting	104	(28.2)
Abdominal pain	90	(24.4)
Diarrhea	90	(24.4)
Headache	81	(21.9)
Itching	73	(19.8)
Sore throat	55	(14.9)
Eye pain	54	(14.6)
Cough	47	(12.7)

* Patients could have more than one symptom

- Results of laboratory tests done in the ED did not indicate any people had new kidney or liver damage.

- People who reported that they swallowed contaminated water or food were more likely to report gastrointestinal symptoms such as nausea, vomiting, and diarrhea. People who reported skin contact with contaminated water were more likely to report redness or itching of the skin.

What does this information mean?

- Symptoms associated with exposure to low levels of MCHM in this public water system appeared to be mild and resolved with no or minimal treatment, such as IV fluids after episodes of vomiting or diarrhea and/or medications to relieve nausea or itching.

- Most people who reported illness associated with the Elk River chemical spill were treated for their symptoms and released.

- Common symptoms included nausea, vomiting, diarrhea, skin rash, itching, headache, sore throat, and cough.

- These symptoms are consistent with known health effects of MCHM and with data reported by West Virginia Poison Center. It was possible that the symptoms reported to be caused by exposure to MCHM could have been caused by other mild clinical illness such as colds or flu or other viral infections.

- There are no laboratory tests or combination of signs and symptoms that can reliably distinguish mild illness caused by exposure to MCHM from mild illness.

- These data cannot 'prove' that MCHM caused the reported symptoms; however, these data are consistent with what is known about MCHM from animal studies.

Next Steps

- WVBPH collaborated with the Centers for Disease Control and Prevention (CDC) on a household survey known as a 'Community Assessment for Public Health Emergency Response' (CASPER) to measure the health, economic, and other impact of this incident on the community as a whole. The CASPER was conducted April 8-10, 2014, and findings will be released after analysis is complete. The number of persons seen in the ED (369) is a small proportion (0.12%) of the estimated 300,000 persons affected by the chemical spill. This household survey will be helpful in expanding the understanding of the impact on the entire population.

- WVBPH epidemiologists will use the information from the ED medical record review and the CASPER to make recommendations to strengthen emergency response in the future.

- Epidemiologists will continue to evaluate this data and finalize a scientific paper. Writing and talking about scientific findings will help everyone better understand all the issues surrounding this investigation.