

Chemical Toxicity and Health Hazards

SAFE SCI: Be Protected!

Dr. Ken Roy*

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A safety incident happened at a high school in early September.

It seemed a chemistry teacher was in the chemical storeroom and noticed a bottle of Barium oxide—BaO powder was cracked. The teacher started to move it to a rubber bottle carrier to contain it in case the crack should fail. Unfortunately, the crack failed when the bottle was picked up—no injuries, but BaO powder went



on the floor, a few shelves, making a huge mess. The teacher planned on covering it with kitty litter and sweeping it up and putting it into a container for hazardous waste pickup.” The supervisor seeing the chemical powder on the floor told the teacher that it should not be touched and a hazmat pickup company was going to immediately be called. The company came the next day, after school dismissal, and the powder was cleaned up with a HEPA vacuum in 45 minutes. The manifest paperwork was secured and all was back to normal—to the tune of about several thousand dollars.

The administration questioned why an outside contractor had to come in and pick up the chemical powder spilled instead of the science teacher. The SDS said nitrile gloves, a gown, chemical splash goggles, and a mask were needed.

The TLV* of BaO is 0.5 mg/m³. The supervisor was concerned and explained that the teacher cleaning it up would have within a few seconds exceeded TLV level. Plus, there was broken glass all over the floor, etc.

Remember that the threshold limit value (TLV) of a chemical substance is believed to be a level to which a worker can be exposed day after day for a working lifetime without adverse effects. TLVs issued by the ACGIH (American Conference of Governmental Industrial Hygienists (ACGIH®)) are the most widely accepted occupational



exposure limits both in the United States and most other countries.

So in the end, no injuries, the mess was cleaned up, the bill was paid. But it's scary that the teacher figured, “oops, I made a mess, I'll just clean it up.”

Bottomline is – train science teachers on a procedure to research the toxicity before deciding to just sweep up a spill!

Health Hazards vs. Toxicity Of Chemicals

Laboratories basically have three types of hazards – biological, chemical and physical. Health effects for hazardous chemical exposure are often incomplete.

Two terms often used interchangeably for health effects are toxicity and hazard. However, these words are quite different. **Toxicity** is the ability of a chemical substance to cause harm. **Hazard** is the likelihood that a material will cause harm under the conditions of use. Thus, with proper handling, even highly toxic chemicals can be used safely. Conversely, less toxic chemicals can be extremely hazardous if handled improperly.



The actual chemical health risk is dependent two factors - the toxicity and the actual exposure. No matter how toxic the material may

be, there normally is little risk involved unless it enters the body. Assessing a chemical's toxicity and potential routes of entry can help determine protective measures that need to be taken. For additional information about toxicity and actual areas of entry in the body, check out “Chemical Safety - Hazard Communication” at <https://ehs.princeton.edu/book/export/html/60>.

WHERE TO GET THE TOXICITY INFO?

The first source for toxicity information is

in **Section 2 – Hazards Identification** and **Section 11 – Toxicological Information in the Safety Data Sheet** prepared for the chemical which has been spilled. If that is not available, there are other Internet sites which could be accessed for the toxicological information such as The National Center for Biotechnology Information or NCBI homepage at the U.S. National Library of Medicine (<https://pubchem.ncbi.nlm.nih.gov>). This is a great reference site to quickly find chemical information from authoritative sources.

IN THE END!

The message is when there is a chemical spill, make sure teachers are trained to know what they are dealing with toxicity-wise BEFORE taking action to have it cleaned up!

References:

- Barium oxide, BaO, is a white hygroscopic non-flammable compound. It has a cubic structure and is used in cathode ray tubes, crown glass, and catalysts. It is harmful to human skin and if swallowed in large quantity causes irritation. Excessive quantities of barium oxide may lead to death
—Wikipedia

•*TLV* — Threshold Limit Value*

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