



ENVIRONMENT, SAFETY & HEALTH

# SAFETY & HEALTH BULLETIN

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# Safe Management of Shock-Sensitive Chemicals

## What Are Shock- Sensitive Chemicals?

Shock sensitive chemicals may explode with movement, friction or heat. These chemicals have the potential to undergo a rapid reaction that may be violent enough to produce an explosive reaction. Some chemicals are shock sensitive by nature. Others become shock sensitive through drying, decomposition, or slow reactions with oxygen, nitrogen, or the container. Some chemicals that are or may become shock-sensitive will have this hazard noted on their MSDS.

## What Can Happen?

Between 1980 and 2002 there were 167 accidents nationally involving shock-sensitive chemicals that killed 108 people.

- A technician used a pair of channel lock pliers to twist the rusty lid off a small, dark green, bottle to characterize the unknown chemicals inside. There was an immediate explosion and glass shards embedded in a nearby chair. Analysis showed that over time the picric acid in the bottle combined with the metal lid to form shock-sensitive metal picrates that lodged in the threads in the neck of the bottle.
- A technician was remotely handling an old, opened can of anesthesia grade ethyl ether to add more ethyl alcohol as an inhibitor. Enough inhibitor was thought to be present, so the ether was not considered hazardous. The liquid level in the small metal can was low so the technician tilted the can to pipette out an aliquot for the peroxide test strip. As the technician turned the can upright, an immediate explosion and fireball filled the fume hood. The slight handling of the can was enough of a mechanical shock to cause peroxide crystals in the top portion of the can to explode.

## Tips to Control the Hazards

**Respect the chemical and the dangers it presents:**

- If you find shock-sensitive chemicals that are outdated or suspect, immediately contact your supervisor and your organization's ES&H or Hazardous Materials department. DO NOT TOUCH OR MOVE SUSPECT CHEMICALS.
- When working with shock-sensitive chemicals:
  - Closely follow approved work procedures and hazard controls.
  - Study the chemical's MSDS and label. Look for information about the chemical's reactivity, stability and hazards. If there is an NFPA diamond, look for a 2, 3, or 4 in the yellow reactivity section. Also use information from other chemical safety resources.
  - Check with your facility's chemical safety personnel.
  - Use appropriate personal protective equipment (PPE).
  - Protect the chemical from shock, friction or heating.
- Make sure that you have access to the MSDS, the chemical is labeled as required by your facility, and the container is entered into your facility's hazardous chemical management program.

## Strategies to Improve the Management of Shock-Sensitive Chemicals

The two main types of shock-sensitive chemicals within the DOE complex are peroxide formers and peroxidizable organic chemicals. The chemistry and management of these and other shock-sensitive chemicals is not well understood. Effective management of these chemicals is a challenge because: 1) there is no absolute answer as to what should or should not be defined as being shock-sensitive, 2) detection methods for potentially explosive concentration levels are not definitive and 3) procedures for removing peroxides are not always effective.

Safe and healthful working environments at facilities that use or store shock-sensitive chemicals can be enhanced by an effective life-cycle management system that includes the following basic elements and written guidance:

- **Acquisition control:** 1) Prior to procurement – follow internal criteria to identify shock-sensitive chemicals; ensure that facilities are rated for explosives work, receivers are authorized and trained for work with shock-sensitive chemicals, and any required authorizations are in place; and determine the disposal path; 2) At procurement – limit to the quantity that can be used before shelf-life is reached.
- **MSDS and Labels:** Incorporate MSDS and label information about hazards and safe handling into work procedures. Add labeling that includes the date received, date opened, responsible person, expiration date, MSDS reference or other appropriate data.
- **Usage:** Implement procedures that define the parameters for testing and safe use of shock-sensitive chemicals.
- **Storage:** Adhere to the manufacturer's recommendations, noting any precautions on the MSDS and label. Ensure that systems are implemented for inspecting, testing and solvating the chemicals.
- **Tracking:** Maintain a current shock-sensitive chemical inventory that tracks locations, inspection dates, etc., from procurement through disposal. Include chemicals created on-site and those not acquired through the acquisition process. Provide for notification if threshold quantities are exceeded.
- **Training:** Ensure that employees are adequately trained on the hazards, safe working methods, and emergency procedures for shock-sensitive chemicals.
- **Disposal:** Establish criteria and procedures for the safe and timely disposal of shock-sensitive chemicals.
- **Review and Verification:** Develop a system to evaluate and verify that the program for managing shock-sensitive chemicals is effective.

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