



Identifying Chemical Reactivity Hazards: Preliminary Screening Method

The Environmental Protection Agency (EPA) is issuing this *Alert* as part of its ongoing effort to protect human health and the environment by preventing chemical accidents. EPA is striving to learn the causes and contributing factors associated with chemical accidents and to prevent their recurrence. Major chemical accidents cannot be prevented solely through regulatory requirements. Rather, understanding the fundamental root causes, widely disseminating the lessons learned, and integrating these lessons learned into safe operations are also required. EPA publishes *Alerts* to increase awareness of possible hazards. It is important that facilities, SERCs, LEPCs, emergency responders, and others review this information and consider whether additional action is needed to address the hazards.

Problem

Lack of awareness of the reactive chemical hazards in a facility results in a higher risk of hazardous uncontrolled chemical reactions.

The current industry consensus defines chemical reactivity hazard as a situation where an uncontrolled chemical reaction could result directly or indirectly in serious harm to people, property, or the environment.

Many materials used in industrial facilities can pose chemical reactivity hazards. Reactivity hazards may not be as easy to identify as other hazards such as toxicity or corrosivity. Your facility is at a higher risk of having an uncontrolled release if you don't identify all the existing chemical reactivity hazards.

The purpose of this alert is to introduce small- and medium-sized facilities to a simple method developed by the Center for Chemical Process Safety (CCPS), *Essential Practices for Managing Chemical Reactivity Hazards*, to screen facilities for chemical reactivity hazards. The CCPS preliminary screening method is a tool to help you identify where

chemical reactivity hazards are likely to occur in your facility and may be applicable to a wide range of activities including warehousing, repackaging, blending, mixing, and processing.

Understanding the Hazard

The first step in managing chemical reactivity hazards is identifying those facility operations and chemicals that represent a potential chemical reactivity hazard.

The preliminary screening method is based on a series of twelve "yes-or-no" questions to help you determine if there are chemical reactivity hazards in your facility. These questions may be answered by one person, but you may be able to do a more thorough screening by setting up a team composed of people with diverse expertise. Whenever possible, include people representing technical, production, health and safety, and the purchasing perspectives. In any case, if you or your team are not certain about the right answer to any question, you should seek expert advice.

Chemical Safety

ALERT

If you answer questions 1 to 4 with a definite NO, then you are not likely to have chemical reactivity hazards at your facility.

Q1. Is intentional chemistry performed at your facility?

Intentional chemistry means the processing of substances such that an intended chemical reaction takes place.

- ◆ Yes? → Go to Question 5
- ◆ No? → Answer Question 2

Q2. Is there any mixing or combining of different substances?

Consider a wide range of activities, from large scale formulations to individual procedures when answering this question.

- ◆ Yes? → Go to Question 6
- ◆ No? → Answer Question 3

Q3. Does any other physical processing of substances occur at your facility?

Physical processing means any modification that results in a product that is physically, but not chemically, different from the original material.

- ◆ Yes? → Go to Question 6
- ◆ No? → Answer Question 4

Q4. Are there any hazardous substances stored or handled at your facility?

Hazardous substances include materials for which material safety data sheets are required as well as chemical intermediates and by-products.

- ◆ Yes? → Go to Question 7
- ◆ No? → **You are not likely to have any chemical reactivity hazards at your facility!**

With the exception of question 5, a positive answer to any of the following questions means that chemical reactivity hazards do exist at your facility and you have to address them.

Q5. Is combustion with air the only chemistry intended at your facility?

Burning of ordinary flammable and combustible material is not considered a chemical reactivity hazard.

- ◆ Yes? → Go back to Question 2
- ◆ No? → Chemical Reactivity is expected to occur

Q6. Is any heat generated during the mixing or physical processing of substances?

Heat can be generated by heat of solution, heat of absorption, mechanical energy, or other physical heat effects.

- ◆ Yes? → **Address Reactive Chemical Hazard!**
- ◆ No? → Go to next Question

If your facility stores, handles, repackages, produces or uses any hazardous materials, you should give special consideration to the following set of questions.

Q7. Is any substance identified as spontaneously combustible?

“Spontaneously combustible” refers to substances that will readily react with the oxygen in the atmosphere, igniting and burning even without an ignition source.

- ◆ Yes? → **Address Reactive Chemical Hazard!**
- ◆ No? → Go to next Question

Q8. Is any substance identified as peroxide forming?

“Peroxide forming” refers to substances that will react with the oxygen in the atmosphere to form unstable peroxides, which might decompose and explode if concentrated.

- ◆ Yes? → **Address Reactive Chemical Hazard!**
- ◆ No? → Go to next Question

Q9. Is any substance identified as water reactive?

“Water reactive” refers to substances that will chemically react with water, particularly at normal ambient conditions.

- ◆ Yes? → **Address Reactive Chemical Hazard!**
- ◆ No? → Go to next Question

Q10. Is any substance identified as an oxidizer?

'Oxidizers' are materials that readily react to promote or initiate combustion of combustible material.

◆ Yes? → Address Reactive Chemical Hazard!

◆ No? → Go to next Question

Q11. Is any substance identified as self-reactive?

"Self-reactive" refers to substances that self react (e.g., polymerize, decompose, or rearrange), often with accelerated or explosive rapidity.

◆ Yes? → Address Reactive Chemical Hazard!

◆ No? → Go to next Question

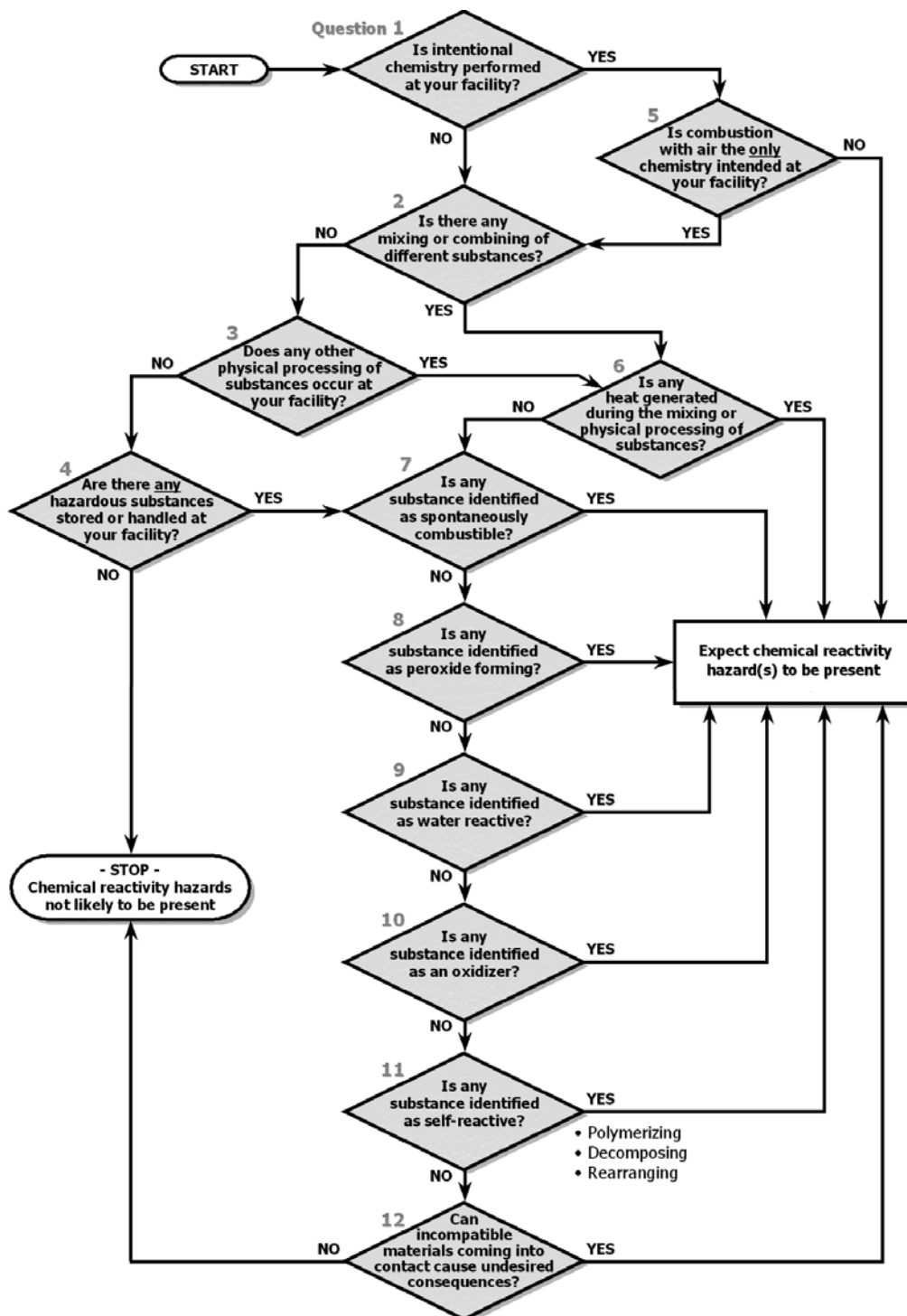


Figure 1. Summary flowchart for preliminary screening for chemical reactivity hazards

Q12. Can incompatible materials coming into contact with each other cause undesired consequences?

'Incompatible materials' are materials that when accidentally mixed or brought into contact with each other will result in an uncontrolled chemical reaction.

- ◆ Yes? → **Address Reactive Chemical Hazard!**
- ◆ No? → Chemical reactivity hazards are unlikely to be present. You completed the Preliminary screening method.

Figure 1, reproduced from *Essential Practices for Managing Chemical Reactivity Hazards*, shows a graphic presentation of the preliminary screening method [Copyright 2003 by the American Institute of Chemical Engineers, and reproduced by permission of AIChE].

Controlling the Hazard

Chemical reactivity hazards can be controlled by incorporating control techniques into the facility's hazard management system.

If you identified chemical reactivity hazards in your facility, a hazard management system can properly address them. Most likely you already have a hazard management system in place to address other hazards and can incorporate reactive chemical hazards into the existing programs. Regulatory process safety and risk management systems such as the Occupational Safety and Health Administration (OSHA) Process Safety Management Standard, and EPA's Risk Management Program (RMP) incorporate elements that are applicable to the management of reactive chemicals and can be used as a basis.

Note that EPA's Chemical Accident Prevention regulations at 40 CFR part 68 do not cover reactive chemicals as a group. Those regulations apply only to facilities having more than a threshold quantity of a

chemical listed at 68.130 of the regulations. However, EPA believes that facilities have a general duty to address significant reactive chemical hazards under the general duty clause of section 112(r)(1) of the Clean Air Act.

Information Resources

Partnership To Provide Information

As mentioned above, this alert is intended to help facilities identify chemical reactivity hazards and become familiar with the preliminary screening method developed by CCPS. You can find a detailed explanation of this method and related management practices in CCPS' book *Essential Practices for Managing Chemical Reactivity Hazards*.

In order to make this valuable tool accessible to all facilities, EPA, OSHA, CCPS, the American Chemistry Council (ACC), the Synthetic Organic Chemical Manufacturers Association (SOCMA) and Knovel Corporation have contributed resources to make CCPS' *Essential Practices for Managing Chemical Reactivity Hazards* available for free downloading at the following web page: <http://knovel.com>.

Chemical Safety Resources

For additional information on CCPS, please visit their website at: <http://www.aiche.org/ccps/>

The U.S. Chemical Safety and Hazard Investigation Board (CSB) is an independent federal agency whose mission is to prevent industrial chemical accidents and save lives. For more information on the CSB, visit their website at: <http://www.chemsafety.gov/>

For additional information on OSHA, visit their website at: <http://www.osha.gov>

For More Information:

**Contact EPA's Emergency Planning and
Community Right-to-Know Hotline
(800) 424-9346 or (703) 412-9810
TDD (800) 553-7672**

Monday-Friday, 9 AM to 6 PM, Eastern Time



**Visit the Emergency Prevention, Preparedness, and
Response website:
<http://www.epa.gov/emergencies>**

NOTICE:

The statements in this document are intended solely as guidance. This document does not substitute for or change any applicable statutory provisions or regulations, nor is it a regulation itself. The guidance it provides may not be appropriate for every situation.