

CSB Reactive Hazards Study

The CSB is replicating its 2002 Reactive Hazards Study. As part of this process, the CSB will be submitting the below survey to OMB for review. The public will have the opportunity to submit comments to reactives@csb.gov during the time frame specified in the Federal Register notice.

Survey of Industry Practices

BACKGROUND

The United States Chemical Safety and Hazard Investigation Board (CSB) is surveying relevant industry organizations with the goal of examining industry practices on the topic of reactive hazard safety and management. Your company/facility was randomly selected and has subsequently agreed to participate in a survey of industry practices involving the evaluation and management of risks associated with storing, handling, and processing chemicals prone to reactivity.

CSB is an independent federal agency with the mission to investigate, and promote the prevention of, major chemical incidents at industrial facilities. The CSB is a scientific investigation organization; it is not an enforcement or regulatory body. The CSB's principal roles are to investigate accidents at fixed facilities, determine the conditions and circumstances that led up to an event, identify the causes, issue safety recommendations, study chemical safety issues, and evaluate the effectiveness of governmental policies and actions involved with industrial chemical safety.

Occasionally in the course of conducting incident investigations, the CSB is alerted to significant safety problems that are beyond the scope of any one particular investigation. As a result, the CSB conducts a hazard investigation or safety study to better understand the nature and causes of more pervasive and systemic safety problems. As an update to the 2002 report, ["Improving Reactive Hazard Management,"](#) the CSB has contracted with the Federal Research Division (FRD), a research and analysis unit within the Library of Congress, to conduct a new hazard investigation of reactive chemical process safety. FRD is executing a number of different research tasks as part of the new investigation, including this survey. The FRD team will use the responses to this survey to examine industry practices associated with the prevention of reactive chemical incidents.

OVERVIEW OF REACTIVE CHEMICAL HAZARD INVESTIGATION

This updated reactive chemical hazard investigation (1) reviews and evaluates historical trends involving reactive chemical incidents, and (2) examines industry practices associated with the prevention of reactive chemical incidents.

The objectives for the new hazard investigation include:

1. Determining the historical trends and impacts of recent reactive chemical incidents;
2. Examining how industry, OSHA, and EPA currently address reactive chemical hazards;
3. Examining practices at large, medium, and small companies with regard to reactive chemical safety, in-house reactivity research, testing, and process engineering; and
4. Developing recommendations for reducing the number and severity of reactive chemical incidents.

The recommendations from the hazard investigation may take a variety of forms, and these would not necessarily be recommendations for regulatory action. The CSB has, in the course of previous investigations, urged industry associations and companies to address numerous safety concerns through a variety of nonregulatory actions.

The Federal Research Division (FRD) of the Library of Congress is contracted by the CSB to, among myriad other research tasks, conduct a survey of industry practices involving hazardous reactive chemicals and reactive chemical incidents. The following definitions may be helpful for you in understanding the scope of the survey.

Reactive Hazard

The CSB is aware that industry uses a variety of ways to classify/evaluate the chemical reactivity of a substance; however, for this survey, the CSB broadly defines a reactive chemical hazard as:

*A situation with the **potential** for an uncontrolled chemical reaction that can result in harm to people, property, or the environment, through the release of heat, energy, or hazardous byproducts.*

For the purposes of this survey, the CSB classifies a **reactive chemical** as any pure substance or mixture that has the capability/potential to create a reactive chemical incident.

Reactive Chemical Incident

A sudden event involving a reactive hazard with abrupt and significant increases in temperature, pressure, and/or gas evolution that has the potential to cause, or has caused, serious harm to people, property, or the environment.

SURVEY INSTRUCTIONS

Your company/facility has agreed to participate in a survey of industry practices involving the evaluation and management of risks associated with storing, handling, and processing chemicals prone to reactivity. The purpose of the survey is to identify the range of practices in place in the industry to deal with hazardous reactive chemicals. This is not a best-practices-only survey, and we are NOT looking for weakness in any specific company/facility activities. Rather, we are surveying 15 selected companies (representing a spectrum of the industry) that handle reactive chemicals simply to see what practices are being routinely employed—so, your thorough and timely response is appreciated!

We request that someone in your company/facility who is knowledgeable about reactive hazard management practices complete this survey. Some of the questions may deal with activities conducted by your company at a corporate or central location. Other questions will require the respondent to focus on activities performed at a plant. The survey is a combination of multiple-choice, yes/no, and short-answer questions. The time it takes to complete the survey will depend upon the complexity of your reactive chemical hazard management practices/program and your knowledge of the survey topics. The survey has been approved by the Office of Management and Budget and has met the conditions of the Paperwork Reduction Act. Reasonably, it can be completed in [INSERT TIME HERE] hours. However, the time can be shortened somewhat if you submit your company's/facility's reactive chemical hazard management written program; the survey could take longer if the survey respondent is not familiar with the survey issues or does not have access to people who do.

Please return the completed survey and any accompanying documents to us by [INSERT DATE WHEN AVAILABLE]. We will contact you one week before the survey results are due to see if you have any questions and to check your progress. Please feel free to contact us at [INSERT EMAIL AND PHONE NUMBER] if you have questions about the survey.

SURVEY QUESTIONS

Survey Respondent Information

- a. Company Name:
- b. Division/Facility:
- c. Number of Employees at the Company and Facility (check only ONE in each column):

Company	Facility
<input type="checkbox"/> ≤50	<input type="checkbox"/> ≤50
<input type="checkbox"/> 51–100	<input type="checkbox"/> 51–100
<input type="checkbox"/> 101–500	<input type="checkbox"/> 101–500
<input type="checkbox"/> 501–999	<input type="checkbox"/> 501–999
<input type="checkbox"/> 1,000–2,999	<input type="checkbox"/> 1,000–2,999
<input type="checkbox"/> 3,000–4,999	<input type="checkbox"/> 3,000–4,999
<input type="checkbox"/> 5,000–9,999	<input type="checkbox"/> 5,000–9,999
<input type="checkbox"/> ≥10,000	<input type="checkbox"/> ≥10,000

- d. Respondent's Name:
- e. Respondent's Job Title:
- f. Respondent's Role in Process Safety (check only ONE):
- Process Safety Management (PSM) Coordinator
 - PSM Specialist
 - Engineer
 - Chemist
 - Management
 - Other (please specify): _____
- g. Street Mailing Address:
- h. Daytime Telephone Number:
- i. Email Address:

Facility Characteristics

For the following questions, CSB classifies a reactive chemical as any pure substance or mixture that has the capability to create a reactive chemical incident. If uncertain, please use the incompatibility matrix from the Chemical Reactivity Worksheet.¹

1. Which of the following characterizes the number of reactive chemicals at your facility?
Check only ONE answer.
- Seldom are used
 - A few (2–5) reactive chemicals are used
 - Some (6–10) reactive chemicals are used

¹ If uncertain, use the matrices in AiChE's Chemical Reactivity Worksheet to determine which chemicals have the potential to create a reactive hazard incident. For more information on the Chemical Reactivity Worksheet and how to install the program, see: <https://www.aiche.org/ccps/resources/chemical-reactivity-worksheet>.

- Many (>10) reactive chemicals are used
2. Which of the following characterize(s) the level of hazard associated with the reactive chemicals used at your facility? Check ALL that apply.
- None are used
 - Minimally reactive chemicals are used
 - Moderately reactive chemicals are used
 - Highly reactive chemicals are used
3. Which of the following characterize the frequency of changes in the number, type, or hazard level of reactive chemicals used at your facility? Check only ONE answer.
- Rarely changes (e.g., less than once every few years)
 - Infrequently changes (e.g., less than once per year)
 - Occasionally changes (e.g., several times per year)
4. Which of the following characterize(s) the type of operations involving the use of reactive chemicals at your facility? Check ALL that apply.
- Storage/handling of containers of reactive chemicals
 - Transfer/repackaging of reactive chemicals
 - Blending of reactive chemicals
 - Manufacturing of products using intentional chemical reactions
 - Other (please specify): _____

Management System

5. Which of the following general reactive chemical hazard management practices are conducted at your company/facility? Check ALL that apply.
- Chemical reactivity data collection and hazard identification
 - Reactive chemical testing
 - Reactive chemical qualitative hazard evaluation
 - Identification of controls/risk management options (including specifying hardware, software, procedural/administrative controls, and management system elements)
 - Documentation of reactive chemical risks and management decisions
 - Communication and training on reactive chemical hazards
 - Investigating reactive chemical incidents, and review, auditing and improvement of reactive chemical hazard management practices/program

6. Is there a written program document, officially approved by company senior management, which describes the formal management system(s) that specifically addresses reactive chemical hazards?

- Yes
 No

a. If "Yes" to question 6, are you willing to share these written documents? You may email/submit these documents to [POINT OF CONTACT]. Note: We encourage you to anonymize information as you see fit and, as a reminder, anything you provide will only be used in an information-gathering capacity.

- Yes
 No

7. If "Yes" to question 6, which of the following management system features do the written program document(s) address? Check ALL that apply.

- Purpose of the program
 Scope of application of the program (e.g., process life-cycle phases, what type/specific substances or circumstances)
 Intended practices (see question 3)
 Identified procedures for the practices (e.g., a testing protocol to ensure high-quality work)
 Specified inputs for each practice (e.g., reactivity test results prior to beginning a Process Hazard Analysis (PHA))
 Intended outputs of each practice (e.g., decomposition temperature for a substance or a situation)
 Designated roles and responsibilities (e.g., Process Development Chemist is responsible for all reactive chemical testing)
 Anticipated schedules, targets, or deadlines for executing work (e.g., all testing work must be completed prior to commencing detailed engineering design)
 Designated resources (e.g., budget, materials, equipment, and personnel)
 Means for auditing or improving the system
 Other (please specify): _____

8. Which of the following best describe(s) how the program was developed? Check ALL that apply.

- Developed by the corporate office
 Developed by the business group level in the organization
 Developed by the plant/facility

- Developed from scratch
- Adapted from a corporate program to meet local facility needs
- Modeled after an industry peer company example
Industry peer company name: _____
- Assembled from good industry practices from a variety of sources
Sources used (please specify): _____
- Adapted from a regulation (e.g., applied OSHA PSM to all reactive substances)
Regulation used (please specify): _____

9. How long have the practices/programs been in existence? Check only ONE answer.

- More than 10 years
- 6 to 10 years
- 1 to 5 years
- Less than 1 year

10. Which of the following best describes the relationship between your reactive chemical hazard management practices/program and related regulatory requirements in OSHA PSM and EPA RMP? Check only ONE answer.

- Company programs driven nearly exclusively by regulatory applicability
- Company programs PRIMARILY driven by regulatory applicability, but SOME nonregulated/chemicals included
- Company programs SOMEWHAT driven by regulatory applicability, but MANY nonregulated hazards/chemicals included
- Company programs are not at all driven by regulatory applicability

11. What position, department, or job function is primarily responsible for implementing your reactive hazard management practices?

- In the section below, please list positions or job functions that implement your reactive hazard management practices.
- Also be sure to indicate which BROAD JOB CATEGORIES the role falls under. We have listed options below
 - Corporate, Technical/Engineering, Outside Contractor, Research & Development, Safety, Management, Production, Design
- Include multiple job titles where appropriate; when entering multiple job titles, list the positions in order from most involved to least involved in your reactive hazard management practice.
- Avoid acronyms or abbreviations, and provide additional context where appropriate, especially if you use a term that might not be industry standard.

Hazard Management Practice/Activity	Position, Department, Title	Broad Job Categories (List all that apply) (Corporate, Technical/Engineering, Facility, Outside Contractor, Research & Development, Safety, Management, Production, Design)
Chemical Reactivity Data Collection and Hazard Identification		
Reactive Chemical Testing		
Reactive Chemical Qualitative Hazard Evaluation		
Identification of Controls/Risk Management Options		
Documentation of Reactive Chemical Risks and Management Findings		
Communications and Training		
Reviews and Audits		
Other (please specify): _____		

12. When assessing the potential hazards of a chemical process, does your facility involve experts from an environmental, health, and safety group?

- Rarely or never
 Sometimes
 Often
 Always

Corporate/Facility Relationship

13. Rank the three MOST important reasons for the original basis for development and implementation of the reactive chemical hazard management practices/program at your facility. Select the TOP three statements and MARK them as 1, 2, or 3. Leave the remainder blank.

- Our experience (including near misses) using reactive chemicals for a long time taught us that we had to carefully manage the risk of reactive chemicals

- We had a major accident involving reactive chemicals and that caused us to start a program
- There was a major accident involving reactive chemicals elsewhere in industry that caused us to start a program
- We became aware of evolving industry practices and resources—we thought it would be a good idea (e.g., through a professional or trade association)
- Voluntary industry process safety initiatives encouraged us (e.g., ACC's Responsible Care Process Safety Code)
- A customer/supplier requested/required us to have a program
- Regulatory compliance motivated us (e.g., OSHA PSM standard)
- Other (please specify): _____

14. Which of the following best describes the driving force or responsibility for making sure the program is implemented on an ongoing basis? Check only ONE answer.

- Corporate management oversight
- Business group management oversight
- Local management oversight
- Combined management oversight
- No formal oversight, but strong safety culture exists
- Other (please specify): _____

15. To what type of projects do you apply reactive chemical hazard management practices/programs? Check ALL that apply.

- New large capital projects
- New small capital projects
- Modifications to existing process equipment
- Modifications to existing process chemistry
- New products planned for manufacture in existing equipment
- Subsequent campaigns for the same product in the same equipment
- Changeover from one existing product campaign to another existing product campaign using the same equipment
- Transfer of production to a contract (toll) manufacturer

Chemical Reactivity Data Collection and Hazard Identification

16. The following are different approaches to gathering or generating reactive chemicals hazard data. How valuable do you find each of these to be in implementing your reactive chemical hazard management program? Check ONE in each row for ALL items that apply.

	Extremely Valuable	Somewhat Valuable	Not Valuable
Literature surveys	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vendor/supplier information (including, but not limited to, safety data sheets)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vendor/supplier technical service representative	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Evaluation of chemical structure (looking for known unstable groups)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thermodynamic calculations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Computer programs (e.g. CRW, CAMEO, CHETAH, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In-house expert opinion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use of outside consultants	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Existing company databases	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chemical reactivity testing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

17. The following are recognized sources of information on reactive chemical hazard management practices. How valuable do you find each of these to be in implementing your reactive chemical hazard management program? Check ONE in each row for ALL items that apply.

	Extremely Valuable	Somewhat Valuable	Not Valuable
OSHA PSM/EPA RMP regulatory requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OSHA PSM/EPA RMP non-mandatory guidance documents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Guidance documents from technical societies (e.g., CCPS, ACS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Guidance documents from chemical manufacturer/distributor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Extremely Valuable	Somewhat Valuable	Not Valuable
Standards and best practices from technical societies (e.g., ASTM, NFPA)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Guidance documents from trade associations (e.g., ACC, SOCMA)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Contracted specialists or consultants outside of your company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peer contacts outside of your company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internal company experts and other resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Papers presented at technical meetings and symposia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Journal articles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reference texts (e.g., Bretherick's, Sax's) ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

18. Does your company/facility site use the National Fire Protection Association (NFPA) Instability Rating System (NFPA 704) when evaluating reactive chemical safety issues (other than for emergency response planning)?

- We seldom use the NFPA Instability Rating System to address reactive chemical safety issues
- The NFPA Instability Rating System is optionally used as the analyst sees fit to address reactive chemical safety issues
- We have site/corporate standards requiring the use of the NFPA Instability Rating System in addressing reactive chemical safety issues

a. If your company/facility site uses the NFPA Instability Rating System (NFPA 704) indicate the response that best describes your experience using the system. Check only ONE answer.

- It is often useful
- It is occasionally useful
- It is seldom useful

² Bretherick's Handbook of Reactive Chemical Hazards and Sax's Dangerous Properties of Industrial Materials.

b. Additional comments:

19. Does your company/facility site use the Stoessel Criticality Classification when evaluating reactive chemical safety issues (other than for emergency response planning)?

- We seldom use the Stoessel Criticality Classification to address reactive chemical safety issues
- The Stoessel Criticality Classification is optionally used as the analyst sees fit to address reactive chemical safety issues
- We have site/corporate standards requiring the use of the Stoessel Criticality Classification in addressing reactive chemical safety issues

a. If your company/facility site uses the Stoessel Criticality Classification, indicate the response that best describes your experience using the system. Check only ONE answer.

- It is often useful
- It is occasionally useful
- It is seldom useful

b. Additional comments:

20. Does your reactive chemical hazard management program include the use of a chemical incompatibility (chemical reaction) matrix?

- Yes
- No

a. If the answer is "YES," indicate below the scope of application of the matrix. Check ALL that apply.

- Combinations of process chemicals
- Combinations of process chemicals and materials of construction (including gaskets)
- Combinations that include credible, inadvertent substitutions (e.g., stainless steel for Hastelloy)
- More than binary combinations—please describe how this is accomplished:

21. If you use chemical incompatibility (chemical reaction) matrices, what data sources are used in completing the matrix? Check ALL that apply.

- Safety data sheets (SDSs)
- Opinions of company experts
- Opinions of outside experts
- References such as Bretherick's or Sax's
- AiChE's Chemical Reactivity Worksheet
- Reactive chemical testing results
- Other (please specify): _____

Reactive Chemical Testing

22. If you use reactive chemical testing as a source of chemical reactivity hazard data, who performs the testing? Check ONE in each row for ALL items that apply.

	Nearly All the Time	Some of the Time	Very Infrequently
We use our own onsite testing capabilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
We use our corporate or business group testing capabilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
We use a contractor for our testing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

23. If you use reactive chemical testing, indicate the likelihood that you would obtain thermal stability data for each of the following. Check ONE in each row for ALL items that apply.

	Very Likely	Likely	Very Unlikely	N/A
Feed materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intermediates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Equipment cleaning materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Maintenance materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Byproducts and waste streams	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

24. Are written guidelines provided for reactive chemical testing methodologies or protocols to help ensure consistent and high-quality results? Check ALL items that apply.

- Yes, corporate guidelines are provided
- Yes, business unit guidelines are provided
- Yes, site guidelines are provided
- Yes, apparatus manufacturer or vendor-supplied procedures
- No

25. The following are typical approaches/methods used to generate data in a reactive chemical testing program. If you use reactive chemical testing, indicate the likelihood that you would seek this data. Check ONE in each row for ALL items that apply.

	Very Likely	Likely	Very Unlikely
Screening to determine thermal stability of process materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Screening to determine compatibility of process materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Screening to identify undesired side reactions including thermal decomposition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Calorimetry to determine runaway onset temperatures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Calorimetry to determine maximum adiabatic reaction temperatures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Calorimetry to determine reaction kinetics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Testing to determine gas evolution and pressure rise rates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Testing to determine emergency relief requirements and flow characteristics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Screening to determine impact (shock) sensitivity of process materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Testing to determine whether specific credible process upsets (e.g., agitation loss, cooling loss, double-batching) could result in runaway reactions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

26. Have you identified key parameters (e.g., onset temperature) and established quantitative criteria (e.g., 50°C safety margin above maximum operating temperature) for categorizing reactive chemical hazard "levels" when interpreting the results of tests checked in question 23.

Yes

No

a. If "yes", please give a few parameters/criteria.

27. Listed below are a number of classes of reactive chemical testing apparatus or analytical techniques that are incorporated in reactive chemical hazard management practices/programs. Indicate for each the frequency with which it is used in support of your reactive chemical testing program. Check ONE in each row for ALL items that apply.

	Frequently Used	Occasionally Used	Seldom Used	N/A
TGA, thermogravimetric analysis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DSC, differential scanning calorimetry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DTA, differential thermal analysis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ARC, accelerating rate calorimeter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
VSP, vent sizing package	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RC1, reaction calorimeter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RSST, reactive system screening tool	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IST, isothermal storage test	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C80	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SIKAREX, RADEX, and/or SEDEX	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
APTAC, automatic pressure tracking adiabatic calorimeter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Carius (ICI) Sealed Tube Test	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PHI-TEC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

28. Where are reactive chemical testing results archived so that they are accessible and can be searched by users? Check ALL items that apply.

- Corporate or business group electronic/cloud database
- Corporate or business group hard copy files
- Facility electronic/cloud database
- Facility hard copy files
- Not kept after project is complete
- Other (please specify): _____

Qualitative Hazard Evaluation

29. We want to know how likely you are to perform a reactive chemical hazard evaluation in a number of common situations. These evaluations may be performed with qualitative analysis methods only (i.e., using well-known methods, such as brainstorming, checklists, what-if analysis, HAZOP analysis, or others), or these evaluations may be supplemented with quantitative reactive testing data. If you are required by a site or corporate program to perform such an evaluation, or are likely to do so, check the first or second column, as most appropriate. Otherwise, check the third column.

	Required	Not Required but Likely	Not Required or Unlikely
Research phase for a new processor product (e.g. laboratory)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Development phase for a new process or product (e.g. pilot plant)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design phase for a new process or product	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Evaluating a proposed modification to an existing process or product	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
As part of an incident or near-miss investigation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Periodic reevaluation of an existing process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Evaluation of an existing process that has not been previously evaluated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In preparation for abandoning a process or decommissioning a process unit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

30. Are there certain criteria that necessitate either a process hazard analysis or a higher level of scrutiny at your company or facility? Check ALL that apply.

- scale-up of chemical activity
- presence of highly energetic reactions
- presence of highly energetic functional groups
- gas evolution
- use of highly corrosive and/or hazardous materials
- presence of pyrophoric reagents
- past history
- literature precedent

31. Which of the following qualitative analysis methods do you use for your reactive hazard evaluations? (Check ALL that apply.)

Brainstorming	<input type="checkbox"/>
Checklists	<input type="checkbox"/>
What-if analysis	<input type="checkbox"/>
HAZOP analysis	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>
N/A	<input type="checkbox"/>

32. What means or sources are used to ensure that reactive chemical hazard information is considered when conducting a Process Hazard Analysis (PHA)? Check ALL items that apply.

- Safety Data Sheets (SDSs)
- Stoessel Criticality Classification
- NFPA (National Fire Protection Agency) Instability Rating System
- Computer programs and other chemical databases (e.g., CRW, CAMEO, CHETAH, etc.)
- Chemistry descriptions in process manuals
- Detailed process technology packages
- Participation by process development chemist or engineer
- Participation by plant technical specialist
- Participation by site reactive chemicals expert
- Participation by manufacturer/supplier/vendor technical service representative
- Other (please specify): _____

33. How many people are involved in conducting reactive chemical qualitative hazard evaluations for each process life-cycle phase? Check ONE in each row for ALL items that apply.

	One Individual	Collaborative Team	N/A
R&D (including laboratory, conceptual design/pilot plant)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Detailed engineering design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Commercial process operation (including start-up)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Decommissioning (including maintenance turnarounds)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

34. Which of the following describe(s) the ways in which you ensure that all significant reactive chemical scenarios are considered in your reactive chemical testing and qualitative hazard evaluation activities? Check ALL items that apply.

- Brainstorming
- Literature survey
- Manufacturer/supplier/vendor technical service information
- Previous plant/company incidents
- Review of industry incident databases
- Checklists
- Material incompatibility matrix
- Other (please specify): _____

35. Do the following personnel receive formalized training in identifying and applying reactive chemical hazards management practices (commensurate with their job roles and responsibilities)? Check ONE in each row for ALL items that apply.

	Yes	No
Research & Development	<input type="checkbox"/>	<input type="checkbox"/>
Technical/engineering	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input type="checkbox"/>	<input type="checkbox"/>

	Yes	No
Corporate	<input type="checkbox"/>	<input type="checkbox"/>
Safety	<input type="checkbox"/>	<input type="checkbox"/>
Management	<input type="checkbox"/>	<input type="checkbox"/>
Production	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>

36. Are the nature and severity of reactive chemical hazards in a process considered in determining the interval between performing periodic qualitative or quantitative hazard evaluations for the process (e.g., are PHAs for processes with "higher" reactive hazards updated/revalidated more often than for processes with "lower" assessed reactive hazards)?

- Yes
- No

a. If "Yes", please describe how you do this:

Identification of Controls/Risk Management Options

37. Which of the following means are used by your reactive chemical hazard management practices/program at your site to ensure a thorough review is undertaken to determine the safe design for the following items? Check ALL that apply.

	Hazard Evaluation Activity						
	Does Not Apply	Peer Practice	Codes & Standards	Design/P&ID Review	Qualitative Hazard Evaluation	Consequence Analysis or QRA	Other
Emergency pressure relief capability							
Safe disposal of materials relieved							

Safety Enhancement	Hazard Evaluation Activity						
	Does Not Apply	Peer Practice	Codes & Standards	Design/P&ID Review	Qualitative Hazard Evaluation	Consequence Analysis or QRA	Other
Emergency Cooling systems							
Quench/dump systems							
Basic process control system							
Alarms Safety interlocks							
Automation to prevent human error							
Inherently safer design alternatives							
Safe operating limits definition							
Emergency ventilation systems							
Secondary containment							
Personal protective equipment							
Other good practices and design features (please specify): _____							
Other good practices and design features (please specify): _____							

38. At your facility/company, what outcomes would require a change in the process or prevent a process from moving forward? Check ALL that apply.

- Stoessel classification above a certain rank
- Large exotherm
- Decomposition detected at or close to the operating temperature

- Uncontrolled gas generation
- Potential for explosion
- Other (please specify): _____

39. Does your facility have an emergency plan of response in case of a reactive chemical incident with the following entities?

	Yes	No	N/A
Local first responders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Local Emergency Planning Committee	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Local Department of Emergency Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other local government entities (please specify):	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
State Emergency Response Commission	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
State Department of Emergency Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other state government entities (please specify):	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Local businesses/residents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

40. Which of the following best describes the performance of your emergency response plans after reactive chemical incidents?

- Our facility has never had a reactive chemical incident.
- Our emergency response plans generally operate according to plan in the case of a reactive chemical incident.
- Our emergency response plans sometimes operate according to plan in the case of a reactive chemical incident.
- Our emergency response plans rarely operate according to plan in the case of a reactive chemical incident.

41. Which of the following best characterizes the frequency of updates to your facility's emergency response plans?

- Rare updates
- Occasional updates
- Regular updates

42. Does your facility have access to a notification system to alert community members in the case of a reactive chemical incident?

- Yes
- No

Communication and Training

43. Which of the following describe(s) the primary way(s) in which the findings from reactive chemical hazard management practices are communicated among corporate departments and facility management, engineering, and production, and between the company and outside parties? Check ALL that apply and add other examples in the extra rows, if needed.

Communication Pathway

Communication Means	Corporate (or Business Group) to Facility	Engineering (or Technical) to Production	Management to Employees	Outside Party to Company/Facility
Simple letter/memo				
Informal presentation				
Project book/data files				
Formal report				
Official action item				
Safety bulletin				
Informal discussion				
Required reading file				
Documented training				
Operating instructions				

Communication Means	Corporate (or Business Group) to Facility	Engineering (or Technical) to Production	Management to Employees	Outside Party to Company/Facility
Regular safety meetings				
Incident reports				
Other (please specify): _____				
Other (please specify): _____				

44. Do the following personnel receive formalized training in identifying, evaluating, and controlling reactive chemical hazards (commensurate with their job roles and responsibilities)? Check ONE in each row for ALL items that apply.

Personnel	Yes	No
R&D	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input type="checkbox"/>	<input type="checkbox"/>
Plant technical/engineering	<input type="checkbox"/>	<input type="checkbox"/>
Operations supervision	<input type="checkbox"/>	<input type="checkbox"/>
Operators/technicians	<input type="checkbox"/>	<input type="checkbox"/>
Maintenance/personnel	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify): _____	<input type="checkbox"/>	<input type="checkbox"/>

Renewal and Continuous Improvement

45. Who in your company/facility is responsible for the ongoing implementation and improvement of the reactive chemical hazard management practices/program?

46. How often are the reactive chemical hazard management practices/program reviewed or audited for improvement? Check only ONE answer.

- Never
- Rarely
- Occasionally, when prompted after an incident
- At regular intervals

47. Does your site report and track reactive chemical incidents (including near misses?) Check ALL that apply.

- At site level
- At corporate or business group level
- Industry-wide
- Do not track on a consistent basis

a. Does your site ensure this information is communicated company-wide and retained as part of corporate memory? Please explain.

48. Do you share data regarding reactive chemical incidents (including near misses) with trade associations, suppliers/customers, or other manufacturers in your industry?

- Yes
- No

49. How is incident data used within your site and company-wide to improve safe design, operation, and maintenance of reactive chemical processes and reactive chemical hazard management practices/programs? Please explain.

Future Needs

50. Does your company see the need for an industry-wide database on reactive chemical incidents? (One that is easily accessible to those who need it.)

- Yes
- No

a. If "yes", would your company be likely to contribute to such a database?

- Yes
- No

b. Who should maintain such a database?

51. Does your company see the need for an industry-wide database on reactive chemical testing? (One that is easily accessible to those who need it.)

Yes

No

a. If "yes", would your company be likely to contribute to such a database?

Yes

No

b. Who should maintain such a database?

52. Does your company see the need for further industry guidance on reactive chemical hazard management issues?

Yes

No

a. If yes, who has a need for this guidance and how might it be developed? Please explain.

53. Would your company be willing to participate in further discussions concerning reactive chemical hazards and management practices/programs?

Yes

No

Additional Comments & Feedback

54. Please let us know about your experience filling out this survey.

a. How satisfied were you with the clarity of intent of questions:

Very Satisfied

Somewhat Satisfied

Neither Satisfied nor Dissatisfied

Somewhat Dissatisfied

Very Dissatisfied

b. How easy was it to collect information to complete the survey:

Very Easy

Somewhat Easy

Neither Easy nor Difficult

Somewhat Difficult

Very Difficult

c. Usefulness of the survey to you (e.g., new ideas, benchmarking):

Very Useful

Somewhat Useful

Neither Useful nor Unhelpful

Somewhat Unhelpful

Very Unhelpful

55. What other comments or questions do you have that you want us to know? Please enter all information into the box below.