

SAFETY DIGEST: THE IMPORTANCE OF WORKER PARTICIPATION



U.S. Chemical Safety and Hazard Investigation Board

Introduction

The U.S. Chemical Safety and Hazard Investigation Board (CSB) has found that worker participation is an essential element to improve process safety and prevent chemical incidents. Existing federal regulations require worker participation in matters of process safety, and industry standards similarly call for worker participation. Yet, CSB incident investigations have identified missed opportunities for workers to effectively participate in process safety activities at facilities where they work, typically in proximity to the most serious hazards. A lack of effective worker participation can lead to an increase in the risk of injury to workers and, in the event of a serious safety incident, can adversely impact the company and members of the public who live near these industrial facilities.

This digest summarizes four CSB investigations where ineffective worker participation contributed to a major chemical incident or otherwise provided insights into opportunities for improved practices. It highlights key lessons and offers guidance to help ensure effective worker participation.

Background

Several existing federal safety regulations require worker participation, including the Occupational Safety and Health Administration's (OSHA) Process Safety Management (PSM) standard; the Environmental Protection Agency's Risk Management Plan rule; and the Bureau of Safety and Environmental Enforcement's Safety and Environmental Management Systems rule (for offshore oil and gas operations).

Similarly, scientific and technical organizations, also call for worker participation. For example, in *Guidelines for Risk Based Process Safety*, the Center for Chemical Process Safety (CCPS) uses the phrase "workforce involvement" to describe the need for effective worker participation as one of 20 essential elements to reduce process safety risks and prevent major incidents:

Those workers directly involved in operating and

Sierra
Chemical
Tesoro
Chevron
Williams
Olefins

maintaining the process are most exposed to the process. The workforce involvement element provides an equitable mechanism for workers to be directly involved in protecting their own welfare. Furthermore, these workers are potentially the most knowledgeable people with respect to the day-to-day details of operating the process and maintaining the equipment and facilities and may be the sole source for some types of knowledge gained through their unique experiences. Workforce involvement provides management a mechanism for tapping into this valuable expertise.¹

This CCPS publication discusses general areas of worker participation in risk assessments, inspections, audits, and performance reviews. CCPS notes that active worker participation leads to worker empowerment, management responsiveness, and improved process safety performance.²

1 CCPS. *Guidelines for Risk Based Process Safety*, March 2007; p 124.

2 *Id* at 125.

SAFETY DIGEST: THE IMPORTANCE OF WORKER PARTICIPATION



U.S. Chemical Safety and Hazard Investigation Board

The American National Standards Institute (ANSI) and the American Industrial Hygiene Association (AIHA) also call for effective worker participation, which they refer to as “employee participation.” For example, ANSI/AIHA Z10 states:

Effective employee participation should include a role in activities such as incident investigations, procedure development, health and safety related audits, training development, job safety analysis, use of occupational risk management processes, and all aspects of the planning process.

Examples or barriers [to worker participation] include lack of response to employee input or suggestions, reprisals (supervisory and/or peer), or any policy, practice, or program that penalizes or discourages participation.³

In several of its investigations, the CSB identified ineffective worker participation as causal to the incident and noted that workers and their representatives play a critical role in hazard identification, risk reduction, and an overall increase in a company’s ability to prevent chemical incidents.

As a result of its investigative findings, the CSB issued recommendations to employers (both companies and specific facilities), unions, industry groups, state governments, and federal agencies aimed at improving worker participation in the following ways:

- Creating or improving opportunities for workers to participate directly in matters involving process safety management and major incidents prevention;
- Empowering workers to provide input on how work is performed, whether through safety-related committees, special projects, inspections and audits, hazard analyses, and other specific measures (such as designing new operating procedures or assessing and

improving process safety culture);

- Sharing safety information or communicating safety improvements as a part of strengthening a company’s or facility’s overall safety management system;
- Enabling workers to bring safety issues to the attention of management without fear of retaliation or reprisal;
- Collecting data (e.g., incident tracking, indicator data, and metrics) to help ensure critical information is retained and used to continuously improve safety;

Worker Participation Findings Recommendations

- Worker training opportunities and information sharing regarding the nature of the hazards present in the workplace, lessons learned from other sites, the outcome of incident investigations, and exposure to both established industry best practices and the results of safety-related research relevant to a company’s or facility’s operations; and
- Strengthening worker participation requirements in industry standards and state and federal regulations.

The following CSB investigations are examples that provide key findings and guidance for industry on the importance of worker participation in PSM and in preventing major chemical incidents.

³ American Industrial Hygiene Association/American National Standards Institute, *American National Standard-Occupational Safety and Health management Systems, ANSI/AIHA Z10*, approved June 27, 2012, page 7.

SAFETY DIGEST: THE IMPORTANCE OF WORKER PARTICIPATION

U.S. Chemical Safety and Hazard Investigation Board

Sierra Chemical Company Explosives Accident

- > 4 Killed, 6 Injured
- > Full Report on Website

Incident Summary

On January 7, 1998, two massive explosions that occurred just seconds apart destroyed the Sierra Chemical Company Kean Canyon explosives manufacturing plant, located in Mustang, Nevada. The explosions killed four workers and injured six others. This incident was the focus of the CSB's first investigation and report.

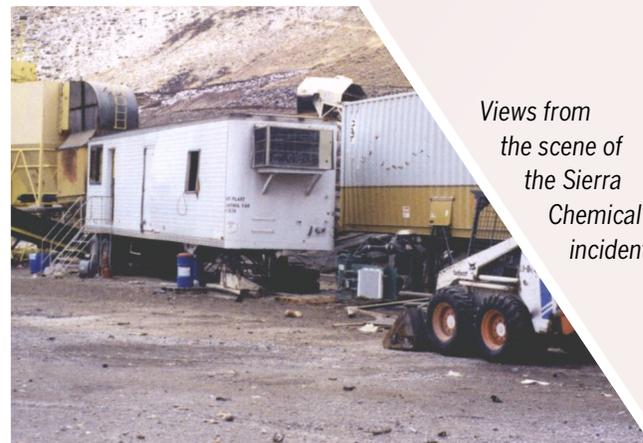
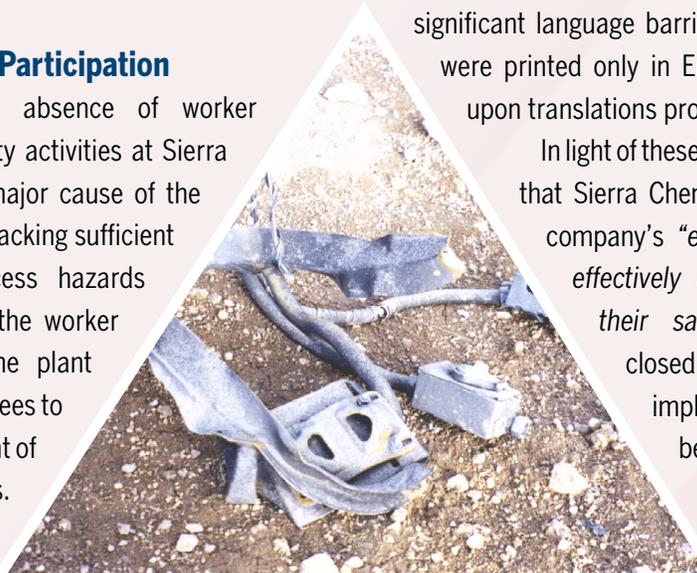
Key Findings on Worker Participation

The CSB found that the absence of worker participation in process safety activities at Sierra Chemical Company was a major cause of the incident, as it led to workers lacking sufficient understanding of the process hazards and controls. For example, the worker participation program at the plant made no provision for employees to be involved in the development of safety programs and policies.

Workers at the site did not use and were not aware of written operating procedures and safety information relevant to their work activity. Neither were

workers aware of any specific hazards associated with the materials at the facility, aside from the fact that the materials were explosives and that they were required to wear dust masks. According to the workers that the CSB investigators interviewed, no operators helped develop any of the safety programs. Workers were not even aware that a worker participation program existed. Worker safety activities were generally limited to preventing fires and wearing personal protective equipment. While workers were told to report problems, the issues they raised were not acted upon, as the supervisor considered them to be production issues, even though they presented safety hazard implications. In addition, most workers spoke and read only Spanish, creating significant language barriers, as safety-related materials were printed only in English. Workers had to depend upon translations provided by a bilingual supervisor.

In light of these findings, the CSB recommended that Sierra Chemical Company ensure that the company's "employee participation program effectively includes workers and resolves their safety issues." CSB, however, closed this recommendation without implementation by the company because Sierra Chemical Company went out of business following the accident.



Views from
the scene of
the Sierra
Chemical
incident.

SAFETY DIGEST: THE IMPORTANCE OF WORKER PARTICIPATION

U.S. Chemical Safety and Hazard Investigation Board

Tesoro Anacortes Refinery Fatal Explosion and Fire

- > 7 Killed
- > Full Report on Website

Incident Summary

On April 2, 2010, the Tesoro Refining and Marketing Company LLC (Tesoro), experienced a catastrophic rupture of a heat exchanger in the Catalytic Reformer/Naphtha Hydrotreater (NHT) unit at its petroleum refinery in Anacortes, Washington, due to High Temperature Hydrogen Attack (HTHA). Highly flammable hydrogen and naphtha at more than 500 degrees Fahrenheit were released from the ruptured heat exchanger and ignited, causing an explosion and intense fire. The rupture killed seven Tesoro employees.

Key Findings on Worker Participation

The CSB investigation found that the Tesoro refinery workforce and its union, the United Steelworkers (USW), expressed concerns regarding the NHT unit that were not adequately addressed by Tesoro managers leading up to the incident. During a 2006 process hazard analysis (PHA) revalidation on the NHT unit at the refinery, workers noted 31 near miss incidents in the NHT unit during the previous five years. These near misses were attributed to many factors, including operators being required to perform too many outside tasks and a continual rotation of the field and control room operators. As a result, the PHA team doing the revalidation requested a review of required experience and training for NHT operators to address these concerns; however, the CSB found this PHA action item was closed without resolution, despite the concerns expressed by the Tesoro workers on the PHA team.

Based on these findings, the CSB issued two closely related recommendations. The first was issued to USW Local 12-591 to participate in what the CSB proposed as a new



Aerial view of heat exchangers damaged from the Tesoro Refinery explosion and fire.

Tesoro process safety culture survey oversight committee. The second, and more comprehensive, recommendation was issued to the Tesoro Anacortes Refinery to implement a refinery-wide safety culture improvement program.

Tesoro informed the CSB in 2016 that the refinery developed and implemented a process safety continuous improvement program and a Process Safety Council of three refinery management members and three local USW union representatives to oversee the program. Based upon the substantial actions taken at the Tesoro Anacortes Refinery, the CSB voted to close the recommendation as acceptable in February 2018.

In this same investigation, the CSB also issued a recommendation to the governor and legislature of the State of Washington to augment its existing process safety management regulations for petroleum refineries. Washington has an authorized state OSHA plan and is thus allowed to issue standards that are more protective than federal standards.

SAFETY DIGEST: THE IMPORTANCE OF WORKER PARTICIPATION



U.S. Chemical Safety and Hazard Investigation Board



Animation still from the CSB's safety video entitled "Behind the Curve".

Therefore, the CSB recommended, in part, that Washington enhance its existing process safety regulation with respect to worker participation by adopting the following:

Require an increased role for workers in management of process safety by establishing the rights and responsibilities of workers and their representatives on health and safety-related matters, and the election of safety representatives and establishment of safety committees (with equal representation between management and labor) to serve health and safety-related functions. The elected representatives should have a legally recognized role that goes beyond consultation in activities such as the development of the comprehensive process hazard analysis, management of change, incident investigation, audits, and identification and effective control of hazards.

The representatives should also have the authority to stop work that is perceived to be unsafe or that presents a serious hazard until the regulator intervenes to resolve the safety concern. Workforce participation practices should be documented by the company to the regulator...

The State of Washington is working to strengthen its own PSM standard for petroleum refineries. The CSB continues to urge Washington to ensure there will be increased roles and responsibilities for refinery workers and their representatives in that state.

Action in Washington comes after a set of similar recommendations the CSB made to the California State Legislature and the governor of California in the CSB's Chevron Regulatory Report, issued in October 2014, as discussed below.

SAFETY DIGEST: THE IMPORTANCE OF WORKER PARTICIPATION

U.S. Chemical Safety and Hazard Investigation Board

Chevron Richmond Refinery Fire

- > **6 Injured; 15,000 members of the public sought medical attention**
- > **Full Reports on Website**

Incident Summary

On August 6, 2012, the Chevron U.S.A. Inc. Refinery in Richmond, California, (“Chevron Richmond Refinery”) experienced a catastrophic pipe failure in the #4 Crude Unit. The pipe at issue, a 52-inch long, 8-inch diameter carbon steel line, ruptured and released flammable, high-temperature light gas oil, which then partially vaporized into a large vapor cloud that engulfed 19 Chevron employees and ignited. All 19 employees escaped, narrowly avoiding serious injury. The ignition of the flammable portion of the vapor cloud and the subsequent burning of the hydrocarbon process fluid resulted in a large plume of particulates and vapor crossing the refinery’s fence line and drifting across the greater Richmond, California, area. Following this release, approximately 15,000 people from the nearby area sought medical treatment.

The CSB issued three reports from its investigation of this incident. The second report volume is referred to as the ‘Chevron Regulatory Report.’ Within this report is a comprehensive, multi-pronged recommendation intended to enhance California’s state-specific PSM regulations in which the CSB addressed worker participation. Specifically, the CSB recommended that California seek to enhance worker participation for improved process safety in the following manner:

Require mechanisms for the regulator, the refinery, and workers and their representatives to play an equal and essential role in the direction of preventing major incidents. Require an expanded role for workers in management of process safety by establishing the rights



CSB Investigators at the site of the Chevron Refinery fire.

and responsibilities of workers and their representatives on health and safety-related matters, and the election of safety representatives and establishment of safety committees (with equal representation between management and labor) to serve health and safety-related functions. The elected representatives should have a legally recognized role that goes beyond consultation in activities such as the development of the comprehensive process hazard analysis, implementation of corrective actions generated from hierarchy of control analyses, management of change, incident investigation, audits, and the identification, prevention, and control of all process hazards. The regulation should provide workers and their representatives with the authority to stop work that is perceived to be unsafe until the employer resolves the matter or the regulator intervenes. Workforce participation practices should be documented by the refinery to the regulator.

In response to the CSB’s recommendation, California implemented significant regulations in 2017 that strengthened PSM, including requiring more comprehensive worker participation.

SAFETY DIGEST: THE IMPORTANCE OF WORKER PARTICIPATION

U.S. Chemical Safety and Hazard Investigation Board

Williams Olefins Plant Explosion and Fire

- > 2 Killed; 167 Reported Injuries
- > Full Report on Website

Incident Summary

On June 13, 2013, a catastrophic equipment rupture, explosion, and fire occurred at the Williams Olefins, Inc. plant in Geismar, Louisiana (Williams Geismar). The incident occurred during nonroutine operational activities; specifically, the supervisor was troubleshooting the process when he opened a valve. By opening this valve, the supervisor introduced heat to a type of heat exchanger called a “reboiler” that was offline, creating an overpressure event while the vessel was isolated from its pressure relief device. The introduced heat increased the temperature of the liquid propane mixture confined within the reboiler shell, resulting in a dramatic pressure rise within the vessel due to liquid thermal expansion. The reboiler shell catastrophically ruptured, causing a boiling liquid expanding vapor explosion (BLEVE) and fire. The event killed two workers and injured more than 150 others.

Key Findings on Worker Participation

The CSB found in its investigation that Williams Geismar did not adequately implement action items developed during Process Hazard Analyses (PHA) or recommendations from a contracted pressure relief system engineering analysis. The CSB also found that in the years leading up to the incident, Williams Geismar exhibited characteristics of a weak process safety culture.

Post-incident, Williams Geismar took steps to improve its PHA, management of change, and pre-start up safety review processes. For example, Williams created diverse teams with appropriate involvement by management, technical experts, and workers, for more robust processes and better-informed decision-making. In another example, the site also introduced an improved method for troubleshooting and began to support



Photos from the June 13, 2013,
Williams Olefins Incident
Geismar, LA

Workers fleeing the site of the fire and explosion during the Williams Olefins incident.

operators working at computer workstations by enabling them to get instant access to technical support, in this case by right-clicking on their mouse. Williams Geismar also improved operating procedures to provide greater clarity for workers.

In guidance to the chemical process industry, the CSB advised that corporate leaders should regularly assess and strengthen their organizations’ respective process safety cultures, including overall commitment to process safety.

In addition to a willingness to lead from the top, various facets of worker participation were highlighted as key to a successful effort to improve process safety culture. To start, a company interested in improving process safety culture should assess whether workers feel they can report safety issues without fear of retaliation, and whether a company or its individual facilities proactively investigate worker safety concerns and implement timely and effective corrective actions based on worker reporting. Additionally, companies should exhibit a learning culture, examining incidents within their own operations and across industry, and applying those lessons through information sharing and workforce training at all levels of the organization. Further, and perhaps most important, companies should critically look at whether its workers are effectively involved in process safety decisions, and whether an open

SAFETY DIGEST: THE IMPORTANCE OF WORKER PARTICIPATION

U.S. Chemical Safety and Hazard Investigation Board



View of the damaged heat exchanger at the Williams Olefins Plant.

and collaborative process is used to consider all viewpoints when analyzing potential problem areas.

In light of the CSB's findings, and in view of actions taken post-incident by Williams Geismar, the CSB issued the following recommendation to the facility to further strengthen worker participation on process safety, enhanced safety culture, and incident prevention:

Implement a continual improvement program to improve the process safety culture at the Williams Geismar Olefins Plant. Ensure oversight of this program by a committee of Williams personnel ("committee") that, at a minimum, includes safety and health representative(s), Williams management representatives(s), and operations and maintenance workforce representative(s). Ensure the continual improvement program contains the following elements:

a. Process Safety Culture Assessments. Engage a process safety culture subject-matter expert, who is selected by the committee and is independent of the Geismar site, to administer a periodic process safety culture assessment that includes surveys of personnel, interviews with personnel, and document analysis. Consider the process safety culture audit guidance

provided in Chapter 4 of the CCPS book Guidelines for Auditing Process Safety Management Systems as a starting point. Communicate the results of the Process Safety Culture Assessment in a report; and

b. Workforce involvement. Engage the committee to (1) review and comment on the expert report developed from the Process Safety Culture Assessments, and (2) oversee the development and effective implementation of action items to address process safety culture issues identified in the Process Safety Culture Assessment report.

As a component of the process safety culture continual improvement program, include a focus on the facility's ability to comply with its internal process safety management program requirements. Make the periodic process safety culture report available to the plant workforce. Conduct the process safety culture assessments at least once every five years.

In October 2016, the Williams Olefins Geismar facility conducted a Process Safety Culture Survey that generated seven action items that are being used to improve the safety culture at the plant. The results of the survey were also shared with Williams Geismar plant personnel. As a result, the CSB closed this recommendation as acceptable in June 2017.

SAFETY DIGEST: THE IMPORTANCE OF WORKER PARTICIPATION



U.S. Chemical Safety and Hazard Investigation Board

Conclusion

In 2018, DuPont Sustainable Solutions conducted a global survey of executives in high hazard industries. The purpose of the survey was to understand their perceptions of how risk is identified and managed within their companies, and to what extent risk is incorporated into corporate objectives. One key finding was that 88 percent of respondents felt that workforce engagement is important to risk management—yet only 35 percent considered it a strong component in their organizations.⁴

Managers at high hazard industrial facilities of all types would benefit from assessing whether the facility where they work and lead has an effective worker participation program. Effective worker participation programs allow workers

(and their union representatives) to participate in matters pertaining to process safety in many ways, including:⁵

- Developing the initial program design;
- Forming labor/management safety committees and/or process safety committees;
- Reporting incidents (including near misses) so they can be investigated, and their underlying causes corrected;
- Analyzing hazards associated with routine and nonroutine jobs, tasks, and processes;
- Defining and documenting safe work practices;
- Conducting site inspections and incident investigations;
- Training workers and new hires; and
- Evaluating program performance and identifying ways to improve it.

Worker participation is essential to improving process safety and preventing incidents at facilities with hazardous chemicals.

4 DuPont Sustainable Solutions, *Lack of Internal Alignment and Commitment of Resources to Manage Risk Threaten Corporate Business Performance*; 2019, pages 1-2. <https://www.dupont.com/content/dam/dupont/products-and-services/consulting-services-and-process-technologies-redesign/consulting-services-and-process-technologies-landing/documents/Global%20ORM%20Report-20.10.17%20FINAL.pdf>

5 See <https://www.osha.gov/safeandsound/safety-and-health-programs.html>.

CSB Policy on Worker Participation

Just as the CSB has found that worker participation is a critical part of an effective PSM system, such engagement is also vital for CSB investigations. In October 2018, the CSB adopted Board Order Addendum 40a., which updates CSB policy for worker participation in CSB investigations. Under this policy, workers and their representatives have the opportunity to participate in certain CSB investigative activities. These activities typically include:

- Investigation opening meetings, status update meetings, and closing meetings;
- Site walk-throughs and on-scene investigation activities;

- Equipment, material, and sample evidentiary testing;
- Employee witness interviews;
- The opportunity to provide documents and other evidence to CSB investigators in response to investigator inquiries and requests for evidence, or that document other worker safety concerns; and
- Review of draft written reports and recommendations and an opportunity to comment prior to publication.

To read this CSB policy, go to <https://www.csb.gov/assets/record/bo40a.pdf>

CSB urges employers to assess, with workers and their workplace representatives, whether they have an effective worker participation program and take steps for improvement.