U.S. Chemical Safety and Hazard Investigation Board

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Occupational Safety and Health Administration
U.S. Department of Labor
200 Constitution Avenue NW
Washington, DC 20210

MAR 3 1 2014

Attention: Docket No. OSHA-2013-0020

Dear Sir or Madam:

Please find attached the U.S. Chemical Safety and Hazard Investigation Board's (CSB's) response to OSHA's December 9, 2013 Request for Information (at 78 FR 73756) on potential revisions to several agency standards, including the Process Safety Management standard.

The CSB appreciates OSHA's consideration of several possible revisions that we believe have the potential to better safeguard the health and safety of workers, and we thank OSHA for the opportunity to contribute to this important initiative.

If you have any questions about our comments, or if we may be of further assistance, please do not hesitate to contact us.

Sincerely,

Rafael Moure-Eraso, PhD, CIH
Chairperson

Issue Area 1: Clarifying the PSM exemption for atmospheric storage tanks

The CSB urges OSHA to eliminate the atmospheric storage tank (AST) exemption at §1910.119(a)(1)(ii)(B) and/or to revise the Flammable liquids standard (§1910.106) to require additional safeguards for atmospheric storage tanks, including:

- Requirements for mechanical integrity during design, construction, and maintenance.
- A requirement for the conduct of written management of change analyses.
- Requirements for the installation and maintenance of an automatic liquid overfill protection system.

OSHA's preamble to the final PSM rule[1] suggested that the rationale for exempting the ASTs described in paragraph (a)(1)(ii)(B) was that they were already regulated by OSHA's Flammable Liquids standard (at 29 CFR §1910.106 (hereafter "the 106 standard" or "106."). Published in 1974, 1910.106 was based on the 1969 edition of the National Fire Protection Association's NFPA 30: *Flammable and Combustible Liquids Code*. But NFPA 30, and hence the 106 standard, was never intended to prevent or minimize the consequences of catastrophic releases, which is the aim of the PSM standard; it was simply to address the fire and explosion hazards of flammable and combustible liquids. Moreover, the NFPA 30 standard has undergone significant revisions over the past forty years[2] and best practices for the storage and processing of flammable liquids have evolved considerably. The 106 standard, in contrast, has remained largely unchanged. For both of these reasons, the applicability of the 106 standard to tanks exempted from PSM has never been sufficient to safeguard against their catastrophic hazard potential. For further discussion on needed changes to the 1910.106 standard, please see Issue Area 14.

Although the CSB now believes more significant changes to the PSM standard are needed, it should be noted that we have long advocated for the action now explicitly under consideration by OSHA: "revising paragraph (a)(1)(ii)(B) to include flammable liquids in atmospheric storage tanks within or connected to a PSM covered process" and thereby "remedying the issue in PSM enforcement that has existed since the *Meer* decision."[3,4] This was the intent of CSB Recommendation No. 2001-5-I-DE-R1, which the Board issued to OSHA in the wake of a July 2001 atmospheric storage tank incident at the Delaware City Refinery, then owned and operated by Motiva Enterprises LLC.[5] The CSB concluded that this accident could have been prevented if Motiva had applied process safety management practices (e.g., mechanical integrity, management of change) to the subject tank, which the site considered exempted from

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[1] See Preamble to 29 CFR Part 1910, Process Safety Management of Highly Hazardous Chemicals. Section 3- Summary and Explanation of Final Rule. Available at: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=PREAMBLES&p_id=1041.

[2] New editions of NFPA 30 were issued in 1972, 1973, 1976, 1977, 1981, 1984, 1987, 1990, 1993, 1996, 2000, 2003, 2008, and 2012. A new edition will be issued in 2015. For more detail on significant revisions to the standard over time, see the "Origin and Development of NFPA 30" section of the preface to the latest available edition of the standard.

[3] See OSHA Request for Information (78 FR 73756, December 9, 2013) at Section I(C)(1).

[4] *Secretary of Labor v. Meer Corporation* (1997, OSHRC Docket No. 95-0341.)

[5] On that date, sparks from a welding torch ignited flammable vapors inside a poorly maintained sulfuric acid tank, causing an explosion that killed a contractor, injured eight, and released 99,000 gallons of sulfuric acid into the nearby Delaware River, causing significant damage to aquatic life. *See* CSB Investigation Report: "Refinery Incident: Motiva Enterprises LLC." Report No. 2001-05-I-DE. Issued August 28, 2002. Available at: http://www.csb.gov/assets/1/19/Motiva_Final_Report.pdf.

PSM because of the AST exemption and the *Meer* decision; therefore, we recommended that OSHA revise PSM to clarify the language of the exemption.

Since issuing that recommendation, the CSB has continued to learn of accidents involving atmospheric storage tanks that were connected or in close proximity to a PSM covered process. Most notably, the CSB is investigating the January 12, 2009, flash fire at the Silver Eagle Refinery in Woods Cross, Utah.[6] On that date, an atmospheric storage tank connected to a refinery process overpressurized, causing the release of flammable light naphtha which subsequently ignited and flashed. Two operators and two contractors suffered serious burns. The CSB found that the process was changed to use a material with a higher vapor pressure; however, no Management of Change analysis was conducted, and the site did not identify that the pressure exceeded the design specifications of the tank.

Remedying the enforcement problem that has existed since the *Meer* decision could help to prevent these and other similar incidents involving atmospheric storage tanks connected to a process. But the CSB believes that this action would not go far enough, since it would not address the catastrophic hazards posed by atmospheric storage tanks that would still remain exempted, including those in terminals or tank farms. The CSB strongly discourages OSHA from continuing to exempt from the PSM standard flammables stored in terminals or tank farms, since our investigations and research indicate that atmospheric storage tanks may pose a catastrophic hazard regardless of their physical connection or proximity to a process.

For example, the CSB is investigating the October 23, 2009, tank farm fires and explosion at the Caribbean Petroleum Corporation's (CAPECO) tank farm in Bayamón, Puerto Rico.[7] On that date, a storage tank was receiving a gasoline from a tanker ship when the tank overfilled without detection. The gasoline pooled in a containment dike and formed a large vapor cloud stretching over 100 acres before it ignited, triggering a massive explosion that caused significant off-site impact. Although no workers were injured, Puerto Rico OSHA fined CAPECO for endangering the lives of its employees, who narrowly escaped the vapor cloud before its ignition. The CSB found that despite the large capacity of the tank (about 5 million gallons), the tank was not equipped with automatic level controls to allow operators to remotely shut off the gasoline flow into the tank or divert flow to a safe location. In addition, the tank was not equipped with high or high-high liquid level alarms[8] to notify operators of the overfill.

The CAPECO incident is very similar to the December 11, 2005, tank overflow and subsequent vapor cloud explosion at the Buncefield Oil Storage Depot, in Hemel Hempstead, Hertfordshire, United Kingdom. On that date, a 1.5 million gallon tank storing gasoline overflowed during filling operations. This explosion generated significant blast pressure, resulting in additional loss of containment that led to fire and other damage involving 22 tanks. There were no fatalities, but 43 people were injured and the damage to nearby commercial and residential property totaled $1.5 billion.[9] As a result of the Buncefield incident, the UK Health and Safety Executive (HSE)

[6] CSB's investigation of this incident is ongoing.
[7] CSB's investigation of this incident is ongoing.
[8] A high-level alarm is triggered at or above the normal fill level and is intended to allow time for shutoff or diversion of flow before the safe fill level is reached. A high-high level alarm is located at or above the safe-fill level and is intended to allow time for shutoff or diversion of flow before the overfill level is reached.
[9] Johnson, M. "The potential for vapor cloud explosions - Lessons from the Buncefield incident." *Journal of Loss Prevention in the Process Industries*. 23(6): 921-927. November 2010.

issued recommendations[10] requiring a risk assessment of ASTs based on Layer of Protection Analysis (LOPA) and automatic level alarms with a redundant level measurement system for storage facilities that meet higher risk criteria.

Both of these incidents demonstrate the catastrophic hazard potential of atmospheric storage tanks not currently subject to the requirements of the PSM standard.

The CSB also does not believe there is a meaningful distinction between tanks used for "storage" versus those used for "processing" in terms of catastrophic hazard potential. Again, we have seen catastrophic accidents in both types of situations. Since all tanks could essentially be used for some incidental separation processes, all tanks should be covered. We discourage OSHA from introducing this concept into the PSM standard.

Issue Areas 2 & 3: Oil- and Gas- Well Drilling and Servicing; Oil- and Gas- Production Facilities

The catastrophic release potential of oil and gas facilities justifies their inclusion under OSHA's Process Safety Management regulation. In addition, high rates of worker injuries and fatalities within this sector[11] suggest that PSM requirements are urgently needed. Therefore, the CSB urges OSHA to both eliminate the PSM exemption for oil- and gas-well drilling and servicing operations (at 1910.119(a)(2)(ii)) and to proceed with the economic analysis necessary to enforce PSM at oil and gas well drilling and servicing and oil and gas production facilities.

The CSB has collected data on multiple incidents related to oil and gas drilling, servicing, and production facilities. The CSB found 1,285 incidents[12] between 2009 and February 2014 resulting in injury, fatality to a worker, evacuation or shelter in place of more than 500 residents, facility impact of more than $500K, and/or acute environmental damage (See Table 1 below). 8 percent (103) occurred in the oil and gas sector. Drilling and extraction activities (NAICS codes 211112 and 213111) resulted in approximately 2 percent (20) of the high consequence incidents during the five year period. Similarly, oil and gas support activities accounts for another 2 percent (25) of incidents.

Table 1: Oil and Gas Incidents, 2009 - February 2014

NAICS Code	#	%
213112 - Support Activities for Oil and Gas	25	1.95
238910 - Site Preparation Contractors	13	1.01
237120 -Oil and Gas Pipeline and Related Structures	11	0.86
211112 - Natural Gas Liquid Extraction	5	0.39

[10] Buncefield Major Incident Investigation Board Report, *Recommendations on the design and operation of fuel storage sites*. March 29, 2007.
[11] Society of Petroleum Engineers. 2005. "Strategic direction for reducing fatal oil and gas industry incidents," *Journal of Petroleum Technology* 57(7): 66-68. *See also* CSB Case Study, "Hot work control and safe work practices at oil and gas production wells." Report No. 2006-07-I-MS. Available at: http://www.csb.gov/assets/1/19/Partridge_Report1.pdf.
[12] Incident data were obtained from screening records comprising of media reports compiled by the CSB. Not all incidents were verified beyond the information presented in the media report.

213111 - Drilling Oil and Gas Wells	20	1.56
211111 - Crude Petroleum and Natural Gas	29	2.26
Total Oil and Gas Sector Incidents	103	8.03
Total high consequence incidents*	1,285	
*High consequence incidents result in injury or fatality to a site worker or member of the public, evacuation or shelter in place of more than 500 residents, acute environmental damage and/or facility impact of more than $500K.		

A number of incidents in the oil and gas producing and servicing sector that the CSB has investigated serve to illustrate the hazards posed by these facilities. Although the work activity varied, PSM coverage would have required assessing and taking appropriate measures to control identified hazards prior to conducting the work. Incidents include:

- The March 4, 1998, catastrophic vessel failure and fire at an oil exploration site near Pitkin, Louisiana, owned by Sonat Exploration Company.[13] Four workers were killed, and the facility sustained significant damage. The vessel lacked a pressure relief system and ruptured due to overpressurization during start-up, releasing flammable material which ignited. The CSB investigation identified a number of causal factors related to PSM elements, including failure to conduct effective process hazard analyses, failure to gather adequate process safety information, insufficient standard operating procedures, and inadequate training of employees and contractors.

- The June 5, 2006, explosion and fire at the Partridge-Raleigh Oilfield in Raleigh, Mississippi.[14] Three contractors died and one contractor suffered serious injuries when welding sparks ignited flammable vapor, triggering the explosion. The CSB concluded that safe hot work practices had not been followed during the welding activities, such as obtaining a written hot work permit that would have required isolation of the equipment from any tanks or piping containing flammables, the use of appropriate flammable gas testing and sufficient employee training.

- The October 19, 2008, explosion at MAR Oil in La Rue, Ohio.[15] One worker and a member of the public were fatally injured when an oil production tank exploded during a hot work operation. The worker did not monitor the tank atmosphere for flammable gases prior to conducting hot work.

- The May 21, 2012, explosion at the Long Brothers oil production facility in El Dorado, Arkansas.[16] Three workers were fatally injured while conducting hot work to remove a catwalk from an oil production tank in El Dorado, AR. Similar to Partridge-Raleigh and

[13] CSB Investigation Report, "Catastrophic Vessel Overpressurization: Sonat Exploration Company." Report No. 1998-02-I-LA. Available at: http://www.csb.gov/assets/1/19/Final_Report.pdf.
[14] CSB Case Study, "Hot work control and safe work practices at oil and gas production wells." Report No. 2006-07-I-MS. Available at: http://www.csb.gov/assets/1/19/Partridge_Report1.pdf..
[15] CSB Safety Bulletin, "Seven key lessons to prevent worker deaths during hot work in and around tanks." Report No. 2009-01-SB. Available at: http://www.csb.gov/UserFiles/file/CSB%20Hot%20Work%20Safety%20Bulletin%20EMBARGOED%20until%2010%20a_m_%203_4_10%281%29.pdf.
[16] The CSB's investigation of this incident is ongoing.

MAR Oil, the three oil field workers did not assess and control the hazards posed by conducting hot work on a tank containing flammable vapors.

One ubiquitous hazard that the CSB has encountered in the Oil and Gas Well Drilling and Servicing facilities is hot work type activities where explosions and fires occur from the ignition of flammable vapors in a confined area, such as a tank, typically during maintenance. As renowned process safety expert Dr. Trevor Kletz noted: "Errors in the preparation of equipment for maintenance are one of the commonest causes of serious accidents in the chemical and allied industries."[17] For this reason, such activities must always be performed under a permit to work system. The advantages of employing such a system are two-fold:

1) A permit provides a checklist for the worker preparing the equipment and this reduces the chance that any part of the procedure will be missed.
2) The permit informs the workers carrying out the repair, modification or inspection of the hazards that are present and the precautions that need to be taken.

The CSB notes that hot work conducted on PSM processes mandate the use of permits while OSHA's welding, cutting and brazing standard (29 CFR 1910.252) only recommends the use of such permits. Thus eliminating the PSM exemption for oil and gas well drilling, production and servicing activities will require the use of permits for all hot work activities in these sectors helping to control this ubiquitous hazard.

Following the CSB's investigation of the March 4, 1998 catastrophic vessel failure and fire at the Sonat oil and gas production facility, the CSB recommended that the American Petroleum Institute (API) "issue recommended practice guidelines governing the safe start-up and operation of oil and gas production facilities." In response, API issued the first edition of API Recommended Practice 74: *Recommended Practice for Occupational Safety for Onshore Oil and Gas Production Operation* in October 2001. Unfortunately, despite the existence of this guidance, serious incidents continue to occur at oil-and gas- production facilities, which suggests that voluntary guidance is insufficient to address the catastrophic hazard potential posed by these sites. The CSB encourages OSHA to analyze its own data on oil and gas related NAICS codes to further understand the scope and magnitude of the hazards posed at these facilities both before and after issuance of industry guidelines.

Issue Areas 4 and 5: Expanding PSM Coverage and Requirements for Reactivity Hazards; and Updating the List of Highly Hazardous Chemicals in Appendix A of the PSM Standard

The CSB strongly urges OSHA to update the PSM standard to expand coverage and requirements for reactivity hazards. The CSB's study, *Improving Reactive Hazard Management,*[18] released in September 2002, identified 167 serious incidents in the United States between January 1980 and June 2001 involving uncontrolled chemical reactivity. Forty-

[17] Kletz, T., "Hazards in Chemical System Maintenance: Permits", *Safety and Accident Prevention in Chemical Operations*, 2nd ed. Fawcett & Wood, eds. New York, NY: John Wiley & Sons, 1982. Chapter 36, page 807.
[18] CSB Hazard Investigation, "Improving Reactive Hazard Management." Report No. 2001-01-H. October 8, 2002. Available at: http://www.csb.gov/assets/1/19/ReactiveHazardInvestigationReport.pdf.

eight of these incidents resulted in 108 fatalities. The CSB also found that more than half of these incidents involved chemicals that were not covered by OSHA's Process Safety Management (PSM) standard or EPA's Accidental Release Prevention Requirements (40 CFR 68).

As a result of the study, the CSB issued a detailed recommendation to OSHA to amend the PSM standard "to achieve more comprehensive control of reactive hazards that could have catastrophic consequences." Unfortunately, that recommendation has yet to be implemented by OSHA. We reproduce the text of that recommendation here, and urge OSHA to address all elements of this recommendation as part of the rulemaking now under consideration.

CSB Recommendation No. 2001-1-H-R1:

Amend the Process Safety Management Standard (PSM), 29 CFR 1910.119, to achieve more comprehensive control of reactive hazards that could have catastrophic consequences.

- *Broaden the application to cover reactive hazards resulting from process-specific conditions and combinations of chemicals. Additionally, broaden coverage of hazards from self-reactive chemicals. In expanding PSM coverage, use objective criteria. Consider criteria such as the North American Industry Classification System (NAICS), a reactive hazard classification system (e.g., based on heat of reaction or toxic gas evolution), incident history, or catastrophic potential.*
- *In the compilation of process safety information, require that multiple sources of information be sufficiently consulted to understand and control potential reactive hazards. Useful sources include:*
  - *Literature surveys (e.g., Bretherick's Handbook of Reactive Chemical Hazards, Sax's Dangerous Properties of Industrial Materials).*
  - *Information developed from computerized tools (e.g., ASTM's CHETAH, NOAA's The Chemical Reactivity Worksheet).*
  - *Chemical reactivity test data produced by employers or obtained from other sources (e.g., differential scanning calorimetry, thermogravimetric analysis, accelerating rate calorimetry).*
  - *Relevant incident reports from the plant, the corporation, industry, and government.*
  - *Chemical Abstracts Service.*

- *Augment the process hazard analysis (PHA) element to explicitly require an evaluation of reactive hazards. In revising this element, evaluate the need to consider relevant factors, such as:*
  - *Rate and quantity of heat or gas generated.*
  - *Maximum operating temperature to avoid decomposition.*
  - *Thermal stability of reactants, reaction mixtures, byproducts, waste streams, and products.*
  - *Effect of variables such as charging rates, catalyst addition, and possible contaminants.*
  - *Understanding the consequences of runaway reactions or toxic gas evolution.*

Since issuing its reactive hazard investigation study in 2002, the CSB has continued to learn of industrial accidents involving reactive chemicals. The agency has investigated several of these incidents, including:

- the October 31, 2002, fire and explosion at the First Chemical Corporation facility in Pascagoula, Mississippi which injured two and caused significant offsite property damage,[19]
- the April 12, 2004, toxic release at MFG Chemical in Dalton, Georgia, which forced a community evacuation of nearly 200 families and necessitated decontamination of 154 people[20]
- the July 31, 2007, explosion at Synthron, LLC in Morganton, North Carolina,[21] which killed one worker, injured 14, destroyed the facility, and caused offsite property damage,
- the December 19, 2007 explosion and fire at T2 Laboratories in Jacksonville, Florida,[22] which killed four workers, injured 32 people, destroyed the facility, and caused offsite property damage,
- the August 28, 2008, explosion and fire at the Bayer CropScience facility in Institute, West Virginia,[23] which killed two, injured eight, and could have led to a catastrophic release of toxic methyl isocyanate, and
- the April 17, 2013, fire and explosion at the West Fertilizer facility in West, Texas, which killed fourteen, injured hundreds, and destroyed much of the surrounding community.

The CSB's study found that 70 percent of reactive incidents occurred in the chemical manufacturing industry, with the remainder occurring in other industrial sectors that store, handle or use chemicals in bulk quantities. That runaway chemical reactions can occur in both chemical reactors and storage warehouses is indicative of the challenge in regulating reactive chemical hazards. Reactive chemical hazards cannot be associated with any one chemical class, type of equipment, or industry sector; therefore, reliance upon a list of chemicals is an inadequate approach for regulatory coverage of reactive hazards. Improving reactive hazard management requires that both regulators and industry address the hazards from combinations of chemicals and process-specific conditions rather than focus exclusively on the inherent properties of individual chemicals.

When OSHA promulgated the PSM rule, the agency selected reactive chemicals from an existing list of chemicals identified and rated by the National Fire Protection Association with the two highest instability ratings ("3" or "4" on a scale of 0 to 4.)[24] Yet, only 10% of the 167 incidents identified in the CSB's 2002 study involved chemicals with the two highest ("3" or 4") instability ratings. In fact, 60% of the incidents involved chemicals either not rated by NFPA for reactivity, or listed as presenting "no special hazard" (rating of "0").

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[19] CSB Investigation Report, "Explosion and Fire: First Chemical Corporation." Report No. 2003-01-I-MS. October 15, 2003. Available at: http://www.csb.gov/assets/1/19/First_Report.pdf.
[20] CSB Investigation Report, "Toxic Chemical Vapor Cloud Release: MFG Chemical, Inc." Report No. 2004-09-I-GA. April 11, 2006. Available at: http://www.csb.gov/assets/1/19/MFG_Report.pdf.
[21] CSB Case Study, "Runaway Chemical Reaction and Vapor Cloud Explosion: Synthron, LLC." Report No. 2006-04-I-NC. July 31, 2007. Available at: http://www.csb.gov/assets/1/19/Synthron_Final_Report1.pdf.
[22] CSB Investigation Report, "T2 Laboratories, Inc. Runaway Reaction." Report No. 2008-3-I-FL. September 15, 2009. Available at: http://www.csb.gov/assets/1/19/T2_Final_Copy_9_17_09.pdf.
[23] CSB Investigation Report, "Pesticide Chemical Runaway Reaction; Pressure Vessel Explosion: Bayer CropScience, LP." Report No. 2008-08-I-WV. January 20, 2011. Available at: http://www.csb.gov/assets/1/19/Bayer_Report_Final.pdf.
[24] OSHA relied on the 1975 edition of NFPA 49: *Hazardous Chemicals Data*.

The CSB is aware that when OSHA was considering rulemaking in the late 1990s and early 2000s to revise the PSM standard to address reactivity hazards,[25] the agency considered adding additional chemicals with reactive potential to the highly hazardous chemicals listed in Appendix A. For example, a draft Advanced Notice of Proposed Rulemaking circulated in late 1997 (although never officially issued) suggested that OSHA was considering adding chemicals with NFPA instability ratings of "2", and also those chemicals rated "3" or "4" (including ammonium nitrate) that were not selected for addition when the standard was promulgated.[26] While such an approach would expand the number of substances regulated by the standard, NFPA instability ratings should not be used as the sole basis for determining coverage of reactive hazards under the PSM standard.

The Center for Chemical Process Safety's (CCPS's) October 2003 publication, *Essential Practices for Managing Chemical Reactivity Hazards,*[27] produced pursuant to a recommendation from the CSB's study,[28] provides valuable guidance for identifying reactive hazards at facilities and managing these hazards throughout the life of the facility; however, utilization of this guidance is voluntary, and the document is not a consensus standard. OSHA could, however, use this guidance in promulgating requirements for reactive hazards covered by the PSM standard.

The New Jersey's Toxic Catastrophic Prevention Act (TCPA)[29] uses a different approach to regulating reactive chemicals that the CSB urges OSHA to consider. The TCPA program utilizes both a list of individual chemicals considered inherently reactive and a list of chemicals with "functional groups" that may become reactive when mixed with one or more substances in a process vessel. The program also establishes coverage based on the aggregate quantities onsite, not in individual processes.

The National Fire Protection Association's NFPA 400: *Hazardous Materials Code* has also been proposed as a possible model for the management of reactive hazards, and the CSB does not believe that exclusive reliance upon this standard is sufficient to protect workers. Although the standard provides good guidance for managing reactive hazards once they are identified, it does not provide clear guidance on how to identify whether a substance may present a reactive hazard. To make such a determination, an operator must rely on the information provided on safety data sheets or consult outside resources (e.g. literature surveys, computerized tools, available chemical reactivity test data, and relevant incident reports.) As the CSB's 2002 study

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[25] See the entry for RIN No. 1218-AB63 at 64 FR 64622, November 22, 1999. OSHA withdrew plans for this rulemaking "due to resource constraints and other priorities" on September 24, 2001. See 66 FR 61882-3, December 3, 2001.)

[26] See CONSAD Research Corporation's Draft Interim Report, prepared under contract for DOL/OSHA, entitled "Analytical Support and Data Gathering for an Economic Analysis of the Addition of Selected Reactive Chemicals within the Scope of the OSHA Process Safety Management Standard." December 15, 1998. Available in OSHA Docket OSHA-S026B-2006-0661 at: http://www.regulations.gov/#!documentDetail;D=OSHA-S026B-2006-0661-0001.

[27] Johnson, Robert. W.; Rudy, Steven W.; Unwin, Stephen D. (2003). *Essential Practices for Managing Chemical Reactivity Hazards*. Center for Chemical Process Safety/AIChE. Available at: http://www.knovel.com/web/portal/browse/display?_EXT_KNOVEL_DISPLAY_bookid=898&VerticalID=0.

[28] See CSB Recommendation No. 2001-1-H-R6 to the CCPS. In June 2004, the Board voted to designate this recommendation with the status "Closed- Exceeds Recommended Action" based on CCPS's publication of this guidance and pursuance of additional actions promoting reactive hazard management.

[29] NJ Stat. Ann. §§13:1K-19 to -35. Signed January 8, 1986.

also noted, chemical reactivity testing data is not readily available, and no publicly available database exists that allows the sharing of reactive chemical test data or reactive chemical incident reports. Based on this finding, the Board recommended that two chemical industry trade associations, the American Chemistry Council (ACC) and the Society of Chemical Manufacturers and Affiliates (SOCMA), collaborate with the National Institute for Standards and Technology (NIST) to "develop and implement a publicly available database for reactive hazard test information" structured to "encourage submission of data by individual companies and academic and government institutions that perform chemical testing."[30] To date, these recommendations have not been implemented.

The Board also recommended that ACC and SOCMA "develop and implement a program for reporting reactive incidents that includes the sharing of relevant safety knowledge and lessons learned with your membership, the public, and government to improve safety system performance and prevent future incidents." Similarly, the Board issued the following recommendation to OSHA:

CSB Recommendation No. 2001-1-H-R2:

Implement a program to define and record information on reactive incidents that OSHA investigates or requires to be investigated under OSHA regulations. Structure the collected information so that it can be used to measure progress in the prevention of reactive incidents that give rise to catastrophic releases.

The Board urges OSHA to collaborate with industry in both of these areas, and again urges OSHA to consider its second recommendation to OSHA out of its 2002 study. The CSB maintains that implementing this recommendation, in conjunction with conducting rulemaking in accordance with CSB Recommendation No. 2001-1-H-R1 (reproduced above), would improve reactive hazard management and thereby promote the safety of workers.

Lastly, the CSB strongly recommends that OSHA establish a formal mechanism within the PSM standard to add to the list of highly hazardous chemicals, or change the threshold quantity of a highly hazardous chemical, without the need for extensive rulemaking that allows changes to be made in other aspects of the standard. Such a mechanism could be similar to the petition process (see 40 CFR 68.120) that EPA developed for changes to its Chemical Accident Prevention Regulations.

[30] See CSB Recommendation Nos. 2001-1-H-R10 and R14. In March 2008, the Board voted to designate CSB Recommendation No. 2001-1-H-R5 (to NIST) with the status "Closed- Reconsidered", because NIST expressed general support for the intent of the recommendation but was unable to implement it as envisioned by the Board due to legal and financial obstacles.

Issue Area 6: Revising the PSM Standard to Require Additional Management System Elements

The CSB supports OSHA's consideration of incorporating additional management system elements into the PSM standard, and agrees with OSHA that the Center for Chemical Process Safety's *Guidelines for Risk Based Process Safety* includes additional elements whose adoption into the PSM could promote worker safety.

Metrics

One essential management system element described by CCPS and highlighted in OSHA's RFI is the use of "Measurement and Metrics." The CSB encourages OSHA to require the reporting of leading and lagging process safety indicators to promote a culture of continuous improvement in the PSM-regulated community.

A key finding of the CSB's investigation of the March 23, 2005 fire and explosions at the BP Texas City refinery, which resulted in 15 deaths, 180 injuries, and significant economic losses,[31] was that the oil refining and chemical industry sectors did not have an effective system of indicators in place to both evaluate performance and promote the continuous improvement of management of process safety risks. Instead, the company and industry sectors were relying on personal safety indicators (i.e. data regarding "slips, trips, and falls") rather than on indicators that could be used to prevent catastrophic incidents. In some instances, the company collected information that could serve as process safety indicators, but the data were not systematically used to drive performance improvements. The CSB's investigation further concluded that standardized and demonstrably effective process safety indicators were not available in the refinery and petrochemical industries as a whole and emphasized in particular the preventative impact of leading performance metrics. Moreover, the investigation found that public reporting of the performance of the firms and individual sites in the area of process safety was extremely weak or non-existent.

Based on these findings, the Board recommended that the American Petroleum Institute (API) and the United Steelworkers of America (USW) jointly lead the development of an American National Standards Institute (ANSI) voluntary consensus standard for leading and lagging process safety indicators for refining and petrochemical industries.[32] Ultimately, the USW

[31] See CSB Investigation Report, "Refinery Explosion and Fire: BP Texas City." Report No. 2005-04-I-TX. March 20, 2007. Available at: http://www.csb.gov/assets/1/19/CSBFinalReportBP.pdf.

[32] CSB Recommendations 2005-4-I-TX-R6A and R6B, to the API and USW, respectively, read as follows: "*Work together to develop [a] consensus American National Standards Institute (ANSI) standard[ ] In the first standard, create performance indicators for process safety in the refinery and petrochemical industries. Ensure that the standard identifies leading and lagging indicators for nationwide public reporting as well as indicators for use at individual facilities. Include methods for the development and use of the performance indicators. In the development of each standard, ensure that the committees*

a. *are accredited and conform to ANSI principles of openness, balance, due process, and consensus;*
b. *include representation of diverse sectors such as industry, labor, government, public interest and environmental organizations and experts from relevant scientific organizations and disciplines."*

withdrew from the standards development process;[33] however, API proceeded and in April 2010, issued Recommended Practice (RP) 754: *Process Safety Performance Indicators for the Refining and Petrochemical Industries*.

Though the Board has significant reservations about the current edition of RP 754 that have precluded closure of these recommendations,[34] the document is significant in its establishment of the collection and use of both leading and lagging indicator data to promote process safety across broad industry sectors. Therefore, an examination of the strengths and weaknesses of the RP may inform OSHA's efforts with regard to process safety indicators.

The Board appreciates that RP 754 created a useful framework of four tiers of indicators (Tiers 1 and 2 for "lagging" indicators; Tiers 3 and 4 for "leading" indicators). The RP also established public reporting requirements[35] for standardized and normalized Tiers 1 and 2 data which will likely provide valuable national measures of industry performance. The Board also appreciates that the RP calls for the collection of data about contract workers, which is highly significant since as much as 50% of the workforce in these sectors may be comprised of contract workers who often work during high-risk periods (e.g. start-ups and shutdowns.)

Unfortunately, the RP also has significant shortcomings which we urge OSHA to seriously consider in the development of any process safety indicators reporting system.

First, RP 754 fails to address the central issue of the statistical validity and power of its proposed indicators. Though there are public reporting requirements for standardized and normalized Tier 1 and Tier 2 indicators, recently published research[36] indicates the number of incidents and events reported are likely to be too small to provide effective performance indicators for individual sites or possibly most companies. Concomitantly, the Tier 3 and 4 indicators are not standardized or normalized, nor are there clear public reporting requirements for these indicators. These factors will seriously limit their effectiveness in assessing and improving industry performance.

As the CSB's recommendations communicated, the CSB believes strongly that the development of process safety indicators and the reporting system to be utilized *must* be achieved via a consensus process involving a balanced group of stakeholders from industry, labor, government, public interest and environmental organizations, and experts from relevant scientific organizations and disciplines. Even before the withdrawal of the USW from the process, the composition of the RP 754 committee was far too heavily weighted towards industry representatives. The committee also lacked representatives from civic or community leaders, regulatory agencies or environmental groups. Moreover, the committee did not include

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[33] *See* USW Press Release: "USW Withdraw from Talks with American Petroleum Institute, Oil Industry." August 4, 2009. Available at: http://www.usw.org/news/media-center/releases/2009/usw-withdraw-from-talks-with-american-petroleum-institute-oil-industry.

[34] The Board designated CSB Recommendations 2005-4-I-TX-R6A and R6B with the status "Open-Acceptable Response" on June 27, 2012 and February 7, 2013, respectively. A summary of the Board's decision is available at: http://www.csb.gov/assets/recommendation/SCS_Indicators1.pdf.

[35] Conformance with RP 754 is voluntary; therefore, only parties who claim to be in conformance with the standard are obligated to conform its requirements.

[36] J. Mendeloff, B. Han, L.A. Fleishman-Mayer and J.V. Vessely. "Evaluation of process safety indicators collected in conference with ANSI/API Recommended Practice 754." *Journal of Loss Prevention in the Process Industries*. November 2013. 26(6): pp. 1008-1014.

expertise from relevant scientific disciplines (e.g., statistics or epidemiology) or other relevant expertise (e.g., senior managers, risk communicators, legal experts).

The CSB is also concerned that the indicator definitions in RP 754 fail to comprehensively count and report a sizeable number of events that could reasonably be considered to be predictors of serious process failures, such as loss of containment events that do not exceed thresholds because control systems functioned effectively, and "routine emissions that are allowable under permit or regulation." This represents another missed opportunity to collect data useful for improving process safety performance.

Finally, the CSB believes that the public can play an important role in monitoring safety management systems and promoting industry accountability for process safety performance. As CCPS noted in its *Guidelines for Process Safety Metrics:*

> Sharing performance metrics and results broadly can engage the public as a partner in holding the organization accountable for process safety performance. Making metrics and performance public can be an especially powerful way of maintaining upper management commitment since it will likely be the CEO or other senior managers who will be called to account by the public if goals are not met or performance declines.

When the CSB recommended as part of its interim report on the August 6, 2013, fire at the Chevron Richmond Refinery[37] that the state of California identify and require the state's oil refineries to report leading and lagging process safety indicators, the agency also called for public reporting of indicators in order to promote accountability. Public reporting of metrics also provides an opportunity for high-performing facilities to demonstrate commitment to improving or maintaining good performance.

Stop Work Authority

The CSB believes that workforce involvement is a key element of improving process safety and accident prevention. As CCPS's *Guidelines for Risk Based Process Safety* notes:

> [W]orkers 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 experience.

Because of the high hazards present in PSM-regulated facilities, the CSB supports OSHA's consideration of the development and implementation of a stop work authority that authorizes workers to stop work where they identify imminent risks or dangerous activities. We would emphasize, however, that stop work authority is a less effective measure for incident prevention than good preplanning, and that its success is contingent upon the existence of a "culture of safety" wherein workers are encouraged and empowered to advocate for their safety on the job. As the CSB noted during our investigation of the February 23, 1999 crude unit fire at the Tosco Avon refinery,[38] stop work authority must often be exercised when pressures to get a job

[37] CSB Interim Investigation Report, "Chevron Richmond Refinery Fire." Report No. 2012-03-I-CA. Issued April 19, 2013. Available at: http://www.csb.gov/assets/1/19/Chevron_Interim_Report_Final_2013-04-17.pdf.

[38] CSB Investigation Report, "Refinery Fire Incident: Tosco Avon Refinery." Report No. 99-014-I-CA. March 28, 2001. Available at: http://www.csb.gov/assets/1/19/Tosco_Final_Report.pdf.

completed are significant, and delays may result in significant financial costs to the facility. In an environment where production pressures trump safety, this authority is often of limited value.

To ensure workforce participation and ensure the use of a stop work authority, the CSB urges OSHA to strengthen existing whistleblower protections. We believe that provisions consistent with those outlined in the 2013 Protecting America's Workers Act[39] (PAWA) would go a long way in protecting workers from retaliation for reporting unsafe work conditions or for cooperating with workplace audits or accident investigations.

Inherent Safety and the Hierarchy of Controls

The CSB encourages OSHA to consider mandating evaluations for inherent safety as an additional management system element when revising the PSM standard. We offer two examples from our investigation history which support inclusion of such a requirement:

- In 2008, an explosion at the Bayer CropScience facility in Institute, West Virginia, resulted in the deaths of two employees, a fire within the production unit, and extensive damage to nearby structures. Debris from the blast hit a shield surrounding the methyl isocyanate (MIC) storage tank. Although the tank was not damaged, the CSB investigation[40] determined that debris could have struck the relief valve vent pipe and caused a release of MIC to the atmosphere. As the National Research Council noted in the aftermath of the incident, however, Bayer had not performed a complete inherent safety assessment on the MIC manufacturing process, which could have resulted in a reduction or elimination of the MIC inventory and therefore a significant reduction in catastrophic risk potential. [41]
- In 2010, an explosion at the Kleen Energy power plant then under construction in Middletown, Connecticut, resulted in 6 deaths, at least fifty injuries, and significant economic impacts.[42] The incident occurred during an operation known as a "gas blow", whereby significant quantities[43] of flammable natural gas are forced through piping at high pressure and velocity to remove debris that may have accumulated during construction. The CSB found that although gas blows are commonly used in the power generation industry, the practice presents an inherent fire and explosion hazard, and safer, non-flammable methodologies are ready available and equally efficient.

While the PSM standard contains fourteen mandatory elements to proactively identify, evaluate, mitigate or prevent chemical releases of highly hazardous chemicals, it does not contain an element for determining whether or not there are safer options available for processing and/or using the highly hazardous chemicals. One approach to ensuring the identification and utilization of safer options is to require PSM-regulated entities to consider the entire hierarchy of

[39] See S.665 and H.R. 1648. 113th Congress (2013-2014).
[40] CSB Investigation Report, "Pesticide Chemical Runaway Reaction; Pressure Vessel Explosion." *Ibid*.
[41] National Research Council. *The Use and Storage of Methyl Isocyanate (MIC) at Bayer CropScience*. Washington, DC: National Academies Press, 2012: page 136.
[42] CSB Urgent Recommendations: Kleen Energy. Report No. 2010-07-I-CT. June 28, 2010. Available at: http://www.csb.gov/assets/1/19/KleenUrgentRec.pdf.
[43] The natural gas involved in this incident was not used as a process fuel; therefore, the process was not exempted from PSM per the "fuel exemption" at §1910.119(a)(1)(ii)(A). The process was not, however, subject to the requirements of the PSM standard because it did not contain the required threshold quantity of 10,000 pounds of flammable gas at any time.

hazard controls. This hierarchy is composed of four tiers of controls: inherent, passive, active and procedural. Currently, PHAs conducted to satisfy PSM focus on only the passive, active and procedural tiers; there is no requirement to evaluate the inherent tier. The inherent approach to hazard control is to minimize or eliminate the hazard rather than accepting the existence of hazards and designing safety systems to control them.

Four strategies need to be considered in attempting to make a process inherently safer:

- Substitution – Are there materials, chemistry or processes that can be used that are less hazardous than the current process?
- Minimization – Is the smallest quantity of hazardous material being used in the process?
- Moderation – Can we reduce hazards using dilution, refrigeration, process alternatives or distance?
- Simplification – Can we eliminate unnecessary complexity and design "user friendly" plants?

As the National Research Council noted in its study on the use and storage of MIC at Bayer CropScience,[44] the inherent safety approach can be applied at all stages of the life cycle in the manufacturing plant. In addition to evaluating for inherent safety during the initial process design review, the Council noted that inherent safety can also be reviewed in a number of ongoing PSM activities, such as management of change, incident investigation, pre-startup safety reviews, operating procedures and training, Moreover, the study also noted that a number of decision aids are available for assisting plants in analyzing whether or not proposed inherent safety alternatives are viable. Thus OSHA should require inherent safety evaluations when revising the PSM standard and list the National Research Council study as a mandatory reference in Appendix D.

Process Hazard Analysis Requirements

a. Damage Hazard Mechanism Reviews

The CSB urges OSHA to consider revising Paragraph (e) of the PSM standard (Process Hazard Analysis, at §1910.119(e)) to explicitly require conduct of a documented damage mechanism hazard review to identify and evaluate damage mechanisms that may affect covered processes. Sometimes referred to as a corrosion review, a damage mechanism hazard review analyzes risks presented by process failure mechanisms, such as corrosion and cracking. It is intended to ensure that all potential hazards caused by process conditions, process materials, and external mechanisms, are properly identified and analyzed, and that systems are put in place to control or eliminate identified hazards.

The CSB concluded that the August 6, 2012, fire at the Chevron Richmond Refinery was caused by the catastrophic failure of piping due to sulfidation corrosion, a common damage mechanism in refineries. A Process Hazard Analysis (PHA) was conducted in accordance with California's Process Safety Management regulation; however, corrosion was *not* identified as a

[44] National Research Council. *The Use and Storage of Methyl Isocyanate (MIC) at Bayer CropScience*. *Ibid,* pp. 65-67.

potential cause of a leak or rupture in the piping. Although Chevron has significant expertise with regard to sulfidation corrosion, California's PSM standard did not explicitly require conduct of a damage mechanism hazard safety review and the CSB found that Chevron PHA teams do not typically seek assistance from corrosion experts. Therefore, damage mechanisms were only identified and appropriate safeguards implemented when the PHA team happened to have knowledge of the mechanism. As a result, many damage mechanisms which occur in various processes are not properly addressed.

b. Evaluation of Controls

The CSB encourages OSHA to explicitly require regulated entities to both evaluate and document the technical basis for and sufficiency of the controls selected to safeguard against identified hazards as part of a Process Hazard Analysis.

At present, Paragraph (e) requires that a PHA address the "controls applicable to the hazards and their interrelationships" (at (3)(iii)) and the "consequences of failure" of these controls (at (3)(iv)), and also requires "a qualitative evaluation of a range of possible safety and health effects of a failure of controls on employees in the workplace" (at (3)(vii). Paragraph (e) does not, however, explicitly require that regulated entity evaluate the effectiveness of the controls selected and document the basis(es) for concluding that the controls selected are sufficiently protective against the hazards identified.

A recognized methodology for consistently and objectively making these determinations could include the use of quantitative, semi-quantitative, or qualitative tools. The CSB's Interim Investigation report on the August 6, 2012, fire at the Chevron Richmond Refinery[45] identified Layer of Protection Analysis (LOPA) as one possible hazard analysis methodology that may be used to determine if sufficient safeguards are in place to protect against a particular hazard or accident scenario; in addition, California's Interagency Refinery Task Force (established following the August 6, 2012, incident) recommended LOPA as one of six prevention strategies for promoting refinery safety.[46] This methodology requires that the effectiveness of safeguards in place be proportionate to the severity of the potential consequences they are intended to prevent, and can help an organization decide whether the risk has been reduced to a level that is as low as reasonably practicable. LOPA may also be used as an organizational tool for implementing a facility's mechanical integrity program.

c. Siting and Human Factors

The CSB encourages OSHA to incorporate more explicit requirements for identifying, evaluating, and addressing facility siting and human factors issues during a process hazard analysis (per §1910.119(e)(3)(v) and (vi)). For example, the PHA methodologies listed in the PSM standard (at §1910.119(e)(2) are not easily adaptable to review of either of these issues, and OSHA should provide more guidance within the text of the regulation as to what methodologies should be utilized to evaluate these issues.

[45] CSB Interim Investigation Report, "Chevron Richmond Refinery Fire." *Ibid.*
[46] *Improving Public and Worker Safety at Oil Refineries: Report of the Interagency Working Group on Refinery Safety.* State of California, 2014. Available at: http://www.calepa.ca.gov/publications/Reports/2014/RefineryRpt.pdf.

The CSB has noted within several of its investigations that improper facility siting has contributed to significant worker injuries and deaths.

For example:

- The October 13, 2002, explosion in a chemical distillation tower at the First Chemical Corporation in Pascagoula, Mississippi,[47] knocked down three operators who were standing inside the unit control room, located only 50 feet away. All received cuts and abrasions from shattering glass, and one reported seeing a fireball move past the door. Several other buildings on site were also significantly damaged, including a nearby administration building.
- The August 19, 2004, explosion in an ethylene oxide sterilization chamber the Sterigenics facility in Ontario, California, resulted in four injuries and rendered the facility unusable. All injuries were caused by shattering glass in the control room, which was located 75 feet away.
- The March 23, 2005, explosions and fires at the BP Texas City refinery killed fifteen workers and injured 180; most of the victims were located in an around temporary office trailers that had been sited near a blowdown drum and stack open to the atmosphere as part of ongoing turnaround activities in an adjacent site. Forty-four trailers were damaged; thirteen were totally destroyed. In addition, workers were injured in trailers located as far as 479 feet away from the release.[48]
- The May 4, 2009, explosion and fire at Veolia ES Technical Solutions, in West Carrollton, Ohio,[49] damaged every structure on the site and injured four workers. The most severely injured workers were located in a lab/operations building located less than 30 feet from an operating unit. One worker in a control room was enveloped in a fireball and received first-degree burns; a second had his pelvis broken by falling personnel lockers.[50]
- The March 21, 2011, electric arc furnace explosion at the Carbide Industries facility in Louisville, Kentucky,[51] broke the double-pane reinforced glass window of a control room located only 12 feet away from the furnace. Two workers were fatally burned.

With regard to human factors, the CSB urges OSHA to incorporate requirements to manage human fatigue in high hazard facilities during the upcoming PSM revision process. A key finding of the CSB's investigation of the March 2005 explosions and fire at the BP Texas City Refinery was that operators were likely fatigued from working 12-hour shifts—some for as many as 29 consecutive days during the turnaround. This likely degraded their judgment and problem-solving skills and hindered their ability to detect the tower overflow during start-up that precipitated the explosions and fire. Following the incident, the CSB recommended that API and the USW collaborate to produce two ANSI standards applicable to the refining and petrochemical industries—one addressing process safety indicators (as discussed above), and

[47] CSB Investigation Report, "Explosion and Fire: First Chemical Corporation." *Ibid.*
[48] CSB Investigation Report, "Refinery Explosion and Fire: BP Texas City." *Ibid.*
[49] CSB Case Study, "Explosion and Fire in West Carrollton, Ohio. Veolia Technical Solutions, LLC." Report No. 2009-10-I-OH. July 21, 2010. Available at: http://www.csb.gov/assets/1/19/Veolia_Case_Study.pdf.
[50] M Kaszniak and D Holmstrom. 2008. "Trailer siting issues: BP Texas City." *Journal of Hazardous Materials* 159: 105-111.
[51] CSB Case Study, "Carbide Industries, LLC, Louisville, KY Electric Arc Furnace Explosion." Report No. 2011-05-I-KY. February 7, 2013. Available at: http://www.csb.gov/assets/1/19/Final_Report_small.pdf.

the other addressing fatigue prevention.[52] The USW withdrew from the standards development process; however, API proceeded and in April 2010, issued Recommended Practice (RP) 755: *Fatigue Prevention Guidelines for the Refining and Petrochemical Industries*.

Though the Board has yet to change the status of the CSB's recommendations, CSB staff have proposed that the Board vote to designate its recommendations to both parties with the status of "Open- Unacceptable Response" due to significant shortcomings about the current edition.[53] An examination of the strengths and weaknesses of the RP may inform OSHA's efforts with regard to fatigue. For example:

- A comprehensive fatigue risk management system must:
  - establish preventive limits on hours and days of work that are consistent with scientifically-established limits;
  - ensure sufficient staffing levels, and
  - establish management responsibility for the implementation of these and other measures for fatigue prevention.
- "Soft" or "personal" components of fatigue control, such as employee training and education on fatigue and effective rest and sleep techniques, and self-evaluation and reporting requirements may supplement (but not serve as the backbone of) a fatigue risk management system.
- As discussed above, requirements for managing human fatigue *must* be developed via a consensus process involving a balanced group of stakeholders from industry, labor, government, public interest and environmental organizations, and experts from relevant scientific organizations and disciplines.

The CSB notes that nearly all other high hazard occupations already have fatigue standards in place (e.g., airlines, railroads, trucking, nuclear, pipeline, etc.) so there are plenty of examples to draw upon for suggested regulatory language and justification. The fatigue standards issued by the Nuclear Regulatory Commission for nuclear power plants (10 CFR Part 26, Subpart I) and by Pipeline and Hazardous Materials Safety Authority (49 CFR Parts 192 and 195**)** for controlling fatigue in control rooms appear to have the most applicability to the chemical and refining sectors based on similarity of job tasks.

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[52] CSB Recommendations 2005-4-I-TX-R7A and R7B, to the API and USW, respectively, read as follows: *Work together to develop [a] new consensus American National Standards Institute (ANSI) standard[]. In the second standard, develop fatigue prevention guidelines for the refining and petrochemical industries that, at a minimum, limit hours and days of work and address shift work. In the development of each standard, ensure that the committees*

a. are accredited and conform to ANSI principles of openness, balance, due process, and consensus;

b. include representation of diverse sectors such as industry, labor, government, public interest and environmental organizations and experts from relevant scientific organizations and disciplines.

[53] The CSB plans to have a public meeting at which the Board will vote on the staff's evaluation; the date of that meeting has yet to be announced.

Issue Areas 7 and 8: Amending Paragraph (d) of the PSM Standard to Require Evaluation of Updates to Applicable recognized and generally accepted good engineering practices (RAGAGEP); and Clarifying the PSM Standard by Adding a Definition for RAGAGEP

The CSB advocates that the PSM standard should require employers to evaluate updates to applicable RAGAGEP (recognized and generally accepted good engineering practices) and to examine new RAGAGEP after evaluating and documenting compliance with either §1910.119(d)(3)(ii) or (iii). RAGAGEP is beneficial in that it requires operators to identify, develop, evaluate, and implement applicable standards, codes, regulations, and laws that affect process safety. However, RAGAGEP fails to require that operators evaluate updates to applicable RAGAGEP or to examine new RAGAGEP after evaluating and documenting compliance with either § 1910.119(d)(3)(ii) or (iii).[54] Given continual changes in the chemical sector, the consequences of a process safety incident, and the interaction of RAGAGEP with every element of PSM; OSHA should mandate that the PSM standard require the evaluation of updates applicable to RAGAGEP.

Failing to require operators to evaluate updates to applicable RAGAGEP after compliance with either § 1910.119(d)(3)(ii) or (iii) amounts to a static approach to oversight. This presents a significant concern as the chemical sector handles non-standard operations that are complex and constantly changing. These changes can be seen at the technical, organizational, and legal levels of the sector. Furthermore, this static approach prevents RAGAGEP from functioning as a performance-based regulation, which is OSHA's intent.[55] A key aspect of a performance-based regulation is its focus on continual improvement to meet the specified goal. In this instance, failing to require updates to applicable RAGAGEP fails to encourage continual improvement and therefore increases process risk.

The CSB has investigated accidents in which requiring evaluation of updates to certain RAGAGEP's could have prevented a process safety incident. A prime example was the propylene explosion at the Formosa Plastics facility in Point Comfort, TX, on October 6, 2005.[56] The incident occurred when a trailer being towed by a forklift snagged and pulled a small drain valve out of a strainer in a liquid propylene system. Escaping propylene rapidly vaporized, forming a large flammable vapor cloud. The vapor ignited, creating an explosion, which resulted in injuries to 16 individuals. The extensive damage shut down a process unit for 5 months. Had fireproofing materials been used on the steel structure supporting the pressure relief valves and emergency vent piping, the consequences of this incident would likely have been less severe. However, the designs for the unit were never updated to incorporate the latest RAGAGEP. The likelihood of these types of incidents can be significantly reduced if operators are required to evaluate updates to applicable RAGAGEP after compliance with either § 1910.119(d)(3)(ii) or (iii).

The chemical sector faces an infinite number of inherently hazardous situations which are complex and continually changing. RAGAGEP is intended to address these incidents through a performance-based approach to the regulation of process safety. Moreover, RAGAGEP's importance can be seen throughout the PSM standard as the usage of RAGAGEP in §

[54] See OSHA Request for Information (78 FR 73756, December 9, 2013)
[55] Process Safety Management of Highly Hazardous Chemicals; Explosives and Blasting Agents, 57 FR 6356 (to be codified at 29 C.F.R. pt. 1910).
[56] See CSB Case Study, "Fire at Formosa Plastics Corporation: Evaluating Process Hazards." Report No. 2006-01-I-TX. July 20, 2006. Available at: http://www.csb.gov/assets/1/19/Formosa_Report.pdf.

1910.119(d)(3) affects all other elements in the standard. The PSM standard's failure to require an evaluation of updates to RAGAGEPs is a significant concern. Such an approach contributes to an increase in process safety risk. Therefore, the PSM standard should require that operators evaluate updates to applicable RAGAGEP (recognized and generally accepted good engineering practices) and to examine new RAGAGEP after evaluating and documenting compliance with either § 1910.119(d)(3)(ii) or (iii).

Issue Area 9: Expanding the Scope of Paragraph (j) of the PSM Standard to Cover the Mechanical Integrity of Any Safety-Critical Equipment

Rather than using a list-based approach, the PSM standard should require companies to identify their safety critical equipment/elements (SCE) and demonstrate to the regulator that each SCE has a performance standard that addresses functionality, availability, reliability, survivability, and interactions with other systems as well as a verification scheme. A performance standard is a qualitative or quantitative statement that describes the required performance of an SCE in order to prevent or mitigate a major accident event and it applies throughout the SCE's lifecycle. The verification scheme, or assessment scheme, identifies those activities necessary to sustain the SCE in a suitable condition, including maintenance, inspection, and testing. A verification scheme should ensure the SCE performance is met by:[57]

1. Identifying those assurance activities, such as maintenance, inspection, and testing, which are required to sustain the SCE in a suitable condition;
2. Ensuring that assurance activities are carried out at the appropriate time by competent people;
3. Maintaining a record of these activities and any findings that arise; and
4. Addressing any deficiencies arising from assurance activities as soon as possible and taking any temporary measure that may be necessary to maintain risk ALARP until deficiencies have been recertified. Any temporary measures should be subject to review and comment by an independent competent person.

The regulator could provide a list of common suggested SCE and/or criteria for what constitutes a SCE to assist the company in ensuring all SCE are identified and managed.

Issue Area 10: Clarifying Paragraph (l) of the PSM Standard with an Explicit Requirement that Employers Manage Organizational Changes

The CSB strongly recommends that OSHA revise Paragraph (l) of the PSM Standard to incorporate an explicit requirement that Management of Change (MOC) Analyses be conducted for organizational changes (e.g., mergers, leadership changes, budget cuts, etc.) that may affect a PSM-covered process.

The CSB formally recommended that OSHA clarify this requirement following our investigation of the March 2005 fires and explosions at the BP Texas City Refinery, which killed 15 workers,

[57] *Guidelines for the Management of Safety Critical Elements*. 2nd ed. London, UK: Energy Institute, March 2007.

injured 180, and caused significant economic losses.[58] The CSB investigated the root and contributing causes of the incident and concluded that poorly managed corporate mergers, leadership and organizational changes, and budget cuts greatly increased the risk of catastrophic accidents at the site. The CSB found that although the need to manage organizational changes was recognized in several sets of good practices guidelines,[59] a 2002 survey indicated that only 41% of the MOC programs of U.S. chemical companies assessed the impact of organizational changes.[60]

Based on these findings, the Board issued CSB Recommendation No. 2005-04-I-TX-R9, which reads as follows:

"Amend the OSHA PSM standard to require that a management of change (MOC) review be conducted for organizational changes that may impact process safety including

a. major organizational changes such as mergers, acquisitions, or reorganizations;
b. personnel changes, including changes in staffing levels or staff experience; and
c. policy changes such as budget cutting."

To date, OSHA has not implemented this recommendation. OSHA informed the CSB that a revision to the PSM standard was unnecessary, since Paragraph (l) already requires covered facilities to manage changes that affect a covered process. OSHA also issued a memorandum to its Regional Administrators to "increase [Compliance Safety and Health Officer] awareness of potential sources of changes covered under the PSM standard", including organizational changes such as mergers, acquisitions, reorganizations, staffing changes, and budget revisions.[61]

While the CSB appreciates that the PSM standard is intended to be a performance standard as opposed to a list of prescriptive requirements, we remain concerned that the standard does not provide sufficient warning to the regulated community that they may be fined for failing to conduct MOC analyses for organizational changes. As noted in the *Meer* court decision: "An agency is bound by the regulation it promulgates and may not attempt to circumvent the amendment process through changes in interpretation unsupported by the language of the regulation." For this reason, the CSB remains concerned that citations issued for failure to conduct MOC analyses for organizational changes may not survive judicial scrutiny.

Meanwhile, additional CSB investigations have illustrated that the failure to manage significant organizational changes may increase the likelihood of catastrophic incidents. In investigating the April 2010 rupture of a heat exchanger at the Tesoro refinery in Anacortes, Washington,[62] the CSB found that the site had not conducted an MOC analysis pursuant to staffing changes for

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[58] See CSB Investigation Report, "Refinery Explosion and Fire: BP Texas City." *Ibid.*
[59] See, for example: Chemical Manufacturers Association, *Management of Safety and Health During Organization Change – A Resource Kit for Organizations Facing Change* (1998); UK Health and Safety Executive, *Organisational Change and Major Accident Hazards* (2003); and Canadian Society for Chemical Engineers, *Managing the Health and Safety Impacts of Organizational Change* (2004).
[60] Keen, West and Mannan, "Benchmarking MOC practices in the process industries," *Process Safety Progress*, 2002: 21(2): pp. 103-112.
[61] Memorandum for Regional Administrators, Subject: Management of Organizational Change. March 31, 2009. Available at: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=28628
[62] CSB's investigation of this incident is ongoing.

exchanger startup activities. This would appear to have been covered by the letter Federal OSHA sent to its regions that addressed coverage of organizational changes covered in procedures; however, it appears this letter was not sent or binding upon state plan OSHA states. Regulatory change at the federal level would have required the States to follow suit.

Issue Area 11: Revising Paragraph (n) of the PSM Standard to Require Coordination of Emergency Planning with Local Emergency-Response Authorities

The CSB strongly supports amending Paragraph (n) of the PSM standard to require coordination of facility emergency planning (including advance sharing of Safety Data Sheets) with local emergency-response authorities. We have found in a number of our investigations that workers, emergency responders, and members of the community have been killed, injured, or at risk of physical harm because of insufficient pre-emergency planning and coordination between facilities and local emergency response authorities. Examples include:

- The CSB investigated the April 12, 2004, release of allyl alcohol and allyl chloride resulting from a runaway chemical reaction at MFG Chemical, a specialty chemical manufacturer in Dalton, Georgia. As part of its investigation, the CSB found that the company had not sufficiently coordinated with local emergency-response authorities to insure incident preparedness, and as a result, local responders lacked appropriate personal protective equipment (PPE) and air monitoring equipment to safely enter the process area to stop the release or to carry out the evacuation order in the surrounding community. In addition, responding police and emergency medical personnel were overcome by toxic vapors and required medical treatment for respiratory distress and eye and skin irritation. The company had not sufficiently coordinated with local emergency-response authorities to insure a community notification system was in place and that community members were prepared to evacuate safely. As a result, more than a hundred community members were exposed to toxic vapors and required medical treatment, including five residents who were hospitalized overnight.
- The CSB investigated the October 5, 2006, explosions and fire at the EQ hazardous waste facility in Apex, North Carolina. As part of its investigation, the CSB found that the facility had not provided emergency responders with detailed information regarding the types, quantities, and location of hazardous materials on site. The facility was also unoccupied at the time and no emergency coordinator was on site to initiate the facility's emergency plan or assess the extent of the release or emergency.
- The CSB investigated the August 28, 2008, pesticide waste tank explosion at the Bayer CropScience facility in Institute, West Virginia. As part of its investigation, the CSB found that Bayer personnel did not provide local emergency response personnel with timely and reliable information regarding the status of the incident; as a result, responding personnel may have been exposed to toxic substances in performing their duties. This also negatively impacted the shelter-in-place decision making process.
- The CSB investigated three incidents within a 36-hour period at the DuPont facility in Belle, West Virginia, in late January 2010. One of these incidents involved the exposure and subsequent death of an employee sprayed with highly toxic liquid phosgene. Similar to the August 2008 Bayer CropScience investigation, which also occurred in WV's Kanawha Valley, CSB investigators found that DuPont personnel did not provide local emergency response authorities with sufficient and timely information regarding the nature of the emergency. Although this did not appear to delay the emergency response

efforts in this case, local emergency response authorities raised the need not only to ensure that emergency responders and their equipment are not exposed to contaminants during response efforts, but also to ensure that exposure victims being assisted receive optimum care in transit for medical treatment.

- The CSB is current investigating the anhydrous ammonia release from the Millard Refrigerated Services facility in Theodore, Alabama on August 23, 2010. A release of 32,000 pounds of ammonia from the roof of the facility formed a hazardous vapor cloud and traveled offsite, injuring 152 members of the public working at a Deep Water Horizon oil spill clean-up facility. Though the CSB has not completed the Millard investigation, investigators have identified issues with the emergency notification system following the release that resulted in confusion when the shelter-in-place order was activated for areas far beyond the hazard zone.

- The CSB is currently investigating the April 17, 2013, ammonium nitrate fire and explosion at the West Fertilizer plant, in West, Texas, which claimed the lives of twelve firefighters who were not adequately trained on how best to respond to the fire at the plant.

As effective site-specific pre-incident planning is needed to guide any initial and subsequent responder action, a pre-incident plan is needed to provide clear and adequate information on the magnitude of hazards in a chemical plant or other business containing highly hazardous chemicals, which can be easily understood by firefighters and other emergency responders. In amending subparagraph (n) of the PSM standard, OSHA should look to NFPA 471: *Recommended Practice for Responding to Hazardous Materials Incidents* (2002) for guidance on developing regulatory language for including incident response plans. These pre-incident plans must include a realistic exit/evacuation strategy especially in situations where a decision is made not to fight a fire. Finally, the pre-incident plan must also be effectively communicated to other external emergency support units within the surrounding areas so this should also be included in this subparagraph as a requirement.

Issue Area 12: Revising Paragraph (o) of the PSM Standard to Require Third-Party Compliance Audits

The CSB generally supports revising paragraph (o) of the PSM standard to require third-party compliance audits. The CSB has noted in several of its investigations, most notably First Chemical,[63] BP Texas City[64] and Valero McKee,[65] that internal company PSM audits often fail to identify systemic PSM program deficiencies. While a third-party audit may be a positive step towards valuable gap assessments and action items for improvement, there are several areas that raise our concerns:

- Third-party audits should not be a substitute for a cadre of sufficiently resourced, competent regulatory staff who are inspecting and auditing facilities directly on a consistent basis focusing on prevention.

[63] *See* CSB Investigation Report, "Explosion and Fire: First Chemical Corporation." *Ibid.*
[64] *See* CSB Investigation Report, "Refinery Explosion and Fire: BP Texas City." *Ibid.*
[65] *See* CSB Investigation Report, "LPG Fire at Valero-McKee Refinery." Report No. 2007-5-I-TX. July 9, 2008. Available at: http://www.csb.gov/assets/1/19/CSBFinalReportValeroSunray.pdf.

- A third-party approach may lead to OSHA contracting out what it should be doing as a regulator to a third-party; if that were to occur, this would have a detrimental impact on the regulator's ability to oversee industry.
- Third-parties hired by industry may not be completely objective unless there are requirements for maintaining their independence.
- Third-party audits may be used to augment the activities of an independent, well-resourced, competent regulator.

Issue Area 13: Expanding the Requirements of §1910.109 to Cover Dismantling and Disposal of Explosives, Blasting Agents, and Pyrotechnics

On April 8, 2011, an explosion and fire occurred at a magazine located at Waikele Self Storage in Waipahu, Hawaii, killing five workers. Donaldson Enterprises, Inc. (DEI), an unexploded ordnance remediation company, was using the magazine for fireworks storage and disposal-related activities. Prior to the incident, DEI workers had disassembled fireworks by hand and accumulated large quantities of black powder and aerial shells in boxes, which greatly increased the risk to DEI personnel by creating the potential for a mass explosion. The CSB investigated the incident and released its final investigation report in January 2013.[66] The CSB determined that the dissembling or dismantling of the fireworks is an extremely hazardous activity that created the conditions for the April 2011 explosion, causing the fatalities.

The CSB reviewed a number of federal regulations in its report and identified a number of gaps with regard to the safe disposal of fireworks. The CSB found that OSHA's *Explosives and Blasting Agents* standard (at 29 CFR §1910.109 (hereafter "the 109 standard" or "109") covers the storage and handling of explosives and pyrotechnics, such as fireworks, but not their disposal. OSHA's PSM standard only applies to pyrotechnics manufacturing operations.[67] A February 4, 1998, OSHA Letter of Interpretation defines the manufacture of explosives and pyrotechnics to mean the "mixing, blending, extruding, synthesizing, assembling, disassembling, and other activities involved in the making of a chemical compound, mixture or device which is intended to explode,"[68] therefore excluding disposal-related activities of explosives and pyrotechnics from PSM.

However, the CSB report identified that the PSM standard could have prevented the incident if applied. DEI would have been required to conduct a formal Process Hazard Analysis (PHA) on its disassembly procedure that explicitly identified a) the hazards of the disassembly process; b) any previous incidents involving DEI that had a likely potential for a catastrophic consequence in the workplace; c) engineering and administrative controls applicable to the hazards; d) consequences of the failure of these controls; e) justification and risk assessment associated with facility siting; and f) a human factors analysis of the proposed process. Instead, DEI conducted a two-page superficial "Activity Hazard Analysis" which did not robustly identify

[66] CSB Investigation Report, "Donaldson Enterprises, Inc. Fireworks Disposal Explosion and Fire." Report No. 2011-06-I-HI. January 17, 2013. Available at: http://www.csb.gov/assets/1/19/DEI_Final_01172013.pdf.
[67] 29 CFR 1910.109(k)(3)
[68] OSHA Letter of Interpretation. *Applicability of PSM Standard to Explosive and Pyrotechnic Manufacturing,* February 4, 1998. Available at: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=22524

hazards associated with the disassembly process and did not identify adequate safeguards to control hazards.

The CSB, however, did not make a recommendation to OSHA to revise its regulations in part because of Section 4(b)(1) of the Occupational and Safety and Health Act of 1970 precludes OSHA from any enforcement activity over a working condition if another federal agency exercises its statutory authority over the same activity. In this case, OSHA's authority to regulate the manufacturing, distribution, handling, and storage of fireworks in Hawaii, would be preempted by the Bureau of Alcohol, Tobacco and Firearms (ATF), 27 CFR Part 555, *Commerce in Explosives*, which regulates the importation, manufacturing, distribution, and storage of explosive materials, including fireworks. ATF storage regulations include requirements for storage within Types 1, 2, 3, and 4 magazines but do not cover disposal activities. ATF, however, chose not to enforce its statutory authority in this case; therefore, OSHA was able to cite the company for various health and safety violations related to storage and handling of pyrotechnics. None of those citations, though, directly address the disposal process.

The CSB found the disposal of fireworks falls under the jurisdiction of EPA's Resource Conservation and Recovery Act (RCRA) because hazardous waste permits are needed to conduct this type of activity. The CSB concluded that the RCRA permitting system did not robustly cover the safe disposal of hazardous waste, especially for pyrotechnics. Therefore the CSB recommended that EPA revise RCRA to require a permitting process with rigorous safety reviews that should require the use of best available technology, safe disposal methodologies, and safety management practices, such as those required by OSHA's PSM standard.

However, the CSB welcomes changing the 109 standard to incorporate requirements for the safe disposal of fireworks, since the standard already regulates the manufacturing and storage of fireworks. CSB believes that safe disposal of fireworks is not just an environmental concern but also a worker health and safety issue, as was evidenced by the five employees who died on April 8th, 2011. OSHA, however, needs to evaluate its authority under the OSH Act to ensure effective enforcement of its regulations.

The CSB believes that OSHA should also consider expanding its definition of "manufacture" to require that fireworks disposal activities also be covered by the PSM standard, as another option. However, if OSHA considers this option, the CSB suggests removing "dismantling" from that definition of manufacturing because it is such a dangerous activity, as it creates the potential for a mass explosion. The CSB recommended to the National Fire Protection Association (NFPA) to discourage the disassembly of waste fireworks as a step in the disposal process. Rather, there are safer ways to dispose of fireworks, such as soaking them whole in diesel, industrial incineration, or microbiological destruction. We also suggest collaboration with EPA on this rulemaking so that both environmental and health and safety issues are addressed and to avoid any redundancy when developing regulations for the safe disposal of fireworks.

Issue Area 14: Updating §§1910.106 and 1910.107 Based on the Latest Applicable Consensus Standards

The CSB strongly supports OSHA's proposal in the RFI to revise its Flammable Liquids standard (at 29 CFR §1910.106 (hereafter "the 106 standard" or "106") in accordance with the latest applicable NFPA consensus standards. CSB agrees with OSHA that both the format and requirements contained in this standard are significantly out of date and in need of revision. CSB has previously recommended to OSHA in two past investigations (i.e., Universal Form Clamp[69] and Bethune Point Wastewater Plant[70]) to revise various aspects of the 1910.106 standard to meet current NFPA 30 requirements. The CSB has also recommended that the NFPA revise various requirements contained in NFPA 30 as a result of several CSB investigations (e.g., Third Coast,[71] CAI/Arnel,[72] Veolia Environmental Services[73] and the Oil Site Safety Study[74]). While the NFPA has successfully addressed, or is currently in the process of addressing, these recommendations, CSB notes that some of these recommendations are not yet closed. Therefore, CSB urges OSHA to also consider addressing these "gaps in safety coverage" in NFPA 30 when revising the 106 standard.

The CSB also notes that in 1987 the NFPA revised the format of NFPA 30 to consolidate the requirements of four specific facility types (e.g., industrial plants; bulk plants and terminals; processing plants; and refineries, chemical plants and distilleries) into a single operations subsection. In making this consolidation, NFPA noted[75] that in many cases it was unclear which facility type applied in a given situation; the hazards presented by one type of facility were generally the same as another, although the scale might be different; and many requirements were common to all four facility types. The CSB urges OSHA to follow the NFPA's approach and also consolidate these facility types into a single operations subparagraph when it revises the 106 standard. Thus the requirements in the operations subparagraph would apply whenever flammable and combustible liquids are used, regardless of quantity. The exceptions would be tank and container storage, which would continue to be addressed in separate subparagraphs of the 106 standard. This change will make the standard's language easier to apply and ensure that appropriate safeguards for using flammable liquids are being implemented consistently across all areas of general industry.

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[69] CSB Case Study, "Mixing and Heating a Flammable Liquid in an Open Top Tank." Report No. 2006-08-I-IL. April 10, 2007. Available at: http://www.csb.gov/assets/1/19/CSBUniversalFormClampCaseStudy.pdf.
[70] CSB Investigation Report, "Methanol Tank Explosion and Fire." Report No. 2006-03-I-FL. March 13, 2007. Available at: http://www.csb.gov/assets/1/19/Bethune_Final_Report.pdf.
[71] CSB Investigation Report, "Petroleum Products Facility Incident: Third Coast Industries." March 6, 2003. Available at: http://www.csb.gov/assets/1/19/Third_Report.pdf.
[72] CSB Investigation Report, "Confined Vapor Cloud Explosion: CAI, Inc. and Arnel Company, Inc." Report No. 2007-03-I-MA. May 13, 2008. Available at: http://www.csb.gov/assets/1/19/CSBFinalReportCAIExplosion.pdf.
[73] CSB Case Study, "Explosion and Fire in West Carrollton, Ohio. Veolia Technical Solutions, LLC." *Ibid.*
[74] CSB Investigative Study, "Public Safety at Oil and Gas Storage Facilities." Report No. 2011-H-1. October 27, 2011. http://www.csb.gov/assets/1/19/Tanks_Safety_Study_FINAL.pdf.
[75] Benedetti, Robert. *Flammable and Combustible Liquids Code Handbook.* Third Edition. Quincy, MA: National Fire Protection Association, 1987. Chapter 5, page 163.

Issue Area 15: Updating the Regulations Addressing the Storage, Handling, and Management of Ammonium Nitrate

When the explosion occurred at the West Fertilizer Company on April 17, 2013, the company estimated that it was storing approximately 40-60 tons of fertilizer grade ammonium nitrate (AN) in a wooden bin inside a warehouse. AN is believed to be the substance involved because of its known physical characteristics and hazardous properties. Although the CSB is still investigating conditions which likely led to the explosion, the agency can provide comments on the scope and clarity of the regulation of AN to assist OSHA in its rulemaking for this chemical.

On October 9, 2013, OSHA issued 24 citations totaling $118,300 to West Fertilizer Co. as a result of its post-incident inspection. Many of the citations were for the facility's failure to comply with OSHA's Explosive and Blasting Agents standard, 29 CFR §1910.109, specifically the requirements at section (i) concerning bulk storage of AN. Additional investigation revealed that the company was unaware of this regulation for a number of reasons, including poor enforcement, and vague, unclear language regarding the scope and applicability of the standard.

When the current owners acquired the fertilizer portion of the site in 2004, state regulators found them to be non-compliant with a number of environmental regulations. The operators of the company were made aware of these regulations because of inspections. OSHA was not one of those regulators and in fact, had not inspected the site since 1985, when the company was cited for problems with its storage of anhydrous ammonia. It is unclear whether OSHA inspected the company against the 109 standard during this inspection, since no citations were issued under this standard. The owners also hired an insurance company to assist with regulatory compliance. While the insurance company conducted its own inspection of the site, it also did not identify compliance issues with the Explosive and Blasting Agents standard.

The CSB reviewed this regulation and questions how well it is understood and implemented throughout the fertilizer industry; therefore, we suggest that greater clarity can be incorporated into the standard. The CSB understands that historically when the standard was first promulgated in 1971, two NFPA publications, one for explosives and another for ammonium nitrate, served as the basis for OSHA's position relative to AN. This integration of two NFPA standards, however, affects how AN is classified. The 109 standard misleads users to view and classify AN as an explosive, though in its pure form the substance is actually classified as an oxidizer. While pure AN is recognized to have explosive properties and is used in the explosives industry explicitly as an explosive, this one purpose overshadows another industry, the fertilizer industry, which uses it for an entirely different and less hazardous purpose, though the same hazard exists.

While section (i) of the standard states in the scope that it covers "fertilizer grade", this designation is lost among the wider use of the standard, which is for explosives. The title of the standard also does not direct the attention of those in the fertilizer industry to the regulation, nor is there a clearly stated purpose that would indicate clearly that the fertilizer industry should comply with this standard on how to safely store ammonium nitrate.

As to the requirements of the standard, section (i) does not provide sufficient guidance for the safe storage of ammonium nitrate. For example, the standard permits the use of wooden bins "protected against impregnation of ammonium nitrate." This provision is problematic because 1)

"impregnation" is not defined for the user to effectively implement and 2) the provision also allows the use of wooden bins which at West contributed to the intensity of the fire that led to the explosion on April 17, 2013. It is well recognized that ammonium nitrate should not be in close proximity to combustible materials because of its oxidizing properties that multiply the fire and explosion hazards of those materials. The U.K's Health and Safety Executive states in guidance dating back to 1996 that ammonium nitrate storage bays should be "constructed of a material that does not burn, preferably concrete." The use of concrete buildings for ammonium nitrate is already in use in the United States. A 2009 fire at the El Dorado Chemical site in Bryan, Texas burned a wooden fertilizer warehouse holding over a million pounds of ammonium nitrate to the ground. The company has rebuilt the warehouse with concrete instead of replacing it with another combustible structure.

In addition, the standard requires that warehouses "shall have adequate ventilation or be capable of adequate ventilation in case of a fire," but does not reference appropriate standards of ventilation nor define the term "adequate." Furthermore, the standard requires that piles or bins shall be so sized and arranged that all material in the pile is moved out "periodically" in order to minimize possible caking. Caking of AN should be avoided because of the hazard of producing an unstable pile and potentially leading to the collapse and burying of workers, but OSHA neglects to define "periodically", leaving the frequency up to the user to determine what is safe. Also, the standard does not provide sufficient fire protection measures for bulk storage of ammonium nitrate, which requires sprinklers only for bagged ammonium nitrate exceeding 2500 tons. The use of a sprinkler during the West Fertilizer incident may have potentially extinguished the incipient fire that started or reduced the intensity of the fire that contributed to the explosion. The standard should be updated since very few revisions have occurred since it was first promulgated in 1971. Additionally, the standard was based off of an NFPA standard that has been replaced with a newer standard, NFPA 400 Hazardous Materials Code, which is currently revising its ammonium nitrate chapter. We suggest OSHA consider their final revision of this chapter when updating its Explosive and Blasting Agents standard.

In conclusion, the CSB urges OSHA to clarify the title, language, and scope of the Explosive and Blasting Agents standard, 29 CFR 1910.109, to more clearly indicate coverage of the fertilizer industry and provide more explicit requirements that do not allow the user to loosely interpret requirements that could potentially lead to unsafe conditions if not implemented correctly. A search of Tier II reports identified hundreds of fertilizer warehouses storing AN in the U.S., demonstrating a widespread risk across the nation, and consequently, we urge stronger enforcement of the standard.

Issue Area 16: Changing Enforcement Policy of the PSM Exemption for Retail Facilities

Prior to the explosion at West Fertilizer Company on April 17, 2013, the company was found to be storing more than 10,000lbs of anhydrous ammonia, the listed threshold quantity for the PSM standard. Their last RMP registration in 2011 listed 54,000lbs of anhydrous ammonia. The company also reported to the CSB that at the time of the incident, they were storing 17 tons (equivalent to 34,000lbs) of anhydrous ammonia, and most of their sales were to farmers, who were the end-users. The retail-exemption would have applied here because they were a PSM covered process and more than 50% of their sales were to end-users, the farmers.

If West Fertilizer's storage of anhydrous ammonia were covered by PSM, the company would have been required to conduct a process hazard analysis and to address facility siting. A facility siting analysis, in turn, would likely have identified that a warehouse storing highly hazardous ammonium nitrate was in close proximity to the anhydrous ammonia storage tanks and precipitated the implementation of necessary safeguards to ensure that if an incident occurred with one hazardous chemical, another incident would not occur with other nearby hazardous chemicals. The April 17, 2013, explosion at West damaged the site's anhydrous ammonia tanks. Had more force been applied to anhydrous ammonia tanks, their contents could have been released into the neighboring community, potentially causing more injuries and fatalities. But West Fertilizer was not required to do a siting study based on the definition of the retail exemption.

As OSHA stated in its RFI, the exemption at 1910.119(a)(2)(i) was intended for facilities who sell highly hazardous materials in small containers, packages, or allotments to the public, and was based on the assumption that these facilities do not generally present the same safety hazards as those encountered at establishments working with large, bulk quantities of materials. This is not, however, clearly stated in the definition. OSHA should consider whether the retail exemption should apply to facilities like West Fertilizer, which store bulk quantities of hazardous materials that exceed the listed PSM threshold but are not required to develop a PSM program to ensure safe storage and handling of PSM-regulated chemicals.

Issue Area 17: Changing Enforcement Policy for Highly Hazardous Chemicals Listed in Appendix A of the PSM Standard Without Specific Concentrations

The CSB supports OSHA's proposal in the RFI to change its enforcement policy regarding highly hazardous chemicals listed in Appendix A of the PSM standard without specific concentrations. Rather than using the current "commercial grade" approach, the CSB agrees with OSHA that a more practical, consistent and straightforward approach for coverage of Appendix A listed chemicals without specific concentrations is to adopt the EPA's RMP List Rule criteria of considering listed chemicals to be covered if their concentrations in the mixture exceed one percent and the calculated weight of the listed chemical in the mixture exceeds the threshold quantity. The EPA's approach is based on the partial vapor pressure in the mixture combined with the acute hazard(s) of the listed chemicals[76]. This is a more suitable basis for establishing coverage, as opposed to the primarily economically driven "commercial grade" approach that OSHA is currently using.

[76] See Section IV.B.2 in 77 FR 4478 (January 31, 1994)