Available online at www.sciencedirect.com

Public Health

journal homepage: www.elsevier.com/puhe

Original Research

Eighteen years of recommendations to prevent industrial chemical incidents: results and lessons learned of the US Chemical Safety Board

V.A. Tinney [a], S.C. Anenberg [b,*], M. Kaszniak [a], B. Robinson [a]

[a] US Chemical Safety and Hazard Investigation Board, 2175 K ST NW, Suite 400, Washington, DC 20037, USA
[b] Environmental Health Analytics, LLC, Washington, DC, USA

ARTICLE INFO

Article history:
Received 28 July 2015
Received in revised form
14 April 2016
Accepted 19 April 2016
Available online 17 May 2016

Keywords:
Occupational health
Environmental health
Chemical incidents

ABSTRACT

Objectives: The US Chemical Safety Board (CSB), a federal agency that investigates significant chemical incidents and hazards, is interested in determining the impact of the recommendations resulting from its investigations, and how to better more effective recommendations to prevent chemical incidents.

Study design: This is a descriptive study of the US Chemical Safety Board's safety recommendations.

Methods: The CSB coded and analysed its safety recommendations according to potential impact on reducing incidents, implementation status, purpose and recipient type.

Results: As of March 31, 2015, the CSB has issued 733 recommendations, 75% (548) of which are closed and 25% (185) of which remain open. For recommendations categorised as having high, medium, and low impact, 38% (78), 76% (160), and 78% (245) were implemented, respectively.

Conclusions: CSB recommendations have led to important and lasting safety changes through regulations, industry guidance and voluntary consensus standards, and individual companies; however, coding recommendations by potential impact do not fully capture the influence of CSB recommendations. While this methodology serves as a preliminary way to determine the effect of recommendations, further data are needed to determine the extent to which these safety changes have reduced the frequency or severity of industrial accidents.

Introduction

The CSB is an independent US federal agency charged with investigating industrial chemical accidents and issuing recommendations aimed at preventing their recurrence. Investigations conducted by the CSB illustrate the severity and public health impact of incidents when they occur at fixed facilities. For example, the CSB investigated the 2005 BP Texas City refinery explosion that resulted in the death of 15 workers

* *Corresponding author*. Tel.: +1 202 821 7184.
E-mail addresses: veronica.tinney@csb.gov (V.A. Tinney), susan.anenberg@envhealthanalytics.com (S.C. Anenberg), mark.kaszniak@csb.gov (M. Kaszniak), bea.robinson@csb.gov (B. Robinson).
http://dx.doi.org/10.1016/j.puhe.2016.04.011
0033-3506/

and 180 injuries.[1] More recently, the 2013 explosion at the West Fertilizer Company in West, Texas, resulted in the death of 15 persons and hundreds of injuries,[2] and in 2014 a spill of 4-Methylcyclohexanemethanl (MCHM) into the Elk River resulted in the loss of water for hundreds of thousands of residents of West Virginia.[3]

The CSB was created by the Clean Air Act Amendments of 1990 (42 US code § 7412) in the wake of the December 1984 industrial disaster in Bhopal, India, in which methyl isocyanate (MIC) gas released from a Union Carbide pesticide plant, resulting in thousands of deaths in the nearby community.[4] The CSB does not issue fines or citations, but rather issues recommendations that, if implemented, aim to prevent the recurrence or reduce the likelihood or consequences of similar incidents or hazards in the future. As of March 31, 2015, the CSB has issued over 700 safety recommendations in its 18 years of operation. The CSB's extensive body of safety recommendations now provides an opportunity to identify common themes across these recommendations, consider successes and challenges, and draw out lessons learned. This article is the first to systematically analyse CSB recommendations to determine lessons learned across the CSB's history of issuing and advocating for recommendations. The objectives of this paper were to summarise the types and statuses of CSB recommendations, to highlight key successes and challenges in achieving recommended actions across CSB's history, and to draw inferences about the types of recommendations that are more likely to be implemented, and have greater impact on improving public and occupational health.

Methods

We started with the full body of CSB recommendations issued throughout the agency's history. To analyse all CSB recommendations by type and status, we coded recommendations according to various parameters. Recommendations statuses are official designations defined by CSB Board Order 2002-01.[5] Recipient type includes categories such as government (federal, state, local), industry, trade association, and labour union. Recommendations purpose describes the objective of the recommended action, including regulatory change (federal, state, local), voluntary standard/guideline change, or actions implemented at a specific industrial facility or corporate-wide across multiple facilities. We define the degree of impact the recommendations would have on society if implemented according to various general rules.

High impact recommendations were thought to have the greatest potential for long-term prevention of chemical incidents, such as the adoption of a federal or state regulation as seen in Fig. 1. Low impact recommendations tended to be one-time events, such as communication of safety messages by a company to its employees. Medium impact recommendations were those such as voluntary consensus standards or corporate policies adopted that may potentially impact a large number of employees. These rules are an imperfect means of capturing the full impacts of recommendations in reality. Our categories are unable to capture such ripple effects unless initial coding results are revisited at a later date to reflect that the recommendation had impacts beyond the stated action. Nevertheless, these categories provide a general indication as to the breadth of societal impact a recommendation may have.

Data on recommendations issued were included if they had been issued prior to March 31, 2015. Recommendations were analysed utilising Microsoft Office Excel 2007 and StataCorp LP Stata Statistical Software, Release 14.

Results

Overall, 75% (548) of CSB recommendations issued throughout the CSB's history have been closed, and 88% (483) of those (or 66% of all CSB recommendations) have been closed acceptably. The remaining 12% (65) of closed CSB recommendations were reconsidered, superseded with another recommendation, considered no longer applicable, or designated as an unacceptable response. Of the 25% of open recommendations (185), 5% (37) have been designated as an acceptable response and 2% (15) have been designated as an unacceptable response. Of all CSB recommendations issued, only 5% (34) have been given a status of unacceptable, with 44% (15) of these still open, and 56% (19) closed. The remaining 18% (133) of open CSB recommendations are awaiting a substantive response from the recipient or action by CSB staff and Board. Those that have been closed acceptably, or implemented, were implemented in a median of 2.75 years. Time to recommendation implementation indicates the time from which the recommendation was issued until its acceptable closure by CSB Board vote.

CSB recommendations are not dominated by a single purpose or recipient type. CSB staff codes recommendations according to 11 recommendation purpose categories, shown in Fig. 1, which have been aggregated here into three main categories and an 'other' category that includes regulatory enforcement, research and data collection/analysis, recommendations to communicate the findings of CSB reports (e.g. to an organisation's membership), and others. Of all CSB recommendations issued throughout the CSB's history, 13% (94) have recommended new or changes to existing regulations (includes federal, state, and local regulations). These regulatory recommendations include 4% (28), 6% (45), and 3% (21) at the federal, state, and local levels, respectively. In addition, 20% (149) have recommended new or changes to existing voluntary standards, recommended practices, or industry guides. Of these aggregate categories, the most recommendations, 40% (288), have recommended actions to fix conditions at a single facility or corporate-wide policies or practices across multiple facilities, although these have represented a smaller portion of issued recommendations in more recent years. As an indication as to the ease or difficulty of implementing different types of recommendations, we examine here the portion of recommendations within each purpose type according to their statuses, shown in Fig. 2.

Utilising the criteria in Fig. 1, the CSB determined that 10% (74) were deemed to have high impact, 18% (130) with medium–high impact, 29% (213) with medium impact, 3% (19) with medium-low impact and 41% (297) with low impact. Since the