Journal of Safety Research 42 (2011) 215–222

Contents lists available at ScienceDirect

Journal of Safety Research

journal homepage: www.elsevier.com/locate/jsr

The impact of the BP baker report

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ARTICLE INFO

Article history:
Received 17 August 2010
Received in revised form 7 January 2011
Accepted 1 March 2011
Available online 8 May 2011

Keywords:
BP Baker Panel Report
Process safety culture
Safety climate
Contractors
Safety surveys

ABSTRACT

Introduction: This study examined the impact of the British Petroleum (BP) Baker Panel Report, reviewing the March 2005 BP-Texas City explosion, on the field of process safety. *Method:* Three hundred eighty-four subscribers of a process safety listserv responded to a survey two years after the BP Baker Report was published. *Results:* Results revealed respondents in the field of process safety are familiar with the BP Baker Report, feel it is important to the future safety of chemical processing, and believe that the findings are generalizable to other plants beyond BP-Texas City. Respondents indicated that few organizations have administered the publicly available BP Process Safety Culture Survey. Our results also showed that perceptions of contractors varied depending on whether respondents were part of processing organizations (internal perspective) or government or consulting agencies (external perspective). *Conclusions:* This research provides some insight into the beliefs of chemical processing personnel regarding the transportability and generalizability of lessons learned from one organization to another. *Impact on Industry:* This study has implications for both organizational scientists and engineers in that it reveals perceptions about the primary mechanism used to share lessons learned within one industry about one major catastrophe (i.e., investigation reports). This study provides preliminary information about the perceived impact of a report such as this one.

1. Introduction

In March 2005, an explosion at the British Petroleum (BP) Texas City refinery killed 15 employees and injured 170 others. As a result of this catastrophic event, the U.S. Chemical Safety and Hazard Investigation Board (CSB) recommended that an independent panel assess BP North America's safety management, corporate safety oversights, and corporate safety culture specific to process safety (i.e., the safety of chemical processing activities, rather than the occupational safety behaviors of personnel). Thus, the BP U.S. Refineries Independent Safety Review Panel was formed, headed by James A. Baker, III, who had served as U.S. Secretary of State during the Reagan administration. The Baker Panel conducted an extensive review including interviews, refinery visits, survey administration, and relevant document reviews to address the CSB's concerns and later released their findings in the BP Baker Report (The BP US Refineries Independent Safety Review Panel 2007). The current study was designed to gather information from chemical processing industry insiders—safety personnel and decision makers—about the impact that the BP Baker Report has had on personal and process safety within their respective organizations and within the chemical-processing industry as a whole. This study was also designed to examine the extent to which the BP Process Safety Culture Survey has become a benchmarking tool for assessing process safety culture.

Although chemical processing has long been concerned with hazard reduction (i.e., solving engineering problems so that processes run with less risk to personnel, the organization, and the environment), the BP Baker Report has the potential to be a paradigm shifting document, recommending chemical processing companies attend more closely to their cultures and to understand and monitor personal and process safety as distinct entities. Our study attempts to document anecdotal evidence within the chemical processing industry and begins to examine the extent to which consensus is coalescing around the BP Safety Culture Survey as a possible benchmarking tool in the industry. Should this happen, it would allow organizational researchers to develop industry-wide tools to aid in process safety and process safety culture improvement through the design of training, process monitoring tools, and benchmarking instruments.

1.1. Are lessons learned across an industry?

Incident reports like the BP Baker Report are generated to reveal what investigators determined went wrong and what led to the catastrophe. They are intended to be read by a wide array of audiences, particularly members of the industry who could benefit from learning how to avoid similar incidents. The occurrence of a major incident should lead to direct learning and adaptation of organization-level routines and mental models (Madsen 2009). Thus, it seems that reports such as the BP Baker Report have value when read and acted upon. Ideally, incident reports are mechanisms for knowledge transfer from one organization to the next. They are written to avoid having

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0022-4375/$ – see front matter
doi:10.1016/j.jsr.2011.03.005

(bad) "history repeat itself." In practice, however, this does not seem to be happening across organizations (Randall 2010, "Oil rig explodes off the Louisiana coast;" Starbuck 2009) or even within individual organizations (Pasman 2009), as is evident from the April 2010 BP Deepwater Horizon oil spill (BP., 2010).

Beyond technical engineering issues (e.g., process hazard analyses, emergency response and planning, mechanical integrity, and maintenance programs), there were a number of important managerial and psychological issues highlighted in the Baker report. We focus on the following three issues: (a) personal versus process safety; (b) safety climate/culture and its assessment; and, (c) the role of contractors.

1.2. Personal versus process safety

The BP Baker Report emphasized the importance of differentiating between personal and process safety (Hopkins 2009). Violations of *personal safety* refer to incidents such as slips, trips, falls, burns, cuts, and other harm to the human body. On the other hand, violations of *process safety* are defined as incidents that arise directly from processing activity at a plant or organization, such as the release of a toxic substance (Hopkins 2009). In high reliability industries, such as chemical processing, nuclear power plants, and airlines, the importance of understanding and monitoring *process safety* indicators is very high, as process failures can be catastrophic to organizations, people, and the environment (Kletz 1993; U.S. Environmental Protection Agency [EPA] 1989). This is not to suggest that personal and process safety are unimportant in other industries, but rather that in high reliability industries, such issues are paramount for the well-being of workers and individuals in the surrounding area.

Among the major findings of the BP Baker Panel was that while corporate leaders of BP North America had set a positive tone regarding *personal* safety, they had not done so with *process* safety (Wark 2007). The BP Baker Panel concluded that BP North America attended to personal safety indicators (e.g., injuries, days missed from work), which were considered above-average for the industry, and erroneously inferred that these positive indicators of personal safety also indicated adequate process safety (The BP US Refineries Independent Safety Review Panel 2007). In fact, the Panel found that BP's personal injury rates were not predictive of process safety performance. Indicators of personal safety are not indicators of process safety; thus, they are not substitutable (U.S. Chemical Safety and Hazard Investigation Board [CSB] 2007).

1.3. The assessment of process safety climate/culture

One meaningful implication from the BP Baker Panel Report pertains to safety climate, or employee perceptions of the relative priority of safety within an organization (Zohar 2000). Although the Report used the term "safety culture" it is important to note that these terms are often used interchangeably.[1] For the purposes of this paper, we use the term safety climate because it is a more accurate representation of the concept discussed in the Baker Report.

One aspect of a healthy safety climate is taking advantage of opportunities to learn about previous incidents and near misses in order to avoid them from happening in the future (Mearns, Flin, Gordon, & Fleming 1998). Thus, we expect employees in organizations with a positive safety climate would be more inclined to read incident reports like the BP Baker Panel Report and share lessons learned that apply to their organization with appropriate parties. This is important because recent research suggests that previous incidents from any time can be learning events. Beus, Payne, Bergman, and Arthur (2010) examined the length of time over which injuries were assessed as a moderator of the safety climate-injury relationship and found that the influence of injuries on safety climate was largely unaffected by the length of time between injury occurrence and safety climate measurement ($M = 16.20$ months). Thus, it appears that safety incidents from more than a year previous can still influence employees' current perceptions of safety climate.

As part of the Panel's investigation, a process safety climate survey was administered at BP. This instrument is included as an appendix in the BP Baker Report and thus publicly available for organizations to benchmark themselves against other organizations. In addition to the impact of the report, we were also interested in the extent to which organizations had administered similar safety climate survey items to their employees and thus were actively trying to check the pulse of their own safety climate.

1.4. The role of contractors

A third issue highlighted in the BP Baker Report was the use of contractors. Contractors are commonly used for a variety of jobs within chemical processing plants and, like core personnel of the organization, should have an appropriate level of knowledge of process safety and should regard process safety as important. The report indicated that this might have been lacking among contractors at BP-Texas City. Thus, we assessed the perceptions of contractors pertaining to several factors, such as training and inclusion in the organization, and examined if perceptions vary based on respondent roles (e.g., organizational core employee, government employee, safety consultant).

2. Method

In February 2009, two years after the BP Report was made available to the public, 5,106 subscribers of the Texas A&M University Mary Kay O'Connor Process Safety Center listserv were invited to participate in an online survey about the impact of the BP Baker Report. The listserv was chosen because of the center's explicit mission to promote process safety in the chemical industry. Subscribers were given three weeks to complete the 15-minute survey and reminded about the survey one week before it closed. They were also offered the opportunity to be included in a raffle for one of five $50 gift cards in exchange for their participation in the survey. Our sample consisted of 384 respondents. The average age for the total sample was 51.3 years ($SD = 10.8$; Missing = 61[15.9%]) and the average tenure was 23.9 years ($SD = 11.4$; Missing = 51[13.3%]). For the respondents that had read the report ($n = 331$), the average age was 51.2 years ($SD = 10.5$; Missing = 52[15.7%]) and the average tenure was 24.2 years ($SD = 11.0$; Missing = 43[13.0%]). Other demographic characteristics for the sample are summarized in Table 1.

Survey questions were developed to examine the influence of the BP Baker Report on the chemical processing industry and were pilot tested with 29 attendees at the 2008 Mary Kay O'Connor Process Safety Center Symposium. Questions are descriptive and were organized into the following five categories: 1) familiarity with the BP Baker Report, 2) impact of the BP Baker Report, 3) personal versus process safety, 4) assessment of safety climate/culture and 5) the role of contractors. The specific questions are reported in the next section with the corresponding results. Skip logic was incorporated into the survey such that only individuals who had read at least some of the Baker Report were asked questions about the impact of it and about personal versus process safety. Further, respondents were not required to answer every survey question; therefore not all questions were answered by all possible respondents. In order to avoid confusion about the percentages

[1] Organizational scientists distinguish between the concepts of culture and climate. Ostroff, Kinicki, and Tamkins (2003) define climate as employee perceptions of events in the workplace and organizational expectations of workplace behaviors, norms, and attitudes. Culture is defined as the shared motives, identities, values, and interpretations or meanings of events that result from the common experiences of members (House & Javidan, 2004). When discussing the differences between climate and culture, Ostroff et al. noted, "Whereas climate is about experiential descriptions of perceptions of what happens, culture helps define why these things happen" (p. 566). Typically, when laypersons use the term "culture," they are encompassing both culture and climate from organizational science. We use the term "climate" as this is believed to be easier to assess with survey methods.

Table 1
Sample Demographic Characteristics.

Demographic Variable	Read Report ($n=331$)	Did Not Read Report ($n=53$)
Sex		
Female	29 (8.8%)	9 (17.0%)
Male	260 (78.5%)	36 (67.9%)
Missing	42 (12.7%)	8 (15.1%)
Ethnicity		
Caucasian	233 (70.4%)	30 (56.6%)
African Americans	3 (0.9%)	0 (0.0%)
Hispanics	8 (2.4%)	6 (11.3%)
Native Americans	1 (0.3%)	0 (0.0%)
Asians	28 (8.5%)	5 (9.4%)
Middle Easterners	1 (0.3%)	1 (1.9%)
Other	5 (1.5%)	0 (0.0%)
Missing	52 (15.7%)	11 (20.8%)
Current Position		
Engineers	75 (22.7%)	15 (28.3%)
Consultants	56 (16.9%)	5 (9.4%)
Safety Managers/Directors	48 (14.5%)	7 (13.2%)
Safety Personnel	34 (10.3%)	3 (5.7%)
Operations Managers	23 (6.9%)	2 (3.8%)
Process Safety Personnel or Managers	24 (7.3%)	0 (0.0%)
Government Employees	12 (3.6%)	4 (7.5%)
Other (e.g., student, faculty, retired)	16 (4.8%)	9 (17.0%)
Missing	43 (13.0%)	8 (15.1%)

Note. Responses reported (n, %).

of responses reported, we report sample sizes (the number of actual respondents) for each question.

3. Results

3.1. Familiarity with the BP baker report

To assess participants' familiarity with the BP Baker Report, respondents were asked about the extent of their reading of the BP Baker Report (Table 2). The majority of respondents (86.2%) indicated they had read at least some portion of the report. Only 53 (13.8%) respondents indicated they had not read any of the report.

We also assessed participants' reasons for reading the report (Table 2). Participants were encouraged to check all the options that applied to their situation. From the 331 participants that read the report there were 511 responses, 251 (49.1%) were personally interested in the information contained in the report, 103 (26.8%) indicated they presented information about the report to others in their company, and 67 (13.1%) indicated they were required to read the report as a part of their job.

3.2. Impact of the BP baker report

We assessed the participants' perceptions of the impact of the BP Baker Report on (a) the chemical processing industry, (b) individuals' personal beliefs about safety, and (c) the participants' respective organizations (Table 2). These issues were assessed via a series of questions that were responded to on a 5-point Likert scale. Respondents who read the report ($n=331$) were asked how important the report is to the future of safety in chemical processing. Respondents tended to feel it was important ($M=4.13$, $SD=0.86$), with 243 (73.4%) respondents indicating "important" or "extremely important." Second, we asked if they agreed with the findings from the report. Respondents tended to agree with the findings ($M=4.21$, $SD=0.76$), with 268 (81.0%) choosing "strongly agree" or "agree." Third, we asked to what extent the respondents felt the findings in the report generalized to other chemical processing plants. On average, respondents thought the majority of the findings apply to plants beyond BP Texas City, ($M=3.95$, $SD=1.01$) with 207 (62.5%) respondents selecting "about 75% of the findings apply to other plants" or "all of the findings apply to other plants."

3.3. Personal versus process safety

As noted earlier, the BP Baker Report highlighted the distinction between process and personal safety. Respondents who had read the report ($n=331$) were asked several questions about this distinction (Table 3). First, respondents were asked about their awareness of the process versus personal safety distinction prior to the BP incident and dissemination of the report. A majority of the respondents (210, 63.4%) indicated that they were aware of this distinction to a great extent. We also asked how related respondents believed process and personal safety were to one another. The majority of the respondents (254, 76.7%) indicated that there was a positive relationship between process and personal safety. However, 39 (11.8%) respondents felt "process and personal safety are not related to one another." Finally, we asked to what extent the process and personal safety distinction influences the way respondents deal with safety. On average, respondents indicated this distinction influenced their actions, with 70 (21.1%) respondents choosing "to some extent" and another 148 (44.7%) respondents indicating "to a great extent."

Table 2
Familiarity with and Impact of the BP-Baker Report.

Items						
To what extent have you read the full BP-Baker Report? ($n=384$; $M=3.48$; $SD=0.90$)	I have not read it (53; 13.8%)	I have read a little bit of it (44; 11.5%)	I have read some of it (132; 34.4%)	I have read all of it (108; 28.1%)	I have read it more than one time (47; 12.2%)	
The following statements concern your experiences with the BP-Baker Report. *Please check all that apply.*[a] (511 total responses from 331 respondents)	I was required to read it as part of my job (67; 13.1%)	My supervisor asked my opinion of it (50; 13.0%)	I presented information about the report (103; 26.8%)	I was personally interested (251; 49.1%)	I received continuing education credit(s) (2; 0.4%)	Other (38; 9.9%)
How important do you think the BP-Baker report is to the future of safety in chemical processing? ($M=4.13$; $SD=0.86$)	Not important (2; 0.6%)	Slightly important (12; 3.6%)	Moderately important (45; 13.6%)	Important (129; 39.0%)	Extremely important (114; 34.4%)	No response (9; 2.7%)
To what extent do you agree with the findings from the BP-Baker report? ($M=4.21$; $SD=0.76$)	Strongly disagree (4; 1.2%)	Disagree (5; 1.5%)	Neither agree nor disagree (22; 6.6%)	Agree (162; 48.9%)	Strongly agree (106; 32.0%)	No response (32; 9.7%)
To what extent do the findings of the BP-Baker report generalize to other chemical processing plants? ($M=3.95$; $SD=1.01$)	Findings are unique to BP (8; 2.4%)	Approximately 25% applies (14; 4.2%)	Approximately 50% applies (69; 20.8%)	Approximately 75% applies (100; 30.2%)	All applies (107; 32.3%)	No response (33; 10.0%)

Note. M = mean, SD = standard deviation. Responses reported (n, %).
[a] $n=331$, question asked only of respondents who had read the report.

Table 3
Personal versus Process Safety.

Items						
To what extent were you aware of this distinction *prior* to the BP incident/ dissemination of the report? ($M=4.52$; $SD=0.87$)	To a great extent (210; 63.4%)	To some extent (53; 16.0%)	To a moderate extent (24; 7.3%)	To a small extent (11; 3.3%)	To no extent at all[a] (3; 0.9%)	No response (30; 9.1%)
How related do you believe process and personal safety are to one another? ($M=4.29$; $SD=0.73$)	To have one you must sacrifice the other (0; 0.0%)	To improve in one, you must sacrifice at least a little in the other (3; 0.9%)	Process and personal safety are not related to each other (39; 11.8%)	Improvements in one lead to improvements in the other (122; 36.9%)	One cannot exist without the other (132; 39.9%)	No response (35; 10.6%)
To what extent does the process vs. personal safety distinction influence the way youdeal with safety? ($M=4.00$; $SD=1.26$)	To a great extent (148; 44.7%)	To some extent (70; 21.1%)	To a moderate extent (36; 10.9%)	To a small extent (25; 7.6%)	To no extent at all (21; 6.3%)	No response (31; 9.4%)

Note. M = mean, SD = standard deviation. Responses reported (n, %). Question asked only of respondents who had read the report (n = 331).
[a] Reverse coded for analyses.

3.4. Assessment of safety climate/culture

3.4.1. Relative priority of safety and productivity

As noted earlier, safety climate has been defined as the relative priority of safety to other operational priorities. One of the most prevalent concerns in the literature is the competing priority of productivity (Starbuck 2009; Zohar 2003). We asked respondents to indicate their own and their organization's emphasis on safety versus productivity (Table 4).

First, we asked individuals' their beliefs about the relationship between safety and productivity ($n=384$). The response options represented the full range of possible relationships from a perfect negative relationship ("to have one you must sacrifice the other"), to no relationship, to a perfect positive relationship ("one cannot exist without the other"). Two hundred and seventy-five of the 384 total respondents (71.6%) indicated that safety and productivity were positively related to each other (i.e., one cannot exist without the other). Secondly, we asked individuals which they emphasized more on a day-to-day basis: safety or productivity. Most respondents indicated that safety was "always" to "usually" emphasized over productivity (212; 55.2%). Another 80 respondents (20.8%) indicated that both safety and productivity were emphasized equally.

For the questions specific to the organization's view on safety versus productivity, we report responses only from those who were part of an organization in the chemical processing industry ($n=362$), excluding a handful of professors, students, and retirees. When asked about their organization's position on the relationship between safety and productivity, 184 (50.8%) respondents indicated that safety and productivity were positively related to each other. When asked whether their organization emphasized safety over productivity, 158 (43.6%) respondents indicated that safety was "always" or "usually" emphasized over productivity. Similar to the individual perspective, 55 (15.2%) indicated that both safety and productivity are emphasized equally. These results suggest that respondents consider that their organizations share their beliefs with respect to the relationship between safety and production ($r=.32$, $p<.01$) and the relative emphasis of safety versus production ($r=.57$, $p<.01$).

3.4.2. Safety climate/culture survey efforts

The next set of questions was specific to individuals' organizations and their efforts to conduct safety surveys, specifically the BP 2006 Process Safety Culture Survey, which was included in the Appendix of the BP Baker Report. For this set of questions, we summarize responses from only those respondents who worked directly in a chemical processing organization ($n=285$), excluding government employees, contractors, and consultants in addition to faculty, students, and retirees. Respondents were asked to what extent the report was useful to the respondent and their organization. On average, respondents tended to report that it was useful ($M=4.00$, $SD=0.85$) with 167 (58.6%) individuals checking "useful" or "extremely useful." Both Report

Table 4
Safety versus Productivity-At the Individual and the Organizational Level.

Items						
Individual-level						
Which of the following represents your belief about the relationship between safety and productivity? ($M=4.29$; $SD=0.71$)	To have one you must sacrifice the other (1; 0.2%)	To improve one sacrifice a little in the other (8; 2.1%)	Safety and productivity are not related (14; 3.6%)	Improve one to improve the other (155; 40.4%)	They exist only together (120; 31.3%)	No response (86; 22.4%)
On a day-to-day basis, which of the following do you emphasize? ($M=1.74$; $SD=0.96$)[a]	Always safety over productivity (176; 45.8%)	Usually safety over productivity (36; 9.4%)	Both equally (80; 20.8%)	Usually productivity over safety (8; 2.1%)	Always productivity over safety (1; 0.3%)	No response (83; 21.6%)
Organizational-level						
Which of the following represents your organization's belief about the relationship between safety and productivity? ($M=4.03$; $SD=1.06$)	To have one you must sacrifice the other (4; 1.1%)	To improve one sacrifice a little in the other (29; 8.0%)	Safety and productivity are not related (13; 3.6%)	Improve one to improve the other (93; 25.7%)	They exist only together (91; 25.1%)	No response (132; 36.5%)
On a day-to-day basis, which of the following does your organization emphasize? ($M=1.93$; $SD=1.02$)	Always safety over productivity (108; 29.8%)	Usually safety over productivity (50; 13.8%)	Both equally (55; 15.2%)	Usually productivity over safety (15; 4.1%)	Always productivity over safety (2; 0.6%)	No response (132; 36.5%)

Note. M = mean, SD = standard deviation. Responses reported (n, %). Respondents who were faculty, students, or retired were excluded from responding to the organizational-level items (n = 362).
[a] Coded such that 1 = emphasizing safety over production.

readers and nonreaders were asked if their company had conducted any surveys about safety-related issues prior to the release of the BP-Baker Report in January 2007. A good number of the respondents who had read (143; 73.0%) and who had not read the report (15; 65.2%) had conducted at least one survey prior to January of 2007; however, 53 (27.0%) readers and 8 (34.8%) nonreaders indicated their organizations had not conducted any surveys. When asked about administering the BP 2006 Process Safety Culture Survey, 69 (35.0%) respondents who had read the report indicated that they had not administered the survey; however an almost equal number of respondents who had read the report (76; 38.6%) indicated that they had administered BP questions in some capacity. Both respondents who had read ($n=73$) and had not read the report ($n=14$) and who indicated that their organization had not administered the BP questions were asked what prevented them from doing so (see Table 5). When asked to check all that apply, the five most frequently reported reasons for those who had read the report were that the BP items were not relevant to their organization (16, 21.9%), that they had doubts about the benefits of administering the BP items (14, 19.2%), they lacked human resources/staff to administer the survey (13, 17.8%), a perceived lack of management commitment (12, 16.4%), and their organization did not perceive the need (12, 16.4%). It should be noted that the distribution of responses was relatively equal across each of these categories.

In the short time since the issuance of the BP Baker report (i.e., two years at the time this survey was conducted), there has been some use of the BP Process Safety Culture Survey. Because organizational surveys take time and effort to plan and implement, it may be the case that in coming years there will be a greater use of this survey tool. Thus, although there has been some anecdotal evidence that this tool is being used widely in the industry, it does not appear that wide use is happening yet.

We also analyzed correlations among items responses. Our results show that organizations that were perceived by survey respondents to emphasize productivity over safety were less likely to conduct safety-related surveys ($r=-.23$, $p<.01$). Also, organizations that are perceived by survey respondents as conveying that safety and productivity are positively related tended to be slightly more likely to conduct surveys ($r=.16$, $p<.05$), including the BP Process Safety Culture Survey ($r=.25, p<.01$). These results imply that organizations that consider safety amongst their more important priorities are more likely to conduct safety-related surveys.

3.5. The role of contractors

Participants were asked about contractors in their current organization. Respondents who classified themselves as government employees or consultants were asked questions about contractors in general from a third-party or external perspective ($n=77$). All other respondents were asked to consider contractors within their organization or from an internal perspective ($n=285$).

Respondents taking the internal perspective tended to respond that contractors in their organization were held to similar standards, trained in the same ways, and considered to be positive contributors to the overall safety climate (Table 6). In contrast, the 77 respondents who classified themselves as government employees or consultants were more likely to perceive contractors as being held to different standards than other employees in the contracting organization and as being more relaxed about safety and more concerned about deadlines (Table 6).

The BP Baker Panel was specifically concerned that contractors were being treated differently than other employees in the organization when it came to safety (e.g., held to different—i.e., lower—standards). Our results lend support to those findings. Specifically, when asked about contractors within an individual's organization, 98 (34.4%) of respondents agreed or strongly agreed that contractors were perceived as being part of the larger organization and as being more similar to others, whereas from an external perspective, only 7 (9.1%) agreed or strongly agreed. When asked if contractors were being held to different standards, respondents answering from an internal perspective tended to disagree or strongly disagree (148; 51.9%) while those answering from an external perspective were just as likely to agree as well as disagree (26; 33.8%). External respondents

Table 5
Safety Culture Assessment.

Items						
To what extent is the BP-Baker report useful to you and your organization? [a] ($M=4.00$; $SD=0.85$)	Not useful (2; 0.7%)	Slightly useful (9; 3.2%)	Somewhat useful (39; 13.7%)	Useful (104; 36.5%)	Extremely useful (63; 22.1%)	No response (68; 23.9%)
Prior to the BP-Baker report coming out in January of 2007, had your company surveyed your employees about safety-related issues? [a]	Had not conducted any surveys	Administered one survey	Periodically survey	Survey on a regular basis [b]	No response	
Read the Report ($M=2.36$; $SD=1.13$)	(53; 27.0%)	(14; 7.1%)	(80; 40.8%)	(49; 25.0%)	(52; 21.0%)	
Did not read the Report ($M=2.57$; $SD=1.20$)	(8; 34.8%)	(2; 8.7%)	(8; 34.8%)	(5; 21.7%)	(14; 37.8%)	
To what extent has your company administered any of the BP 2006 Process Safety Culture Survey questions to employees in your organization?	Have NOT administered any of the BP questions	Have administered SOME of the BP questions	Have administered ALL of the BP questions	Have administered SOME of the BP items but modified them	Have administered ALL of the BP items but modified them	I don't know
Read the Report ($M=3.12$; $SD=2.06$)	(69; 35.0%)	(33; 16.8%)	(16; 8.1%)	(16; 8.1%)	(11; 5.6%)	(52; 26.4%)
Did not read the Report ($M=3.44$; $SD=2.52$)	(12; 48.0%)	(1; 4.0%)	(0; 0.0%)	(0; 0.0%)	(0; 0.0%)	(12; 48.0%)
What has prevented your company from administering the BP survey items? *Please check all that apply.*[c]	Do not see the need	Not relevant to our organization	Lack of management commitment	Lack of time	Lack of human resources/staff to administer the survey	Lack of financial resources to administer the survey
Read the Report	(12; 16.4%)	(16; 21.9%)	(12; 16.4%)	(3; 4.1%)	(13; 17.8%)	(4; 5.5%)
Did not read the Report	(5; 35.7%)	(4; 28.6%)	(0; 0.0%)	(1; 7.1%)	(0; 0.0%)	(0; 0.0%)
	Employees would not participate	Not sure how to implement/ use the findings	Do not believe the findings would be used/ implemented	Doubts about the benefits of administering the survey	Lack of a safety-oriented organizational culture	Other (please specify)
Read the Report	(0; 0.0%)	(10; 13.7%)	(4; 5.5%)	(14; 19.2%)	(5; 6.8%)	(27; 37.0%)
Did not read the Report	(0; 0.0%)	(3; 21.4%)	(0; 0.0%)	(0; 0.0%)	(0; 0.0%)	(4; 28.6%)

Note. M = mean, SD = standard deviation. Responses reported (n, %).
[a] $n=285$, only organizationally-employed respondents.
[b] reverse coded.
[c] $n=81$ only those that responded that they had not administered BP items.

Table 6
The Role of the Contractor Items.

Items	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	No response
Contractors follow stricter safety rules/procedures than the rest of the employees in the organization.						
Internal perspective ($M=2.50$; $SD=1.02$)	29; 10.2%	93; 32.6%	61; 21.4%	22; 7.7%	11; 3.9%	69; 24.2%
External perspective ($M=2.51$; $SD=0.78$)	3; 3.9%	39; 50.6%	27; 35.1%	4; 5.2%	2; 2.6%	2; 2.6%
Contractors keep the safety rules/follow the safety procedures of the organization.						
Internal perspective ($M=4.05$; $SD=0.80$)	4; 1.4%	5; 1.8%	25; 8.8%	126; 44.2%	57; 20.0%	68; 23.9%
External perspective ($M=3.37$; $SD=0.91$)	1; 1.3%	16; 20.8%	16; 20.8%	40; 51.9%	3; 3.9%	1; 1.3%
Contractors are more relaxed about safety than non-contracting employees.						
Internal perspective ($M=2.32$, $SD=0.95$)	41; 14.4%	93; 32.6%	60; 21.1%	18; 6.3%	5; 1.8%	68; 23.9%
External perspective ($M=3.07$; $SD=0.88$)	3; 3.9%	17; 22.1%	29; 37.7%	26; 33.8%	1; 1.3%	1; 1.3%
Contractors are more concerned with meeting contract deadlines than working safely.						
Internal perspective ($M=2.46$, $SD=0.92$)	27; 9.5%	96; 33.7%	63; 22.1%	26; 9.1%	4; 1.4%	69; 24.2%
External perspective ($M=3.24$; $SD=0.98$)	2; 2.6%	18; 23.4%	18; 23.4%	32; 41.6%	4; 5.2%	3; 3.9%
Contractors receive the necessary training to perform their work safely.						
Internal perspective ($M=3.81$; $SD=0.86$)	3; 1.1%	17; 6.0%	35; 12.3%	125; 43.9%	37; 13.0%	68; 23.9%
External perspective ($M=2.99$; $SD=0.99$)	4; 5.2%	22; 28.6%	21; 27.3%	25; 32.5%	2; 2.6%	3; 3.9%
Contractors are held to different safety standards than non-contracting employees.						
Internal perspective ($M=2.29$; $SD=1.08$)	51; 17.9%	97; 34.0%	32; 11.2%	29; 10.2%	8; 2.8%	68; 23.9%
External perspective ($M=2.99$; $SD=0.97$)	4; 5.2%	21; 27.3%	26; 33.8%	22; 28.6%	3; 3.9%	1; 1.3%
The safety of contracting employees is monitored the same by the organization as it is for non-contracting employees.						
Internal perspective ($M=3.90$; $SD=1.00$)	4; 1.4%	24; 8.4%	24; 8.4%	102; 35.8%	63; 22.1%	68; 23.9%
External perspective ($M=2.85$; $SD=1.05$)	2; 2.6%	34; 44.2%	16; 20.8%	15; 19.5%	6; 7.8%	4; 5.2%
Contractors contribute positively to the organization's safety climate/culture.						
Internal perspective ($M=3.85$; $SD=0.85$)	3; 1.1%	9; 3.2%	51; 17.9%	108; 37.9%	45; 25.8%	69; 24.2%
External perspective ($M=3.11$; $SD=0.79$)	0; 0.0%	16; 20.8%	37; 48.1%	18; 23.4%	3; 3.9%	3; 3.9%
Contractors are perceived to be separate or different from the rest of the employees in the organization.						
Internal perspective ($M=2.94$; $SD=1.18$)	23; 8.1%	75; 26.3%	27; 9.5%	79; 27.7%	14; 4.9%	67; 23.5%
External perspective ($M=3.57$; $SD=0.83$)	3; 3.9%	4; 5.2%	18; 23.4%	46; 59.7%	3; 3.9%	3; 3.9%

Note. M = mean, SD = standard deviation. Responses reported (n, %). Internal perspective items were responded to by only organizationally-employed respondents (n = 285). External perspective items were responded to by only government employees and contractors (n = 77).

were more likely to perceive contractors as being more relaxed about safety (27; 35.1%) and more concerned with deadlines (36; 46.8%) than internal respondents (23; 8.1% and 30; 10.5%; respectively). Additionally, contractors were seen as more likely to contribute positively to an organization's safety climate by internal respondents (153; 53.7%) than by external respondents (21; 27.3%).

4. Discussion and conclusions

In summary, the BP Baker Report appears to be generally familiar and important to chemical processing industry insiders who responded to this survey. For the most part, these industry insiders also believe that the BP Baker Report is generalizable to other organizations. Most people in our study agreed with the findings in the report and found the information useful to them and their organizations.

4.1. Personal versus process safety

Whereas most survey respondents were aware of the distinction between process and personal safety and most respondents believe the two are positively related to each other, there were still some individuals who believe they are not related to one another. Additional research may reveal why there are differing views and under what conditions personal and process safety are most related to one another. Further, respondents indicated the personal versus process distinction appears to have at least some influence on the way safety is treated in organizations. Future research may probe specifically how organizations treat personal versus process safety differently.

4.2. The assessment of safety climate/culture

Safety climate has been defined as the relative priority of safety (Zohar 2003) to other operational goals. In manufacturing organizations, another important operational goal is production. This may imply that safety and production are competing goals and therefore efforts to fulfill one inhibit efforts to fulfill the other. However, this is only true in the short-term. Over time, organizations that are not safe cannot be productive either. Empirical research has shown that productivity and safety can and do coexist (e.g., Fernandez-Muniz, Montes-Peon, & Vazquez-Ordas 2009; Montorselli et al. 2010). Our respondents tended to perceive safety and productivity as positively related to one another.

Currently, there is no uniformly accepted tool for assessing process safety climate or culture (The BP US Refineries Independent Safety Review Panel 2007, p. 7); however, the publicly available BP Process Safety Culture Survey presents an opportunity for a benchmarking tool for the chemical industry. Should it be perceived and utilized this way, organizations would be able to compare their process safety cultures to other organizations and identify areas where they may need to intervene or probe further. However, we do concede that there is a lack of information-sharing about the instrument such that it may be too soon to conclude anything about the reliability and validity of this instrument. That being said, surveys gather information from the perspective of employees about what is widely known and what tends to be shared in the organization across employees. From this, we can infer perceived priorities and identify trends.

Our study revealed that whereas 72% of the organizationally employed respondents reported conducting safety-related employee surveys, only about a third (34.7%) of the respondents administered BP process safety questions. Perhaps not enough time has transpired between the release of the BP Baker Report and the timing of our survey for the BP safety questions to emerge as a benchmarking tool. Further, organizations may have a long-standing survey plan that they are committed to using year after year to assess their safety climate/culture; changes to include the BP process safety questions might be counterproductive to their survey plan goals. Of greater concern, however, is the number of organizations that had not conducted any

employee surveys that could identify problems within their own organizations.

Respondents' explanations for why their organizations were not using the BP items seemed to indicate that organizations do not feel that they need to administer these types of items, they do not see the benefits of using such a survey, or they perceived a lack of management commitment and administrative support.

4.3. The role of contractors

It is apparent from our results that there are differing perspectives on the role of contractors when it comes to safety in organizations. Our respondents indicated that organizationally-employed individuals perceive contractors as playing a more positive role and staying in line with overall safety rules than did externally-employed individuals, whereas externally-employed individuals perceive contractors as less integrated into the organization and less in line with the overall safety rules of the contracting organization. Future research is needed to identify what contributes to these discrepant views.

4.4. Limitations

It is important to keep in mind some limitations to our study when interpreting these results. First, our sample may not be fully representative of the intended population (i.e., safety personnel and decision makers in the processing industry) as our response rate was 8% of the total listserv solicited. Research shows that internet studies tend to have lower response rates (Kraut et al. 2004; Paolo, Bonaminio, Gibson, Partridge, & Kallail 2000). That said, research has also demonstrated that there are no significant differences between the use of web-based methods and paper-and-pencil methods (Gosling, Vazire, Srivastava, & John 2004). Second, we surveyed a relatively unique population of process safety listserv subscribers who are likely aware of the importance of process safety and concerned about it. Approximately 30% of our sample identified themselves as specifically safety or process safety personnel or managers, potentially overestimating the importance of the report that would not be seen if we had surveyed the average engineer or manager in chemical processing plants. Thus, our results may actually over-represent the number of people who have read the BP report and the magnitude of the concerns and feelings about related issues.

Third, whereas our survey questions were descriptive and reveal some meaningful trends, they do not provide extensive qualitative information about the reasons why respondents answered survey questions the way they did. Thus, additional research, perhaps using alternative research methods (e.g., interviews, focus groups) is warranted in order to provide further insights into participants' responses. Finally, social desirability is always a concern with survey research; however, because this survey was anonymous, there is a smaller likelihood that respondents would have engaged in socially desirable responding.

5. Implications for industry

The current study was an attempt to capture engineers' and other industry insiders' perspectives on the value and impact of the BP Baker Report and BP Process Safety Culture Survey. This study has implications for both organizational scientists and engineers in that it reveals perceptions about the primary mechanism used to share lessons learned within one industry about one major catastrophe (i.e., investigation reports). This study provides preliminary information about the perceived impact of a report such as this one. Learning from critical events such as the BP Texas City chemical explosion is a critical practice for organizations to undertake in order to prevent such catastrophes from recurring. Unfortunately, even in the case of major catastrophes, our study, in combination with research by Starbuck (2009) and Pasman (2009), indicates that organizations are not taking appropriate advantage of the learning that should occur following such events.

Acknowledgment

Support for this research was provided by the Mary Kay O'Connor Process Safety Center, Texas A&M University. A previous version of this paper was presented in J. B. Henning & T. Woodrick (Chairs), *Personal vs. process safety: What's the difference?* Symposium presented at the 24th annual Conference of the Society for Industrial and Organizational Psychology, New Orleans, LA, April, 2009.

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