ABS Group

# CULTURAL CAUSE ANALYSIS™

## MAPPING PROCESS SAFETY INCIDENT AND PERFORMANCE DATA TO CULTURAL CAUSAL FACTORS

**Laura O. Jackson**, Director, Advanced Training Solutions
**Steve Arendt**, Vice President, Global Oil, Gas & Chemicals

TABLE OF CONTENTS

# Cultural Cause Analysis™

**Mapping process safety incident and performance data to cultural causal factors**

**Laura O. Jackson**
**ABS Group**
1525 Wilson Blvd., Suite 625 | Arlington, Virginia 22209 USA
ljackson@abs-group.com

**Steve Arendt**
**ABS Group**
1701 City Plaza Drive | Spring, Texas 77389 USA
sarendt@abs-group.com

**Keywords:** Cultural Cause Analysis™ (CCA); Cultural Cause Map™; Root Cause Analysis (RCA); Root Cause Map™; Incident Investigation; Process Safety Management (PSM); Health, Safety, and Environment (HSE, ESH, SHE); Center for Chemical Process Safety (CCPS); Risk Based Process Safety (RBPS); safety culture; culture assessment; safety; quality; reliability; and ABS Group.

## Disclaimer

*ABS Group refers to various subsidiaries of ABS Group of Companies, Inc., including ABSG Consulting Inc. These concepts, methods, and tools were developed by ABSG Consulting Inc. (ABS Group). This methodology and the corresponding tools are meant to assist users in identifying (1) cultural causes of incidents that have occurred and (2) cultural issues that exist and may lead to accidents. The cultural cause analysis tool is not intended to eliminate all risks and does not guarantee against the occurrence of any incident. Any user of this tool agrees to defend, indemnify, and hold harmless ABS Group, its affiliates, directors, agents, employees, and subcontractors, against any claims of loss, injury, death, or damage of any nature whatsoever, including, but not limited to, claims for contribution and indemnification with respect to third-party claims unless directly caused by the sole negligence of ABS Group. This tool may be used by other parties, but it may not contain sufficient information for purposes of other parties and uses. This tool has been developed using a degree of care and skill ordinarily exercised, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, express or implied, is made with respect to this method or tool. All ownership rights and interests in this tool remain with ABS Group.

## Abstract

Cultural Cause Analysis™ (CCA) is a new approach for evaluating cultural causes for more effective and efficient incident investigations and root cause analyses (RCAs). This approach was developed by the same authors as the Center for Chemical Process Safety's book, Guidelines for Risk Based Process Safety, which is recognized globally by high-hazard industries as the benchmark for process safety management (PSM) practices. CCA is a reactive analysis method that supports determining the underlying cultural issues that led to an incident (a near miss, accident, or series of chronic events). Specifically, CCA supports organizations in assessing the underlying behaviors, actions, and cultural issues that allowed management system weaknesses (root causes) to exist and led to equipment or human performance gaps that caused an incident(s). Corrective actions addressing these cultural issues, if effective, are valuable because they positively impact seemingly unrelated areas of performance, including safety, quality, reliability, etc. CCA is an extension of root cause analysis (RCA) and is completed at the same time as RCA or afterwards. The CCA method works universally with available RCA models. The Cultural Cause Map™ is a tool which supports CCA and enhances organizations' ability to systematically trend data related to cultural issues. CCA is a reactive analysis methodology, occurring like RCA after an incident. While many organizations proactively assess their culture (e.g., safety culture assessments), this next-generation RCA method and tool support organizations in reactively assessing and understanding cultural issues post incident to avoid repetition and improve organizational performance.

# 1. Cultural Cause Analysis™

Organizations want to understand what happened after an accident has occurred because it is vital to ensure it will not recur. In the 1960s, the introduction of the "5-Why's" method from the automotive industry spurred deeper thinking. In the 1970s, as government agencies sought higher reliability and better occupational safety standards in energy and space travel, they formalized the root cause analysis (RCA) method to understand management system weaknesses in standards, policies, and administrative controls leading to accidents. RCA now encompasses (1) most industries, (2) issues, including safety, reliability, and quality, and (3) analysis of near misses, chronic issues, and accidents. This paper introduces the next evolution in the RCA discipline, Cultural Cause Analysis™ (CCA). CCA dives further into understanding the organizational tendencies, behaviors, actions, and individual cultural causes that created the environment that allowed the root causes to occur and exist, which inevitably led to the incident(s). This greater depth of understanding strengthens an organization's ability to influence the underlying cultural issues to avoid repetitive negative results in the organization's performance.

## 1.1 Industry's Need to Understand Cultural Causes of Incidents

*"We never want to have an accident like this occur again. So, how can we really learn from this?"*

*"Our corrective actions and controls, developed from a thorough RCA, do not seem to correct the underlying drivers of behavior. So, now what?"*

*"How can we achieve a sustainable 'drive to zero' process safety and Health, Safety, and Environmental (HSE) performance?"*

*"We want to have a mature culture. What does a mature culture look like, where are we, and how do we get to the desired maturity?"*

These are the questions ABS Group response teams have documented from over 40 years of conducting on-site investigations following major process safety incidents such as an explosion, oil spill, or chemical release. Response teams support organizations through the incident investigation and response to executive and regulatory inquiry. The teams then complete an RCA, which includes data collection and interviews, and report these findings to the organization. Our teams have observed an inability in RCA to dive deeper into the drivers of

performance. Wanting to support clients' need to (1) achieve sustained safety, quality, and reliability and (2) mature, ABS Group has continued to work beyond root causes to understand the cultural causes of incidents. After more than a decade of development, we have matured this approach and created the **Cultural Cause Analysis™ (CCA)** tool.

The desire for CCA is driven by many factors, both positive and negative. The *negative* drivers of CCA are that (1) accidents continue to occur and (2) the recommendations from RCAs that focus on correcting company standards, policies, and administrative controls do not create the desired long-term change. As a result, similar issues may occur again. The *positive* drivers of CCA are (1) the desire to create lasting changes post-accident, (2) the demand from stakeholders for sustained outstanding HSE performance, and (3) a drive to leverage HSE data in a more meaningful way.

A growing need exists to (1) understand cultural issues behind undesired behaviors, (2) develop corrective actions to influence the organizational culture in positive ways, (3) correct management system weaknesses, and (4) reduce the potential for chronic performance gaps and associated incidents. CCA is the answer to that need.

## 1.2 The Vision

### *1.2.1 Fulfillment of the safety culture vision*

The need for deeper analysis of culture is not a surprise; it was the process safety management (PSM) vision. The following is from the closing remarks in CCPS's *Guidelines for Risk Based Process Safety:*

> *Widespread use of risk based process safety metrics will enable companies to correlate off-normal events to management system failures and dysfunctional behaviors, ultimately focusing on accident prevention by improving the culture at the base of the accident/incident pyramid. Companies will understand that "learning lower on the pyramid" leads directly to safer, more productive, and more profitable operations.*

The PSM accident pyramid is in Figure 1.

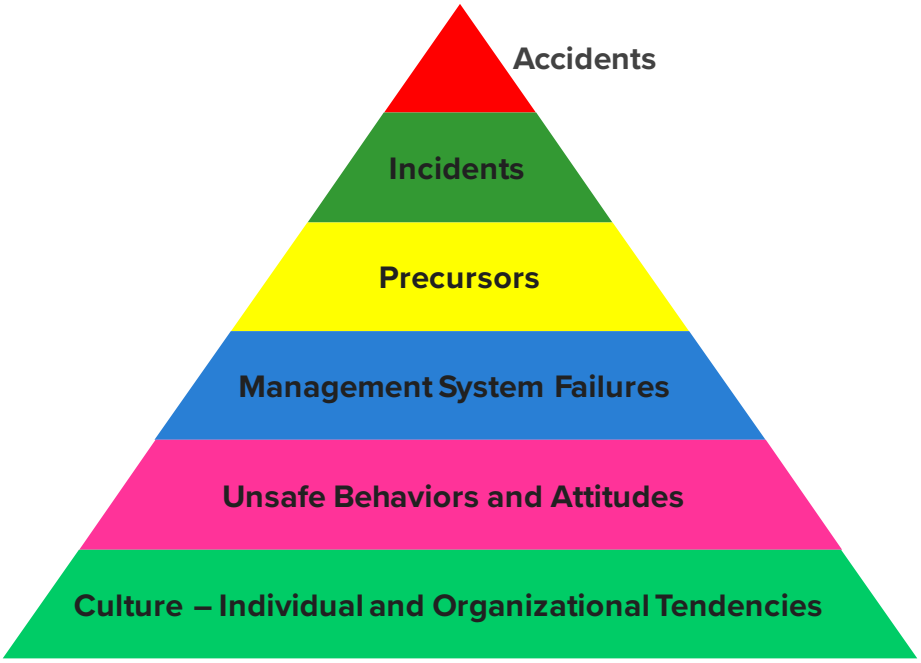


***Figure 1. The PSM Accident Pyramid***

At the base of this pyramid, poor individual and organizational tendencies [green] manifest into unsafe actions and behaviors [pink]. These cultural issues create the environment in which policies and standards are either not created, not sufficient, or not enforced [blue]. And those insufficient management systems allow for poor performance in people and equipment, leading to accidents [red]. While this pyramid specifically focuses on safety, the same principles apply to quality and reliability, or any other performance aspect that can be defined through its culture.

### *1.2.2 Fulfillment of the RCA vision*

The need for deeper analysis of culture is not a surprise; it was the RCA vision. In 2005, the *Root Cause Analysis Handbook: A Guide to Effective Incident Investigation* (second edition) included Figure 2, which shows the "different organizational levels and the corresponding level of learning that can be accomplished based on an incident."

The lowest level of the triangle shows the organizational culture issues [black], leading to the management system issues (e.g., standards and policies that are nonexistent, deficient, or not enforced) [grey], which inevitably lead to performance gaps in both people and equipment at the top of the triangle [white].

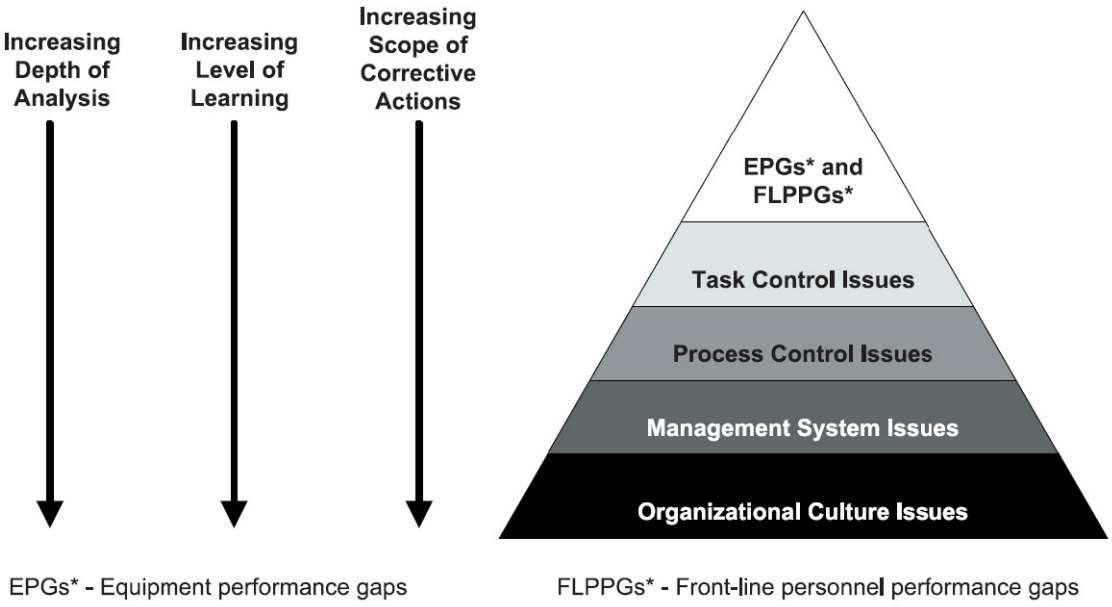


***Figure 2. The RCA Triangle***

The *Root Cause Analysis Handbook: A Guide to Efficient and Effective Incident Investigation* (third edition) discusses that existing root cause methods are effective at tackling the management system issues, but advancements are needed to understand and influence change at the next level, the cultural cause level. The arrows on the left side of the image depict the increasing depth of analysis, learning, and corrective actions that occur when evaluating incidents lower in the RCA triangle.

## 1.3 The Appeal of Proactive and Reactive Culture Analysis

Industry is making progress on evaluating culture *proactively*, as in "what cultural weaknesses can we identify that might lead to an issue?" However, industry generally does not attempt to identify and affect cultural issues *reactively* (i.e., after an incident).

PSM focuses on the prevention of, preparedness for, mitigation of, response to, and restoration from catastrophic releases of chemicals or energy from a process associated with a facility. This speaks to both proactive and reactive management, and yet industry focuses its evaluation of culture predominantly on *proactive* culture assessments rather than *reactively* performing analyses of cultural causes of incidents that do occur. States such as California are leading in this area of proactive safety culture assessment by regulating it. For example, the State has promulgated California General Industry Safety Order 5981.1 – Process Safety Management for Petroleum Refineries requirements to improve process safety performance. In the future, performing an analysis of cultural drivers to major accidents (at a minimum) should be expected as well.

All of us – and our organizations – want to do the right thing in the right way at the right time, all the time – even when no one is looking. And yet, culture is hard to measure and more difficult to change. Culture is the result of all the actions and inactions in institutional and workforce memory. Organizational culture is a complex combination of individual cultures and environments. The time for *culture* analysis both before *and* after incidents is now.

## 1.4 The Approach

### *1.4.1 Goals of CCA*

The goals of CCA are to identify and resolve the true underlying undesirable behaviors, attitudes, and cultural causes of losses that occur for:

- individual major events (as they occur)
- chronic minor events (as indicated in risk profiling)
- near misses with high potential severity
- any performance gaps that reveal a cultural weakness

### *1.4.2 Definition of cultural causes*

Cultural causes are the core causes of an event that can be reasonably identified, and management can correct or positively influence.

Typically, cultural causes are the absence, neglect, or deficiencies of an individual's or organization's demonstrated value system, which create an environment where management system (e.g., policies, procedures, and administrative control) weaknesses occur, leading to issues with human actions and equipment performance.

### *1.4.3 CCA connection to existing methods*

Organizations desire normal operations with people and equipment functioning in harmony, behaving as they should, and yielding the desired results. However, even in high reliability operations, near misses and accidents occur, people do not perform as they should, and equipment fails. Sometimes the issues coalesce to a point of catastrophe. Other times, the consequences are minimal, but the chronic repeat nature of the issues can cause greater pain to the organization. No matter how the incident occurs, if the high-potential (risk profile) of the near miss or accident is high enough, then analysis is needed to help assure that it does not occur again. Figure 3 depicts the progression of the level of details associated with using increasingly more detailed incident investigation approaches.

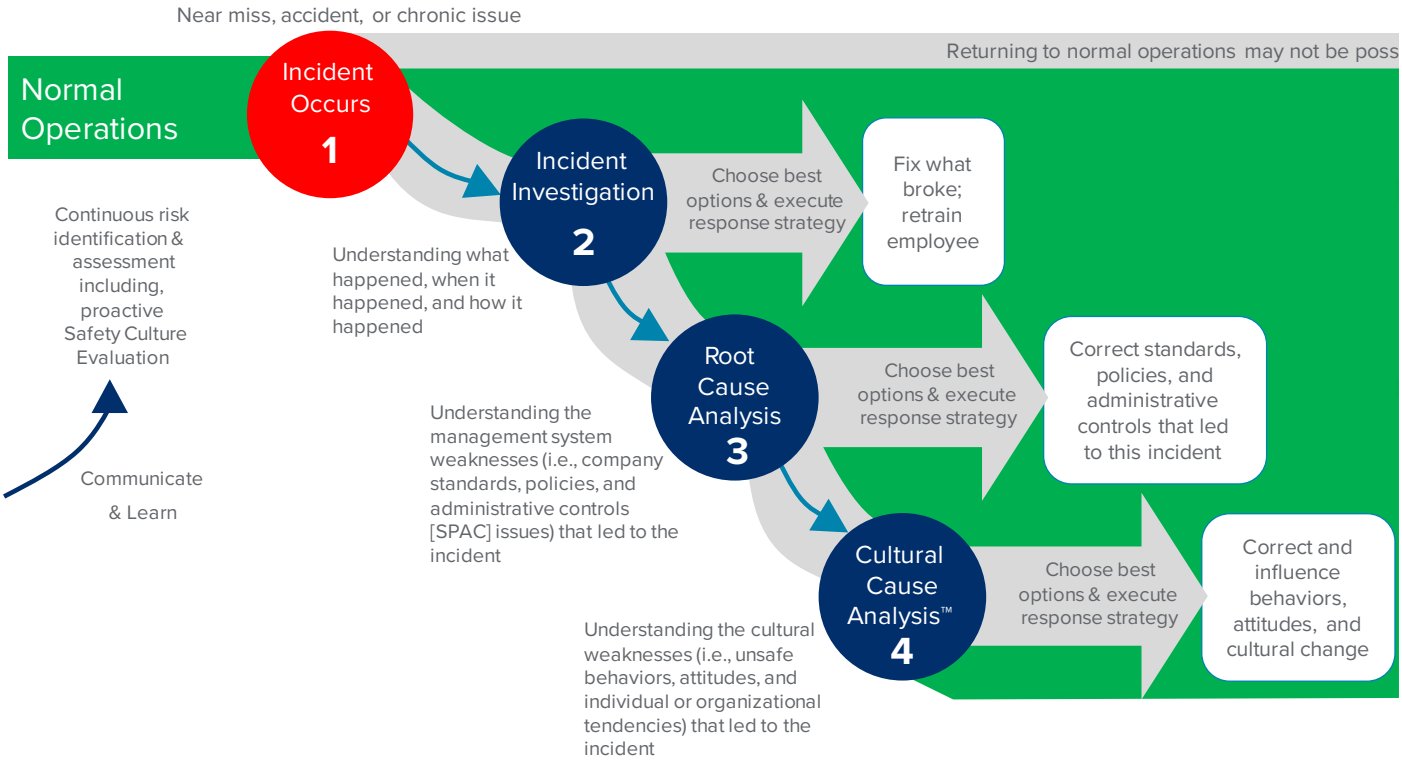


*Figure 3. Increasing Depth of Understanding Post Incident*

### *1.4.4 Benefits of CCA*

There are several benefits from performing CCA. Using CCA and implementing the resulting recommendations can:

1. Keep the same and similar events from recurring
2. Keep other seemingly unrelated future events that would have shared the same underlying cultural cause from occurring
3. Save time and money by avoiding implementing recommendations that do not address the underlying attitudes, behavior, and cultural issues
4. Achieve quick results from the cultural cause initiative
5. Demonstrate excellence by meeting and exceeding regulatory requirements for incident investigations and RCA
6. Promote cultural change within the organization

### *1.4.5 Optimal approach for implementation*

Like any program or process, an effective rollout is vital to the success of the new approach. The following three-step approach is recommended:

1. Focus the initial CCA teams on tackling (a) high-priority chronic items identified in the high-level risk profile or (b) more significant sporadic problems
2. Work with program management to structure a tailored CCA program (possibly integrated with the site's incident investigation and RCA program)
3. Provide training sessions on the customized CCA program and associated Cultural Cause Analysis™ tools

## 1.5 The Analysis Technique

This analysis technique has two major benefits. First, CCA is built from the foundation of CCPS's RBPS Safety Culture Essential Features and can be aligned for use with other culture frameworks. Secondly, CCA is compatible with any conventional RCA methodology, with no tailoring needed.

### *1.5.1 Comparison to CCPS's new book on safety culture*

CCA and its corresponding tool, the Cultural Cause Map™, are based on the Center for Chemical Process Safety's 2007 book, *Guidelines for Risk Based Process Safety*, which is recognized globally by high-hazard industries as the benchmark for process safety management (PSM) practices. CCPS recently published (2018) new culture core principles. The essential features of CCPS's RBPS (red book) are very similar to the new core principles. Much of the essential features of the two models are substantively identical, as shown in Table 1.

| CCPS's Guidelines for Risk Based Process Safety Culture Features (2007) | Comparison | CCPS's Essential Practices for Creating Strengthening, and Sustaining Process Safety Culture Core Principles (2018) |
|---|---|---|
| 1. Process safety must be a core value | Word differences only | 1. Establish the imperative for process safety |
| 2. Provide strong leadership everywhere | Identical | 2. Provide strong leadership |
| 3. Enforce standards of performance and accountability | Word differences only | 9. Combat the normalization of deviance |
| 4. Formalize the culture approach | Combined into one | 10. Learn to assess and advance the culture |
| 5. Maintain a sense of vulnerability | Identical | 5. Maintain a sense of vulnerability |
| 6. Empower individuals | Identical | 7. Empower individuals |
| 7. Defer to expertise | Identical | 8. Defer to expertise |
| 8. Ensure open and effective communications | Word differences only | 4. Ensure open and frank communications |
| 9. Establish a safe questioning and learning environment | Possible gap → | 6. Understand and act upon hazards/risks |
| 10. Foster mutual trust | Identical | 3. Foster mutual trust |
| 11. Responsiveness to process safety issues | Possible gap → | |
| 12. Provide continuous monitoring of performance | Combined into one | 10. Learn to assess and advance the culture |

***Table 1. Benchmarking with CCPS Culture Core Principles***

## 1.6 The Tool

The tool ABS Group developed for CCA is intended to be used after an RCA has been completed or in tandem with an RCA. The style and function of the Cultural Cause Map™ are similar to the Root Cause Map™, progressing from the top to the bottom with an increasing depth of understanding. The Root Cause Map™, Figure 4, is a proven tool after being leveraged for over 20 years in thousands of investigations in a variety of industries. As issues lower on both the Root Cause Map™ and Cultural Cause Map™, Figure 5, are understood and corrected, the corrective actions can be more impactful for the organization in preventing future issues that were seemingly unrelated.

### *1.6.1 The Root Cause Map™*

The Root Cause Map™ flows from top to bottom and is oriented with more equipment-based issues on the left and more personnel-based issues on the right. The top portion of the map begins with a causal factor (equipment or front-line personnel performance gap). For example, an equipment issue might be "the bolts failed on the coupling" and a personnel issue might be "the employee did not chock the wheels of the delivery truck." The map continues downward as the question "why" is asked until an intermediate cause level is reached; for example, "the bolt failed due to a design issue" or "the procedure did not require the employee to chock the wheels." Then the path transitions to the bottom left of the map where the root causes (deficiencies in standards, policies, and administrative controls) are identified.

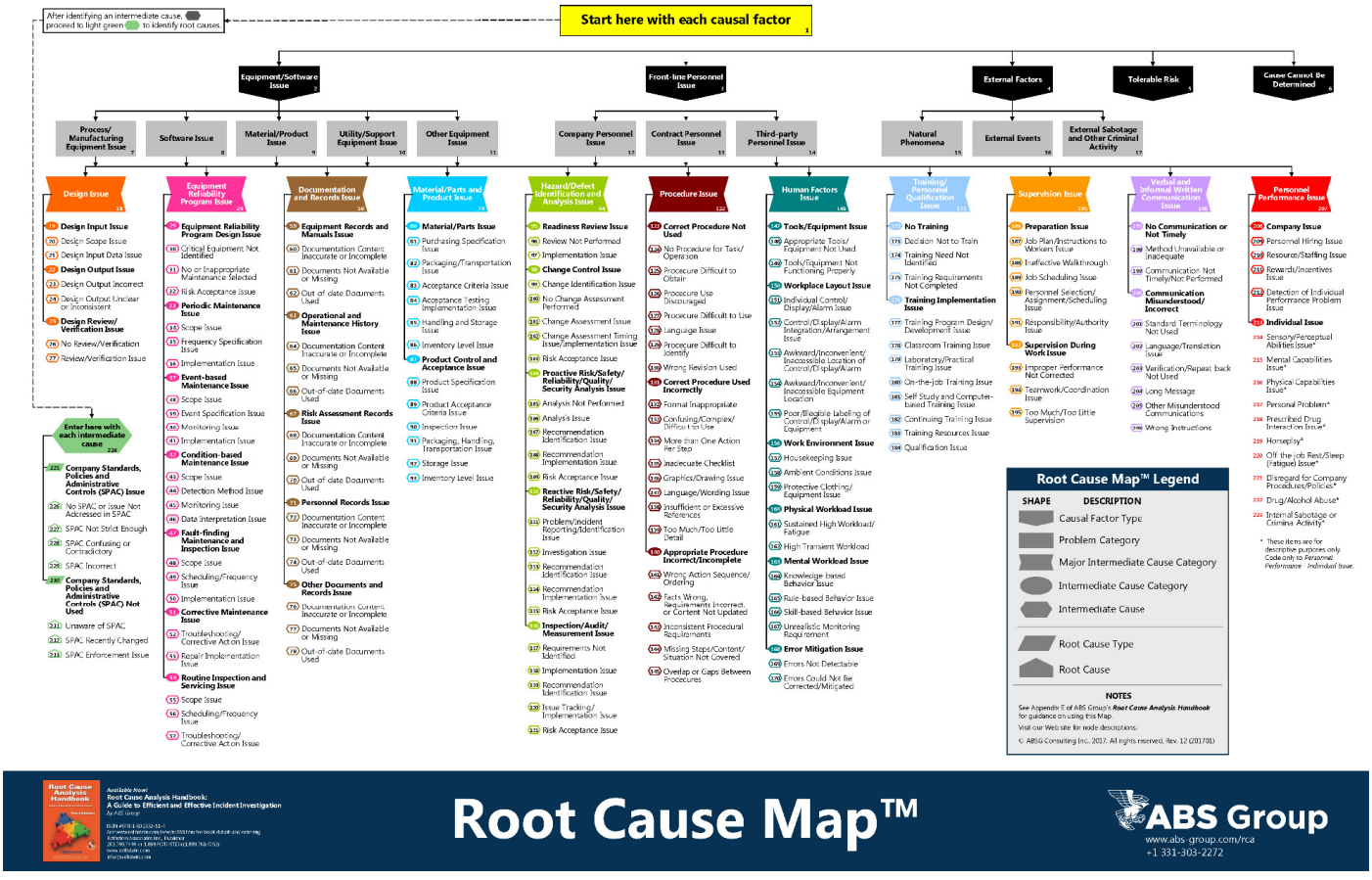


*Figure 4. Root Cause Map*

### *1.6.2 The Cultural Cause Map™*

The Cultural Cause Map™ is divided into four layers of cultural causes. Like the RCA Map, the flow of the Cultural Cause Map™ is also from top (Layer 1) to bottom (Layer 4). Layer 1 is predominantly focused on performance action issues. Layer 2 targets issues related to situational awareness. Layer 3 addresses factors related to adoption of leadership values by organization personnel. Layer 4 is related to the values expressed by leadership that drive the organization. While it is possible to have a strong organizational culture without any documented policies and procedures or a poor culture with comprehensive documentation, our model is built on the principle that both the culture and its documentation are important.

The case studies depicted in the section following the Cultural Cause Map™ are simplified to only show one path through the map. Actual analysis is more complex with a one-to-many relationship. A CCA involves analyzing and documenting the entirety of that complex relationship. The aggregate of the causal information is valuable. For example, after the analysis is completed, a user may observe that "mutual trust issues" were the predominant cultural issue that led to deficiencies in management systems, which ultimately caused an incident to occur.

A key advantage of routinely performing CCAs on near misses, accidents, and chronic events using this map is providing more comprehensive and accurate data trends. The data collected from this trending are a predominant source of input into proactive culture evaluation and performance management.

## 1.7 Case Studies

Below are two case studies that demonstrate the application, flexibility, and applicability of the CCA methodology and tool. These studies are based on real experiences that occurred in ABS Group's support to organizations. For simplicity, while the case studies had multiple causal factors, this discussion focuses on only one causal factor and limiting intermediate causes and root causes for each case study.

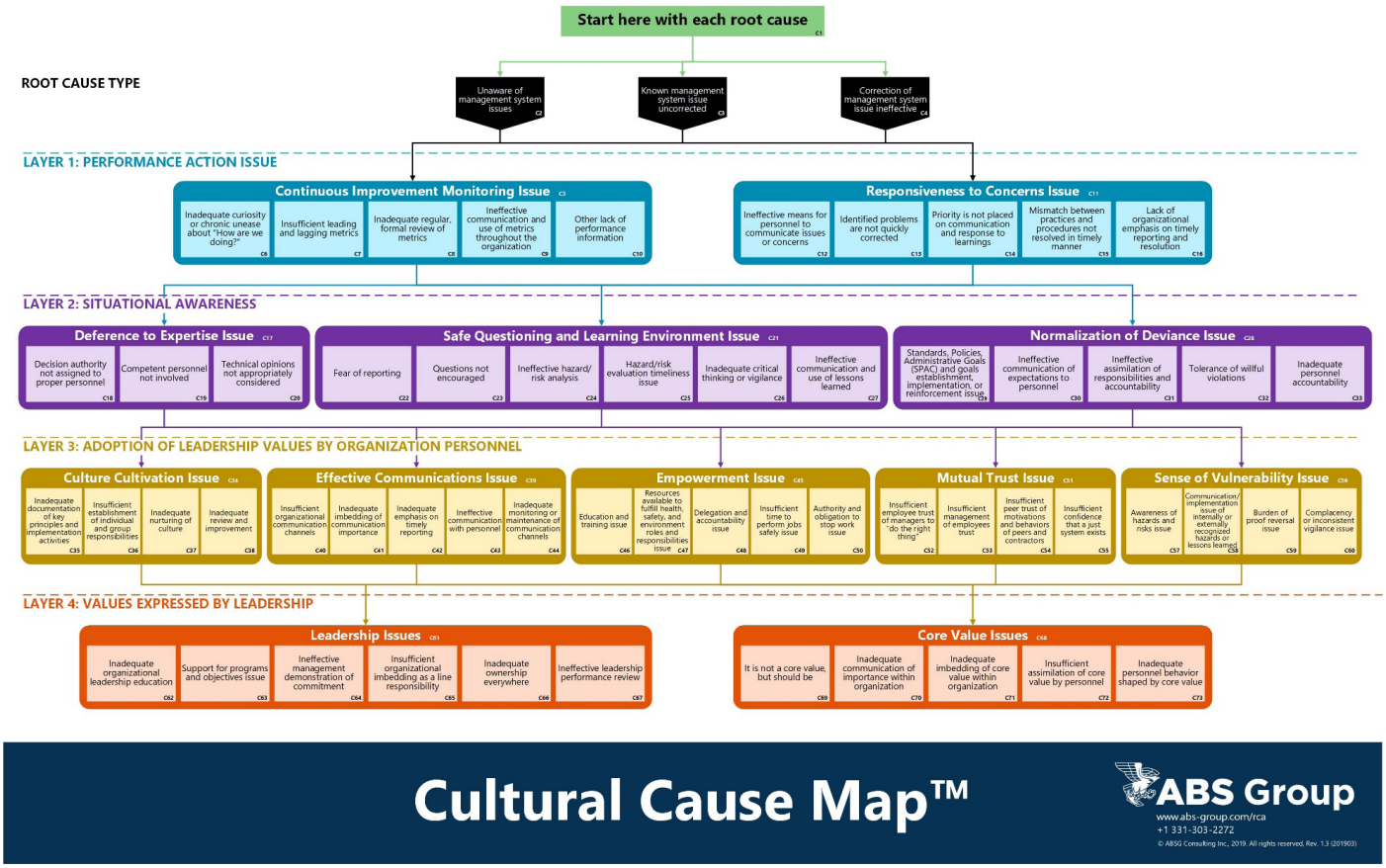


*Figure 5. Cultural Cause Map™*

### *1.7.1 Case Study 1: The "Lucky" Explosion (significant accident, but not catastrophic, that triggered a quick look at cultural causes)*

At a process facility, an unrecognized change to a gas compressor inlet/outlet led to a "lucky" explosion that caused no injuries because everyone was at lunch. Someone repositioned the chemical additive injection point from the suction side of the compressor to the discharge side (a physical distance of about 1 meter). No one considered this to be a change in the process, so no one thought to look at the properties of the chemical additive, which is very corrosive above 50°C. The process temperature was 40°C at the suction side and 135°C at the discharge side. After about 2 hours in operation, the discharge piping failed due to accelerated corrosion caused by the additive.

The **accident** was the explosion of a gas compressor system at the process facility that led to shutdown of the unit for an extended period and financial losses.

The company's incident investigation identified the following **causal factor** (i.e., performance gap[s] either by a person or piece of equipment that caused the incident, allowed the incident to occur, or allowed the consequences of the incident to be worse than they might have been):

- Worker repositioned the chemical additive injection to a new location (Root Cause Map™ Path: 3, 12)

The **intermediate causes** (i.e., underlying reason[s] why the causal factor occurred, but not deep enough to be a root cause) were determined to be:

- Failure to recognize and evaluate the modification as a change (Root Cause Map™ Path: 3, 12, 94, 98, 99 [as shown in Figure 6]) and
- The organization's investigation procedure did not require incidents related to management of change (MOC) issues to be routed through the MOC coordinator. Had the organization routed incidents through the MOC coordinator, the organization believes the MOC coordinator would have seen the increase in related incidents and taken action to support front-line personnel to identify actions that needed MOC. (Root Cause Map™ Path: 3, 12, 122, 140, 144 [as shown in Figure 7])

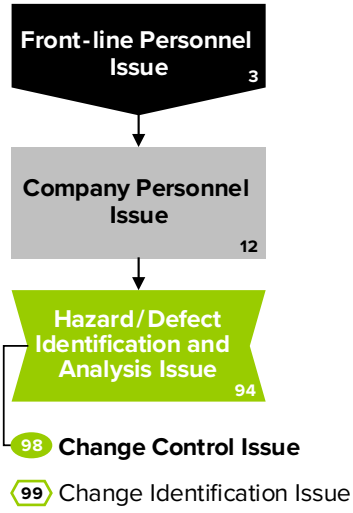


*Figure 6. Path to Intermediate Cause*

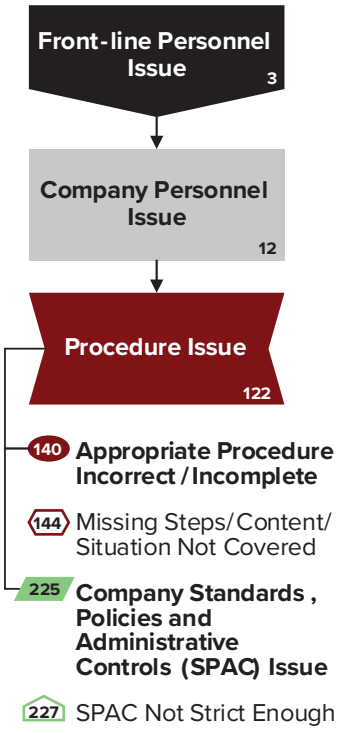


*Figure 7. Root Cause Path*

The company RCA identified the following **root causes** (i.e., management system weaknesses) of the incident:

- Failure to account for change type during the development of the MOC procedure (Root Cause Map™ Path: 3, 12, 94, 98, 99, 225, 227) [Not shown in a figure]
- Because investigation reports and findings related to MOC issues were not routed to the MOC coordinator, he/she was not aware of the need to improve the MOC management system based on the prior incidents. (Root Cause Map™ Path: 3, 12, 122, 140, 144, 225, 227 [as shown in Figure 7])

In addition to the immediate repairs required, the company also took the following **corrective actions** to address the root causes by:

- Revising the MOC procedure to address the change type involved in the incident
- Revising the investigation process to have all incidents that involve MOC issues routed to the MOC coordinator for learning assessment
- Providing refresher training for all personnel on incident lessons and the MOC process – in particular, recognizing changes

These corrective actions, if effective, addressed the direct technical intermediate and root causes. At the time, the investigators did not evaluate any underlying company cultural issues.

Sometime later, by request, ABS Group completed a quality assurance (QA) check of several incident investigations for the company. In our review, we came upon this incident report and another similar incident report. Given the significance of the incidents that occurred and that there were two similar incidents, we identified the need to analyze the cultural causes. The resources used for this quick-look CCA were one consultant, two employees, and 4 hours. The CCA identified the following **cultural causes**:

**Root Cause Type –**

*Unaware of the MOC management system issue (Cultural Cause Map™ Path: C2)*

**Cultural Cause Layer 1 –**

*Continuous Improvement Monitoring Issue – Other lack of performance information (Cultural Cause Map™ Path: C2, C5, C10)*

**Cultural Cause Layer 2 –**

*Deference to expertise issue – competent personnel not involved. The MOC coordinator was not involved in assessing MOC-related incident findings (Cultural Cause Map™ Path: C2, C5, C10, C17, C19)*

**Cultural Cause Layer 3 –**

*Sense of vulnerability – awareness of hazards and risks issue.* There are two issues here: (1) the incident investigation findings were not proactively shared with the MOC coordinator and (2) the MOC coordinator did not actively seek out the incident findings *(Cultural Cause Map™ Path: C2, C5, C10, C17, C19, C56, C57) as depicted in Figure 8.*

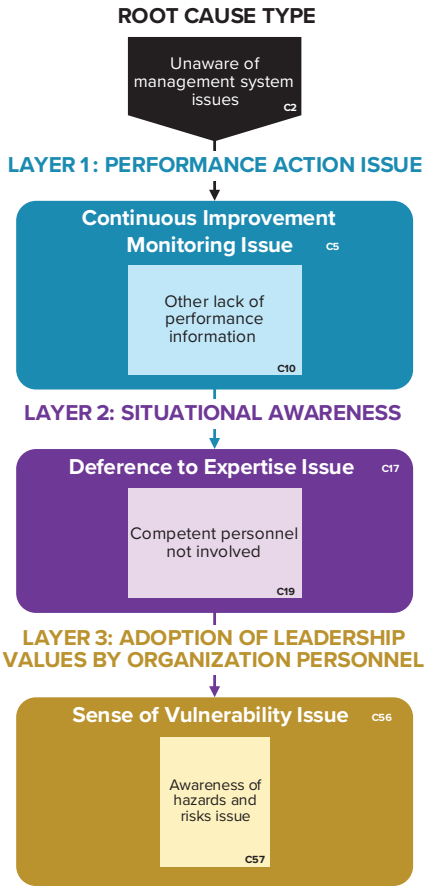


*Figure 8. Cultural Cause Path*

**Below are the other cultural causes reached at Layer 3 (from other Cultural Cause Map™ paths)**

- ***Lack of a sense of vulnerability*** – Personnel were not disposed to consider the hazards of "standard" maintenance and other chemicals. They had become complacent about all but the most significant direct hazards they faced.
- ***Failure to empower individuals*** – Operations leadership reduced refresher training during the past 3 years due to cost reductions.
- ***Failure of leadership*** – There was leadership failure, resulting from inadequate support for programs and objectives.

In summary, had the initial RCA team dug deeper into the underlying causes using the CCA method and Culture Cause Map™, the team would have uncovered several cultural causes that needed to be addressed to help ensure prevention of similar events.

### *1.7.2 Case Study 2: BP Texas City (catastrophic accident that triggered an in-depth review of cultural causes)*

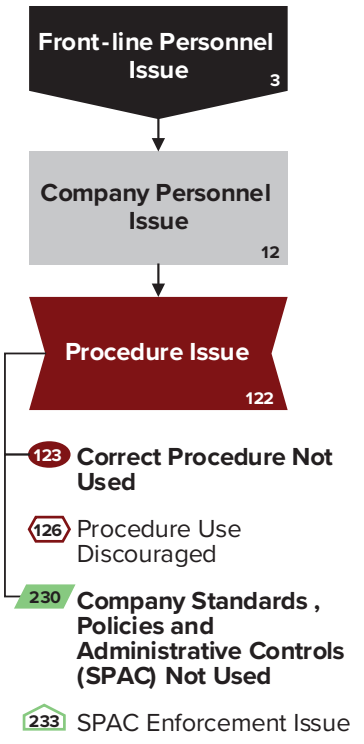


*Figure 9. Root Cause Path*

The BP Texas City accident had numerous technical causes and associated root causes. The organizational findings "imply" probable cultural causes. Using the Cultural Cause Map™, ABS Group traced the cultural cause path, starting with the technical finding of "Failure to Follow Start-Up Procedure" to:

The **accident** involved the ignition of a hydrocarbon vapor cloud that exploded at the octane-boosting isomerization unit, killing 15 people, injuring hundreds, and crippling the refinery.

A **causal factor** of the incident was determined to be that the blowdown drum was overfilled with highly flammable liquid hydrocarbons (Root Cause Map™ Path: 3, 12).

An **intermediate cause** identified per the Chemical Safety Board (CSB) Technical Finding was an employee failed to follow the startup procedure because the procedure use was not encouraged (Root Cause Map™ Path: 3, 12, 122, 123, 126).

A **root cause** identified by CSB was that the enforcement of policies was not strict enough because cost-cutting and production pressures impaired process safety performance (Root Cause Map™ Path: 3, 12, 122, 123, 126, 230, 233). This path is depicted in Figure 9.

The cultural cause path of this root cause is outlined below, using the Cultural Cause Map™. One path through the map is depicted in Figure 10. The **cultural causes** that allowed this root cause to occur are:

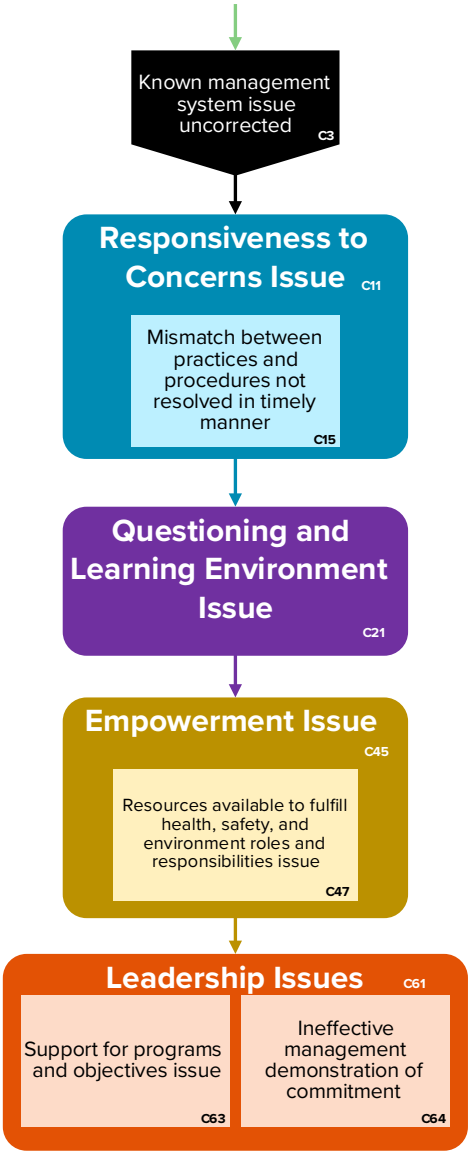


***Figure 10. Cultural Cause Path***

**Root Cause Type –**

The eroding management system enforcement of following procedures was an uncorrected known issue (Cultural Cause Map™ Path: C3)

**Cultural Cause Layer 1 –**

*Two cultural issues from Layer 1 led to the root cause:*

*Continuous improvement monitoring issue* – Inadequate curiosity or chronic unease about "How are we doing?" The company was measuring process safety success/performance by occupational safety metrics (Cultural Cause Map™ Path: C3, C5, C6)

*Responsiveness to concerns issue* – Mismatch between practices and procedures not resolved in a timely manner (Cultural Cause Map™ Path: C3, C11, C15)

**Cultural Cause Layer 2 –**

*Drilling down into understanding why "C15 – responsiveness issues" happened were due to two issues:*

(1) Normalization of deviance – Tolerance of willful violations and inadequate personnel accountability (Cultural Cause Map™ Path: C3, C11, C15, C28, C32 & C33 [not pictured])

(2) Questioning and learning environment – There was a general lack of questioning, including all of the identified notes on this topic

(C22 – fear of reporting, C23 – questions not encouraged, C24 – ineffective hazard/risk analysis, C25 – hazard/risk evaluation timeliness issues, C26 – inadequate critical thinking or vigilance, and C27 – ineffective communication and use of lessons learned). These are trended as: (Cultural Cause Map™ Path: C3, C11, C15, C21, C22 through C27)

**Cultural Cause Layer 3 –**

*Drilling down into understanding why "C21 – questioning environment issue" happened was because of:*

*Empowerment issue* – Resources available to fulfill health, safety, and environment roles and responsibilities issue (Cultural Cause Map™ Path: C3, C11, C15, C21, C45, C47)

**Cultural Cause Layer 4 –**

*Finally, the core cultural cause is:*

*A leadership issue* – Support for programs and objectives and ineffective management demonstration of commitment (Cultural Cause Map™ Path: C3, C11, C15, C21, C45, C47, C61, C63 & 64). This path is depicted in 10.

In summary, leadership's lack of support and commitment led to lack of empowerment, which resulted in a poor questioning and learning environment and normalization of deviance that led to a chronic mismatch between practices and procedures (i.e., the enforcement issue as a root cause, management system weakness).

## 1.8 Application of Data Analytics

Today, organizations spend extensive resources to collect and manage enterprise data to support a wide variety of operational and business functions. While these data are created to support other decisions, we recognize an untapped potential exists to use these data to support CCA. Performance management related to safety is not new, but applications related to more complex algorithms, business intelligence, timely (real-time) monitoring, and leveraging advanced techniques like machine-learning and big data are the next phase. Organizations are taking first steps to leverage artificial intelligence and data tools to find cultural issues, patterns, etc. For example, an organization might leverage big data applications to assess safety predominance in the culture and to trend it over time through monitoring safety-related content companywide through email and new or revised content on the topic of safety all of which can be paired with tracked information such as the number of documented near misses.

Modern data science tools are capable of extracting, integrating, and analyzing previously inaccessible and siloed data. ABS Group is already supporting organizations to use these data to monitor, analyze, and manage their culture as it evolves. Monitoring culture and ultimately predicting safety performance are no longer impossible tasks. Data science tools can support the proactive evaluation of the organization's culture (driving forces) and forensic analyses into "what went wrong?" and "why it went wrong" when an accident does occur. Use of these technologies are the vision for the future of CCA, and for some companies, it is already a reality.

## 1.9 Conclusion

Implementing effective corrective actions that address not only root causes but cultural causes is the best approach for achieving sustainable "drive to zero" process safety and HSE performance improvements, superior quality, and sustained reliability. If your organization is already using both proactive and reactive analyses of culture and achieving sustained performance, then bravo! If not, then the gauntlet is thrown down. Take RCA to the next level and dig deeper into understanding cultural issues by applying these CCA methods and the Cultural Cause Map™.

## 2. References

ABS Consulting, *Root Cause Analysis Handbook: A Guide to Effective Incident Investigation, 2005.*

ABS Consulting, *Root Cause Analysis Handbook, A Guide to Efficient and Effective Incident Investigation, 2008.*

Baker, James et al., 2007. "The Report of the BP U.S. Refineries Independent Safety Review Panel" http://www.safetyreviewpanel.com/, January 30, 2007.

Center for Chemical Process Safety (written by ABS Group under contract to CCPS), Guidelines for Risk Based Process Safety, 2007.

U.S. Chemical Safety and Hazard Investigation Board, BP America Refinery Explosion, REPORT NO. 2005-04-I-TX, March 2007.

## 3. About the Authors

**ABS Group** is a trusted technical services advisor with safety, risk, and integrity management at the core of what we do. ABS Group began providing technical services in 1971, and over the decades, we have expanded to offer comprehensive risk management solutions to an even broader spectrum of industries that power, fuel, and regulate our world. ABS Group is an experienced leader in incident investigations, RCA, and CCA and can support you as much or as little as you need: augmenting your staff with onsite support; being your on-call incident investigators and RCA and CCA response teams; developing and implementing management systems; performing specific analyses; providing software and other resource materials; designing and implementing big data applications in support of informed decision making; and training and coaching your staff.

**Laura Jackson** is Director, Advanced Training Solutions, and an expert risk management advisory professional. She specializes in developing innovative applications of risk, safety, quality, and reliability management to help major corporations, government agencies, and nonprofits make effective use of their limited resources to achieve organizational performance goals. Ms. Jackson is a recognized pioneer and subject matter expert of CCA, ERM, and RCA, and a thought leader in organizational excellence and business intelligence (BI). Ms. Jackson leads management projects that involve industry experts, risk modeling, data science, and technology-based solutions.

**Steve Arendt** is Vice President, Global Oil, Gas & Chemicals, with 42 years' experience in process safety and risk management in upstream, midstream, and downstream oil and gas, petrochemical, and related processing industries. He is a recognized thought leader with global expertise in PSM/HSE, organizational culture, and risk communication, with over 80 articles and 12 books to his credit. Mr. Arendt is a CCPS Fellow, a Mary Kay O'Conner Process Safety Center Merit Awardee, and is the 2019 AIChE Walton/Miller award winner recognizing his lifetime achievements in loss prevention and process safety.

## ABOUT ABS GROUP

ABS Group of Companies, Inc. (www.abs-group.com), through its operating subsidiaries, provides data-driven risk and reliability solutions and technical services that help clients confirm the safety, integrity, quality and environmental efficiency of critical assets and operations. Headquartered in Spring, Texas, ABS Group operates with over 1,000 professionals in over 20 countries serving the marine and offshore, oil, gas and chemical, government, power and energy and industrial sectors. ABS Group is a subsidiary of ABS (www.eagle.org), one of the world's leading marine and offshore classification societies.

info@abs-group.com

www.abs-group.com

ABS Group