

# Integrated Safety Systems

Ensuring Safety and Operational Performance

November 2011

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## Executive Summary

An increased focus to comply with regulations and the need to reduce safety injuries are driving organizations to adopt new strategies and technologies to ensure the safety of people, processes and products. From September to October of 2011, Aberdeen surveyed over 120 executives about the current state of their safety program and technologies they use to support their safety initiative. This report will provide a roadmap for organizations attempting to better understand how an integrated safety system, and other enabling technologies, can best be deployed in a plant environment.

### Best-in-Class Performance

Aberdeen used the following four key performance criteria to distinguish Best-in-Class companies:

- 90% Overall Equipment Effectiveness (OEE)
- 0.09% repeat accident rate
- 0.2 injury frequency rate
- 2% unscheduled asset downtime

### Competitive Maturity Assessment

Survey results show that the firms enjoying Best-in-Class performance shared several common characteristics, including:

- **81%** more likely than Laggard organizations to leverage outsourcing services to maintain their safety systems
- **1.5** times as likely as Laggard organizations to integrate their safety system with their plant automation system
- **Twice** as likely as Laggard organizations to leverage diagnostics tools to gain visibility into manufacturing operations

### Required Actions

In addition to the specific recommendations in Chapter Three of this report, to achieve Best-in-Class performance, companies must:

- Establish a formalized risk management strategy
- Ingrain safety as part of the culture through executive leadership
- Implement a single platform to perform safety functions and plant operations
- Adopt open protocols to enable communication between the safety system and their components
- Ensure the availability, reliability and security of the safety system by implementing security tools

### Research Benchmark

Aberdeen's Research Benchmarks provide an in-depth and comprehensive look into process, procedure, methodologies, and technologies with best practice identification and actionable recommendations

### How Does Your Performance Compare to the Best-in-Class?



- Compare your processes
- Receive a free, personal PDF scorecard
- Benefit from custom recommendations to improve your performance, based on the research

**Take the Assessment**

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## Table of Contents

---

Executive Summary.....	2
Best-in-Class Performance.....	2
Competitive Maturity Assessment.....	2
Required Actions.....	2
Chapter One: Benchmarking the Best-in-Class.....	4
Business Context .....	4
The Maturity Class Framework.....	5
The Best-in-Class PACE Model .....	6
Best-in-Class Strategies.....	6
Chapter Two: Benchmarking Requirements for Success.....	10
Competitive Assessment.....	10
Capabilities and Enablers.....	12
Chapter Three: Required Actions .....	18
Laggard Steps to Success.....	18
Industry Average Steps to Success .....	18
Best-in-Class Steps to Success .....	19
Appendix A: Research Methodology.....	21
Appendix B: Related Aberdeen Research.....	23

## Figures

---

Figure 1: Pressure driving companies to focus on safety.....	4
Figure 2: Differentiated Safety Strategies .....	7
Figure 3: Challenges.....	8
Figure 4: Performance Standards.....	9
Figure 5: Safety Lifecycle Capabilities .....	12
Figure 6: Reasons for Leveraging Outsource Services .....	14
Figure 7: Safety System Architecture .....	15
Figure 8: Security Solutions.....	17

## Tables

---

Table 1: Top Performers Earn Best-in-Class Status.....	5
Table 2: The Best-in-Class PACE Framework .....	6
Table 3: The Competitive Framework.....	11
Table 4: The PACE Framework Key .....	22
Table 5: The Competitive Framework Key .....	22
Table 6: The Relationship Between PACE and the Competitive Framework .....	22

## Chapter One: Benchmarking the Best-in-Class

### Business Context

Over the past few years, safety has moved to the forefront of critical topics for manufacturers. The past two years have seen some of the most talked about incidents such as the Gulf of Mexico oil spill, the Chilean mining accident, and the Virginia coal mine explosion. These events have impacted businesses, customers, shareholders and employees in unique ways that highlight the importance of having an effective safety strategy that ensures compliance and reduces the risk of an adverse event.

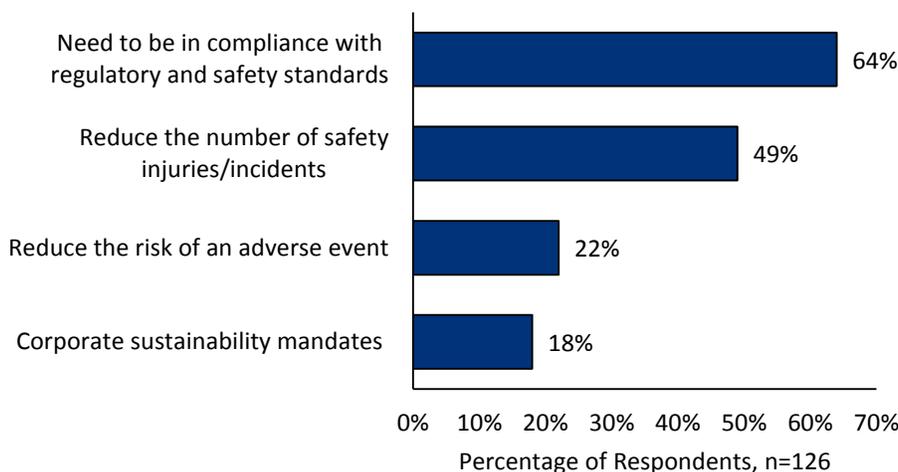
In today's economic environment, manufacturers are under immense pressure to contribute value to the organization's bottom line by cutting costs and improving productivity wherever possible. In fact, in the [Aberdeen Business Review](#) study of over 170 manufacturers revealed that their primary goals for 2011 were profitability and cost reduction. In such an environment, it is unfortunately far too easy for organizations to singularly be focused on improving manufacturing productivity at the sacrifice of the safety of employees.

This study focuses on how the industry leaders are looking at new ways to improve productivity without compromising safety. This research will highlight the role that business processes and safety technology assumes in improving safety and productivity in industrial plants.

### Market Pressures

Before diving into the details about what leading companies are doing well, let us take a step back to understand the dominant pressure driving companies to focus on safety.

**Figure 1: Pressure driving companies to focus on safety**



Source: Aberdeen Group, October 2011

### Fast Facts

Best-in-Class companies significantly outperform their competition in all three KPIs.

These manufacturers enjoy:

- ✓ **90%** Overall Equipment Effectiveness (OEE)
- ✓ **0.09%** repeat accident rate
- ✓ **0.2** injury frequency rate
- ✓ **2%** unscheduled asset downtime

"Initially there was a feeling that if we concentrate too much on safety, then manufacturing productivity will decrease and deadlines cannot be achieved. Management took a stand and stressed the importance of safety and that it cannot be compromised. This strategy worked and now safety is part of the culture."

~Parag Dabir,  
Automation Engineer,  
Energy Company

The top pressures driving companies to focus on safety are the need to be in compliance with current and future regulations and reduce the number of safety incidents. In this particular study there are a relatively high percentage of process industry survey participants. So it isn't surprising that with the recent high profile events in off shore drilling, mining, and power production, that organizations fear another high profile adverse event in their facilities. Due to these recent events, executives are increasingly pressured to stay on top of compliance issues and ensure the safety of their employees. Non-compliances can lead to not only brand image issues, but also penalties, fines, plant shut downs and potential injury. As our analysis will show, new technologies and approaches in safety, and especially safety systems, can address these pressures.

### The Maturity Class Framework

In this study Aberdeen uses four key performance criteria to distinguish the Best-in-Class from Industry Average and Laggard organizations:

- **Overall Equipment Effectiveness (OEE)** is a composite metric accounting for availability, performance and quality
- **Unscheduled asset downtime** is measured as the amount of unscheduled asset time the asset is offline against the total asset availability
- **Injury frequency rate** is expressed as the number of injuries recorded per 100 full-time employees per year
- **Repeat accident rate** is measured as the ratio of repeat accidents over the total number of accidents in the year

Respondents were divided among three categories based on their aggregate performances in these four metrics. Table I displays the average performance of Best-in-Class, Industry Average, and Laggard organizations.

**Table I: Top Performers Earn Best-in-Class Status**

Definition of Maturity Class	Mean Class Performance
<b>Best-in-Class: Top 20%</b> of aggregate performance scorers	<ul style="list-style-type: none"> <li>▪ 90% OEE</li> <li>▪ 0.09% repeat accident rate</li> <li>▪ 0.2 injury frequency rate</li> <li>▪ 2% unscheduled asset downtime</li> </ul>
<b>Industry Average: Middle 50%</b> of aggregate performance scorers	<ul style="list-style-type: none"> <li>▪ 83% OEE</li> <li>▪ 0.64% repeat accident rate</li> <li>▪ 0.4 injury frequency rate</li> <li>▪ 4% unscheduled asset downtime</li> </ul>
<b>Laggard: Bottom 30%</b> of aggregate performance scorers	<ul style="list-style-type: none"> <li>▪ 75% OEE</li> <li>▪ 4.54% repeat accident rate</li> <li>▪ 3.9 injury frequency rate</li> <li>▪ 12% unscheduled asset downtime</li> </ul>

Source: Aberdeen Group, October 2011

These four KPI's provide a holistic measure of success in any organization, but are especially telling when examining the success of safety performance. Indeed, Best-in-Class companies are outperforming their competitors across all metrics, and are able to create not only a safer working environment but also achieve higher operational performance with a 90% OEE rate and 2% unscheduled asset downtime.

### The Best-in-Class PACE Model

Ensuring safety without sacrificing manufacturing productivity requires a combination of strategic actions, organizational capabilities, and enabling technologies that are summarized in Table 2.

**Table 2: The Best-in-Class PACE Framework**

Pressures	Actions	Capabilities	Enablers
<ul style="list-style-type: none"> <li>▪ Need to be in compliance with current and future regulations</li> </ul>	<ul style="list-style-type: none"> <li>▪ Invest in technology solutions to improve safety</li> <li>▪ Establish a corporate program to reduce injuries</li> </ul>	<ul style="list-style-type: none"> <li>▪ Executive sponsorship enabling the success of safety initiative</li> <li>▪ Established cross functional team responsible for aligning maintenance, production, safety and corporate goals</li> <li>▪ Leverage outsource services to manage safety system</li> <li>▪ Establish a proactive risk assessment strategy</li> <li>▪ Leverage diagnostics tools to gain visibility into manufacturing operations</li> </ul>	<ul style="list-style-type: none"> <li>▪ Integrate the safety system with the plant automation system (single platform to perform safety functions and operate the plant)</li> <li>▪ Open protocols are used for communication between safety system and its components</li> <li>▪ Anti-virus / anti-malware</li> <li>▪ Network access control</li> <li>▪ Network firewall</li> </ul>

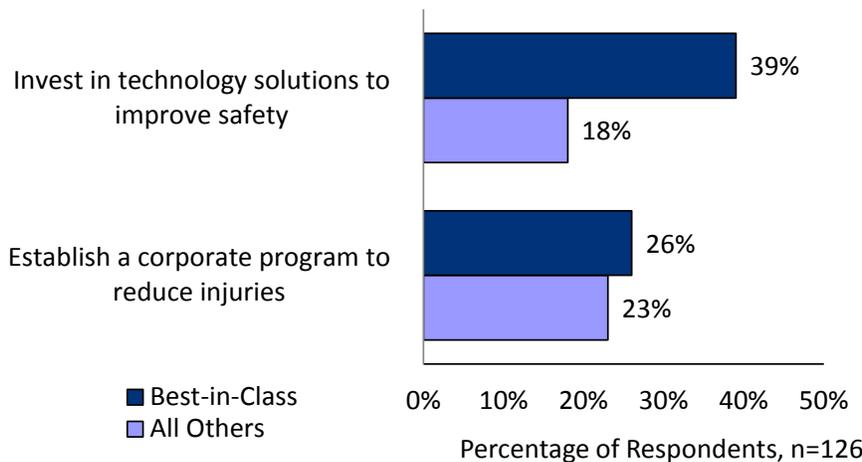
Source: Aberdeen Group, October 2011

### Best-in-Class Strategies

Regarding the strategic actions executives are taking in response to the market pressures faced, there are two strategic actions that align with Best-in-Class performance. First, as compared to their competitors, they are more likely to invest in technology solutions to improve safety. Safety is critical in manufacturing operations, and Best-in-Class companies understand that it often requires organizations to invest in the latest technology, specifically safety systems, to provide them with the ability to identify events before they occur. The nemesis for all manufacturers is unscheduled downtime resulting from equipment failure, operator error or nuisance trips. Investing in safety technology will also enable organizations to gain visibility into understanding the reasoning for asset downtime. The Best-in-Class are twice as likely as their competitors to make investments in technology. Even in difficult economic times, this speaks to how Best-in-Class companies are willing to make investments in new technologies and

upgrades to their assets to ensure the safety of their people, products and environment. This is further proof that safety has moved up the strategic agenda within manufacturing organizations.

**Figure 2: Differentiated Safety Strategies**



Source: Aberdeen Group, October 2011

Secondly, Best-in-Class companies also understand the importance of establishing a safety corporate program. Safety needs to be ingrained into the culture and the way to do that is to establish a corporate program. The program includes the involvement of various parts of the organization (such as maintenance, production, manufacturing, engineering and safety teams) - and not fall on the shoulders and sole responsibility of the safety engineer or plant manager. Indeed, Best-in-Class companies understand that safety cannot be managed in an independent and silo'ed manner, but rather with a holistic view of the organization.

**Issue at Hand**

Unfortunately, when it comes to implementing an effective safety system there are numerous challenges. As Aberdeen's research uncovered, they revolve around a lack of resources and lack of subject matter experts on safety standards and cost (Figure 3).

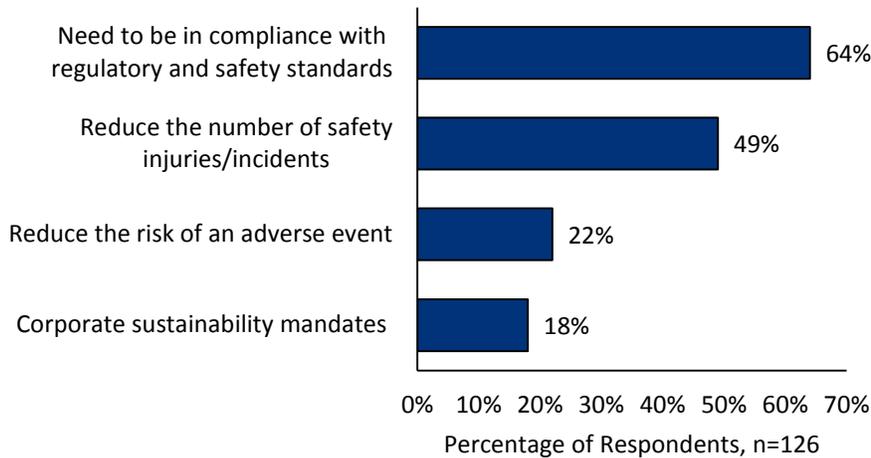
"Safety is part of everything we do since we are an oilfield service and manufacturing company. The biggest issue is to constantly remind people to think safely before they act, since every condition cannot be anticipated. If people are not careful, injuries will occur. Further, we are integrated with our supply chain partners, so their safety and our safety is seamless. We collaborate heavily across various functional groups to identify and weed out risks."

Stephen Hester,  
Senior Vice President  
Energy Company

"The challenges that we faced internally revolved around our very low competencies in the area of safety, process safety and functional safety."

~Process Engineer,  
Medium sized Oil and Gas  
Company

**Figure 3: Challenges**



Source: Aberdeen Group, October 2011

Manufacturers are challenged with the ability to have the right skills sets and knowledge base for managing their safety systems. Safety systems and control systems are often far from intuitive, and finding the right operator with the right skills sets can be challenging. These challenges are magnified by the economic condition and the impending retirement of a large number of experienced workers over the next several years. In addition, the cost associated with SIL certified safety systems and building the business case makes it challenging for manufacturers to want to invest in these systems.

**Definition**

**Safety Integrity Level (SIL)** is a statistical representation of the reliability of the safety system when a process demand occurs.

It is used in both ANSI/ISA-S84.01 and IEC 61508 to measure the reliability of safety system. Both ISA and IEC have agreed that there are three categories: SILs 1, 2 and 3. IEC also includes an additional level, SIL 4. The higher the SIL is, the more reliable or effective the safety system is.

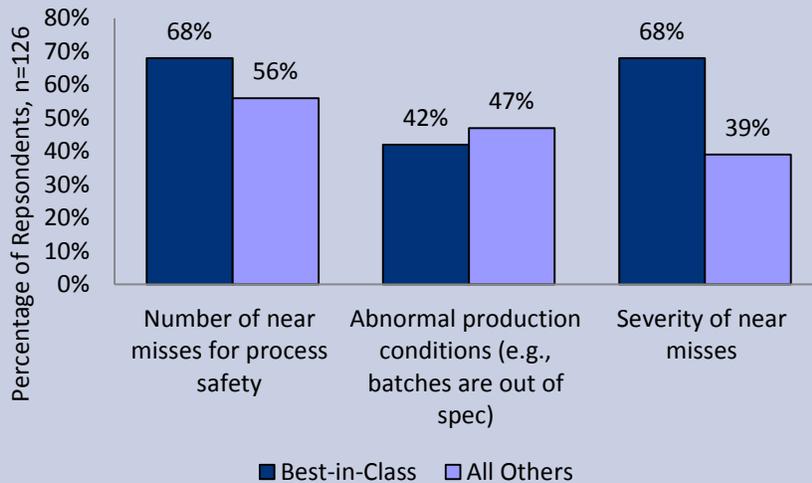
**Aberdeen Insights — Strategy**

All the strategies highlighted in Figure 2 are more likely to be used by the Best-in-Class but none of them are the highest adopted strategies in the market place. One of the most adopted strategies amongst all respondents was to implement performance standards to measure the success of safety initiatives. OSHA has mandated organizations to capture and measure metrics around personal safety. However, in the process industry, process companies are not mandated to measure and capture metrics around process safety. Within the survey, we asked respondents what kind of metrics were they measuring (Figure 4).

*continued*

**Aberdeen Insights — Strategy**

**Figure 4: Performance Standards**



Source: Aberdeen Group, October 2011

Aberdeen uncovered that the Best-in-Class are more likely than their peers to measure the number of near misses for process safety. For the most part, these leaders were on par with their competitors to also measure abnormal production conditions such as when batches were out of their controlled specifications. Where these leaders differentiated from their competitors was that they not only measured the number of near misses for process safety but they also measured and kept track of the severity of these near misses. By effectively keeping tabs on the near misses that had the biggest risk of causing an adverse event, these leaders were able to identify potential issues within their operation before they occurred. In the next section, we will see how the Best-in-Class are using a combination of business capabilities and technology to gain this critical visibility into operations.

In the next chapter, we will see what the top performers are doing to achieve these gains.

## Chapter Two: Benchmarking Requirements for Success

The way in which manufacturers sense and respond to events across manufacturing operations is highly correlated to the achievement of Best-in-Class performance.

### Case Study

In the energy industry, there are certain National Fire Protection Association (NFPA ) codes that companies need to adhere to in order to ensure the appropriate level of safety within the units. These codes mandate energy companies to have a certain level of safety systems to power plant furnaces and combustion technology. For a small North American energy company, management was pressured to ensure that their facility met all safety standards and decided to turn internally to their sister company to re-design, implement, and maintain their safety system.

The energy company took advantage of the latest safety technology and decided on a re-design their safety system, where their safety system and their control system are integrated on a single platform. In addition, rather than use proprietary protocols for communication between these systems, they decided to utilize open protocols. By having such an open architecture, the company was able to achieve significant benefits. A single platform means lower hardware, software, and support costs, while ensuring the same level of reliability and safety. In addition, by utilizing open protocols, it enables them to choose best-of-breed hardware rather than being restricted to a single vendor.

As the Vice President of Field Service explains, “By not separating the two systems, it made the development and implementation of our safety system significantly easier. In addition, the tangibles that we’ve able to achieve through cost savings have been great. However, we’ve also been able to achieve the intangibles such as the long term benefits from easier operation and maintenance of our updated systems, which makes the upgrade worthwhile.”

### Competitive Assessment

Aberdeen Group analyzed the aggregated metrics of surveyed companies to determine whether their performance ranked as Best-in-Class, Industry Average, or Laggard. In addition to having common performance levels, each class also shared characteristics in five key categories: (1) **process** (the approaches they take to execute daily operations); (2) **organization** (corporate focus and collaboration among stakeholders); (3) **knowledge management** (contextualizing data and exposing it to key stakeholders); (4) **technology** (the selection of the appropriate tools and the effective deployment of those tools); and (5) **performance management** (the

### Fast Facts

As compared to Laggards, Best-in-Class companies are:

- √ **81%** more likely to leverage outsource services to maintain their safety systems
- √ **Twice** as likely to leverage diagnostics tools to gain visibility into manufacturing operations
- √ **1.5 times** as likely as to integrate their safety system with their plant automation system

ability of the organization to measure its results to improve its business). These characteristics (identified in Table 3) serve as a guideline for best practices, and correlate directly with Best-in-Class performance across the key metrics.

**Table 3: The Competitive Framework**

	Best-in-Class	Average	Laggards
<b>Process</b>	Established a proactive risk assessment strategy to understand the risk profile of assets and operating procedures		
	70%	54%	46%
<b>Organization</b>	Executive sponsorship enabling the success of safety initiative		
	71%	68%	67%
	Established cross-functional team responsible for aligning maintenance, production, safety and corporate goals		
	75%	55%	50%
	Leverage outsource services to support safety system		
	65%	45%	36%
<b>Knowledge</b>	Automated data collection for all safety data		
	61%	42%	28%
	Failure data is used to perform root cause analysis to understand the impact and the probability of equipment failures		
	71%	68%	59%
	<b>Performance Management</b>	Alarms are monitored and escalated (ability to identify dangerous failures) in real time to decision-makers	
61%		56%	40%
Leverage diagnostics tools to gain visibility into manufacturing operations			
	56%	33%	28%
	<b>Technology</b>	Technology Enablers currently in use:	
<ul style="list-style-type: none"> <li>▪ 40% Integrate safety system with plant automation system</li> <li>▪ 61% Open protocols are used for communication between safety system and their components</li> </ul>		<ul style="list-style-type: none"> <li>▪ 33% Integrate safety system with plant automation system</li> <li>▪ 50% Open protocols are used for communication between safety system and their components</li> </ul>	<ul style="list-style-type: none"> <li>▪ 26% Integrate safety system with plant automation system</li> <li>▪ 36% Open protocols are used for communication between safety system and their components</li> </ul>

Source: Aberdeen Group, October 2011

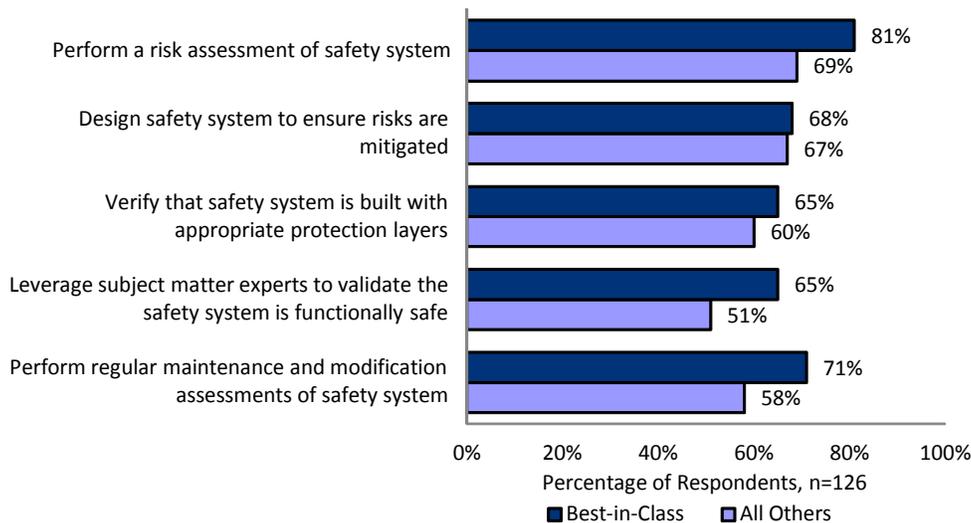
## Capabilities and Enablers

Based on the findings of the Competitive Framework and interviews with end users, Aberdeen's analysis of the Best-in-Class demonstrates that there are a number of business capabilities and technology enablers driving Best-in-Class performance.

### Process

Best-in-Class companies are 52% more likely than their competitors to establish a proactive risk assessment strategy to understand the risk profile of their safety system and operating procedures. Aberdeen finds that manufacturers that have this effective risk management strategy are more likely to adopt the safety lifecycle capabilities shown in Figure 5.

**Figure 5: Safety Lifecycle Capabilities**



Source: Aberdeen Group, October 2011

At the highest level, these capabilities focus on four key areas: identification, quantification, prioritization, and mitigation. Taking this segmented approach provides the decision makers with a clear picture of the risks within their safety systems and allows them to be better equipped to define strategies to address these risks. First, Best-in-Class companies are effectively performing an extensive risk assessment of their safety system. Once they have identified these risks, they are designing their safety systems to ensure that these risks are mitigated. Next, once they have designed the safety system, they verify that they have built the safety systems with appropriate protection layers. For example, in the case of machine safety, this means designing in additional safety components to ensure that the machine is functionally safe. Where the Best-in-Class companies are differentiating themselves is that they are leveraging subject matter experts (such as TÜV certified engineers) to validate that their safety system is functionally safe

and meets the various safety standards, such as IEC 61511, IEC 61508 and IEC 62061. Finally, Best-in-Class companies are also more likely than their competitors to perform regular maintenance and assessments to the safety system. This is important because once a safety system is implemented; manufacturers often forget to reassess the system to ensure that it is still reliable and functionally safe. Therefore, it is important to perform regular maintenance and risk assessments to the system and regularly update it accordingly.

### Organization

In Figure 2 it was highlighted that one of the ways the Best-in-Class are differentiating themselves is in their ability to establish a corporate program focused on safety. The Best-in-Class are creating such a culture in multiple ways. First, they are more likely than their competitors to have safety at the top of the executive agenda. It is extremely difficult to change the culture without having a true budget holder driving the philosophy of "safety first" before anything else. In addition, a true budget holder would be more willing to invest funds to upgrade assets, safety systems and control systems as well as investing in resources to manage the systems.

Secondly, the Best-in-Class also understand that safety needs to be ingrained from the top floor to the shop floor. Safety cannot be managed in a silo'ed manner and thrown over the wall to the next group to deal with. Indeed, Best-in-Class companies understand the importance of managing in a holistic manner and are establishing cross functional teams (from safety, maintenance, manufacturing, production to corporate) to implement the strategic decisions made in the board room. In addition, cross functional teams enable the ability to identify and share best practices across these different departments in various job roles, functions and groups. Enabling collaboration between functional groups is also very important in the case of the aging workforce within the manufacturing sector. As the baby boomers retire over the next five years, manufacturers are at risk of not properly sharing the safety best practices to the newer employees. By ensuring collaboration between functional groups, the best practices of past employees will not be lost.

Lastly, Best-in-Class companies are 81% more likely than Laggard organizations to leverage outsourcing services to support their safety systems. Implementing and maintaining a safety system is far from intuitive. Therefore, the Best-in-Class are leveraging outsourcing services to ensure that their safety systems are properly implemented, maintained and most importantly, are functionally safe. Figure 6 shows the primary reasons companies are leveraging outsourcing services (Figure 6).

#### Definition

**TÜV Certified Engineers:** TÜVs (short for Technischer Überwachungs-Verein) is a German organizations that work to validate the safety of products of all kinds to protect humans and the environment against hazards. As independent consultants, they examine and ensure that safety systems are functionally safe and adhere to the various safety standards.

“Safety systems and philosophy are well-developed in our company. Our primary challenge is the shift of a focus from a reactive response to incidents to a proactive prevention of incidents. The usual conflict between stated intent of 100% safety and actual demand for maximum production often lead to sub-optimal safety performance by individuals.”

~Steven Cooke,  
Quality Engineer,  
Oil and Gas Company

**Figure 6: Reasons for Leveraging Outsource Services**



Source: Aberdeen Group, October 2011

"Within our organization migrating to the new technology of safety systems and understanding the functionality of the new systems with respect to the legacy systems (i.e. confirming that the new systems are in compliance, like the old systems are/were) was extremely challenging. We leveraged third party services to help with this migration to the new technology."

~David Orent  
Engineer  
Large Consumer Packaged  
Goods Company

For the most part, the primary reasons as to why organizations leveraged outsource services revolved around lack of internal resources, cost and the desire to leverage TÜV certified engineers to validate the integrity of the safety system. In Figure 5, one of the ways the Best-in-Class were differentiating themselves was in their ability to implement key business capabilities throughout the lifecycle of their safety systems. Leveraging TÜV certified engineers to validate the safety system is one of the ways to ensure that the safety system is implemented and maintained correctly. In addition, it is often cheaper to leverage outsourcing services rather than hire a full time engineer to manage the safety system. Therefore, for manufacturers that lack the internal resources, it may make economic sense to outsource parts of the design, implementation and maintenance of the safety system to a third party.

### **Knowledge Management and Performance Management**

To effectively manage all safety issues in manufacturing operations, organizations need to equip their employees with visibility into safety data. The Best-in-Class are ensuring that they're providing key decision makers with the right data, at the right time and in the right form. They do this by automating data collection for all their safety data. It becomes significantly more difficult to react to incidents in real time if decision makers are relying on old safety data. In addition to automating the collection of safety data, Best-in-Class companies are also leveraging diagnostics tools to gain visibility into manufacturing operations as well as have the ability to escalate alarms to key decision makers in real-time. In the real-time nature of manufacturing operations, manufacturers need to be able to gain visibility into events as near real-time as possible. This can spell the difference between a batch being slightly out of temperature range to being so far out as to cause a

catastrophic event. If an event were to occur, Best-in-Class companies have standardized processes in place to learn why an event occurred, and subsequently perform an extensive root cause analysis. This allows manufacturers to uncover the reasons for the event and most importantly the probability of the event occurring again. This way, the Best-in-Class have the ability to create a closed loop process to ensure that the event is properly mitigated.

### Technology

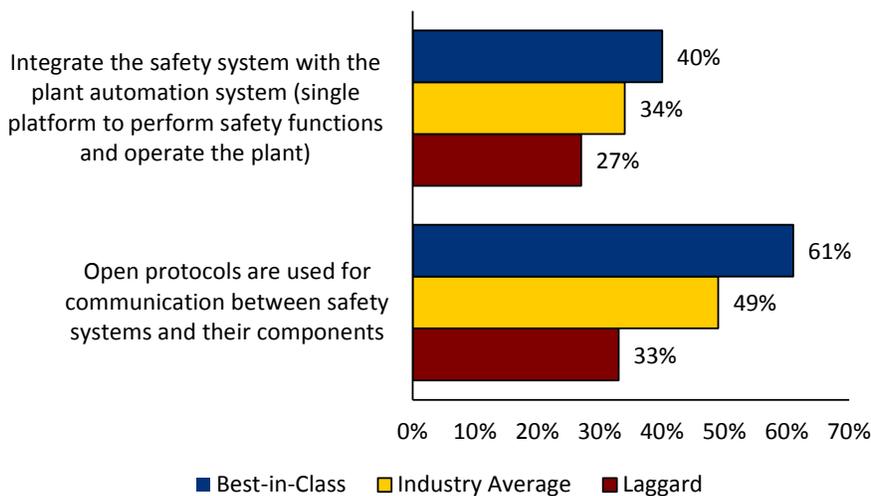
Historically, investments in plant and factory-level real-time systems were mainly driven by the need to control and safely operate large investments in plant and equipment. This objective often warranted physical and technical isolation between the control systems and safety systems. In this approach, manufacturers would have dedicated personnel who would monitor and control the safety systems. The idea was that by implementing such architecture, there would be less risk of the safety system being compromised by events on the control system. This approach generally costs more and raises a number of complex design and integration issues. In fact, in Aberdeen's research, we uncovered that when it comes to the safety system architecture, 71% of the Industry Average are still separating the two systems.

Additionally, innovation in the design and implementation of safety systems was limited due to application standards that placed constraints on the flexibility of safety system design. The Best-in-Class companies are differentiating themselves and have taken advantage of the latest technology and recent changes to the global safety standards to implement the safety system architecture shown in Figure 7.

“By integrating our safety system and control systems, it made the development and implementation of our safety system significantly easier. In addition, the tangibles that we’ve able to achieve through cost savings have been great. However, we’ve also been able to achieve the intangibles such as the long term benefits from easier operation and maintenance of our safety systems, which makes the recent upgrade worthwhile.”

~Vice President of Field Services  
Energy Company

**Figure 7: Safety System Architecture**



Source: Aberdeen Group, October 2011

The manufacturing industry is seeing some major changes in technology. One of the areas of innovation is the ability for manufacturers to integrate their safety system with their plant automation system. The Best-in-Class are 48% more likely than their competitors to integrate their safety system with their plant automation system. This enables them to have a single platform to perform defined safety functions, more effectively operate the plant and adhere to safety standards. In addition to these benefits, a single platform also delivers other major benefits. It means reduced hardware, software and support costs because the same software can be used and personnel only have to learn and keep current with one architecture.

Another area of technology innovation comes in the form of network protocols used to communicate and transfer data between safety systems and their components. Best-in-Class companies are 84% more likely than their competitors to leverage non-proprietary protocols. In the past, communication between the safety system and their components was done through proprietary protocols based on the vendor product. This was done for many reasons, mainly, manufacturers believed that by using proprietary protocols it ensured the reliability, availability and security of their safety systems. However, with the recent advances in networking, manufacturers can ensure the same level of availability, reliability and security through the use of open protocols. Over the past years, several open protocols have been released PROFIsafe, CIP Safety, FOUNDATION Fieldbus SIF, Safety over EtherCAT to name a few, and are supported by numerous vendors. These open protocols greatly improve the level of integration and interoperability between standard and safety control systems. This seamless communication allows manufacturers with better visibility into the reasons for and frequency of events and their ability to more effectively manage the massive amounts of complex safety data. In addition, by utilizing open protocols, it allows manufacturers to combine best-of-breed hardware to produce the most efficient safety and control system, rather than be restricted to using a particular vendor.

Indeed, Best-in-Class companies are recognizing the deployment of an intelligent, integrated safety solution can not only ensure the safety of their employees but also directly affect their bottom line by improving manufacturing productivity. The time is now for manufacturers to take advantage of the changing landscape in technology, not only from the safety system perspective but also the change in networking capabilities.

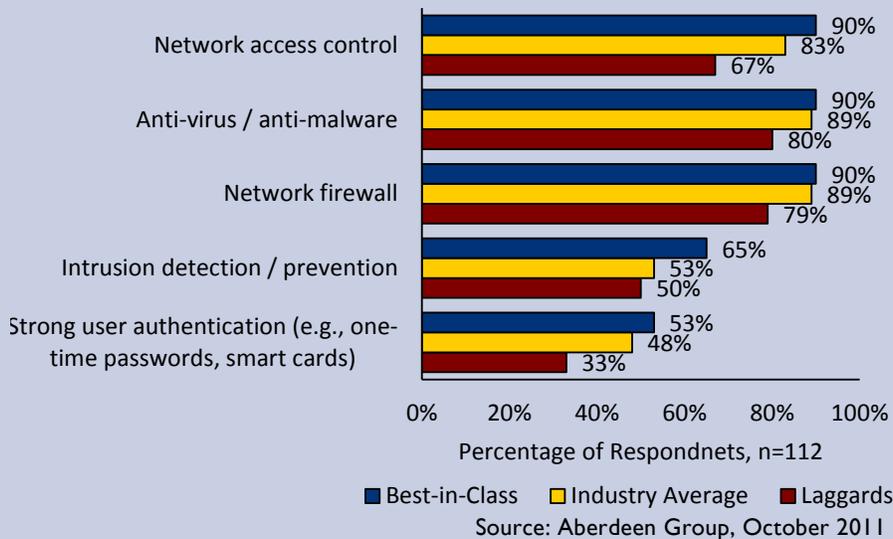
"We deal in a multi-vendor environment, so sometimes there are challenges in integrating safety and automation systems. Generally there is management support to ensure process safety is not compromised. Within our organization we leverage subject matter experts and have executive sponsorship to provide governance to process safety systems."

~Johnson Ntemuse,  
Control Engineer,  
Oil and Gas Company

**Aberdeen Insights — Technology**

2010 changed the shape of industrial security with the arrival of Stuxnet, the first malware targeted specifically at industrial environments. It removed any doubt that such threats are real. With the discovery of Stuxnet, manufacturers realized how safety, security and industrial processes are interrelated in terms of cyber security. Most recently, in March 2011, Italian researcher Luigi Ariemma published a list of 34 Supervisory Control and Data Acquisition (SCADA) vulnerabilities which had the potential to exploit systems used at oil and gas, water-management facilities, as well as factories around the world. While the Best-in-Class are taking advantage of the convergence of safety and control systems, they also have taken extensive measures to ensure the security and, most importantly, the reliability of their mission critical processes. They have done this through a portfolio of tools ranging from network access control, to network firewall to intrusion detection and prevention (Figure 8). For manufactures looking to implement an integrated safety system architecture, they should **not** overlook the security of their safety system. Manufacturers need to develop, implement and maintain the security and reliability of their safety systems.

**Figure 8: Security Solutions**



## Chapter Three: Required Actions

Whether a company is trying to move its performance in safety from Laggard to Industry Average, or Industry Average to Best-in-Class, the following actions will help spur the necessary performance improvements:

### Laggard Steps to Success

- **Executive leadership drives the focus on safety.** In order to enable real change in the culture, manufacturers need to have an executive sponsor driving the focus on safety across the organization. Only 67% of Laggard organizations have an executive driving this initiative. To truly take advantage of the latest safety technology, organizations need a true budget holder driving this initiative.
- **Establish a proactive risk management strategy.** While 70% of Best-in-Class companies have a formalized strategy to identify, quantify, prioritize and mitigate all risks within their safety systems, only 46% of Laggard organizations have done so. Not being able to manage these risks in a proactive manner can potentially lead to fines, penalties, plant shutdowns and severe injury.
- **Automate the collection of safety data.** Only 29% of Laggard organizations have the ability to automate the collection of their safety data. It becomes extremely difficult to collect all the safety data manually (which puts the integrity of the data into question) and on top of that, manage all the safety data in silo'd systems. Automating data collection enables companies to provide their key decision makers with the right data, at the right time and in the right form.

### Industry Average Steps to Success

- **Leverage outsourced services to support safety systems.** Designing, implementing and maintaining safety systems is far from intuitive. In some cases, many manufactures lack the internal expertise to ensure proper risk assessment and design of an effective safety system. By leveraging outsourcing services to support the safety systems, the Industry Average can ensure that their safety system meets all standards and is functionally safe.
- **Enable cross-functional collaboration to foster a safety culture .** To help shape the enterprise vision for safety, executives should create cross functional continuous improvement teams focused on safety. Our survey indicated that barely half of the Industry Average are creating this cross-functional team. Manufactures need to ensure that the safety strategies established at the boardrooms are implemented across the complete network of

### Fast Facts

As compared to Laggards, Best-in-Class companies are:

- ✓ **67%** more likely to have an executive driving their safety initiative
- ✓ **46%** more likely to establish a proactive risk management strategy
- ✓ **Twice** as likely to automate data collection for all safety data

### How Does Your Performance Compare to the Best-in-Class?



- Compare your processes
- Receive a free, personal PDF scorecard
- Benefit from custom recommendations to improve your performance, based on the research

**Take the Assessment**

Receive Your Free Scorecard

industrial facilities. Indeed, cross functional teams improve the likelihood of change taking place and taking hold.

- **Leverage diagnostics tools to gain visibility into manufacturing operations.** Once manufacturers have automated the data collection of safety data, they need to have a way of leveraging diagnostics tools to contextualize the data in order gain critical visibility into manufacturing operations. Only 33% of Industry Average companies are leveraging these tools and should look into implementing them for greater visibility and control in their safety processes. When an event occurs, diagnostic tools will enable these manufacturers to diagnose an event, quickly rectify the problem and get production back online sooner.

"A significant amount of work has been done to properly identify safety issues and resolve unsafe equipment. Additional software programs are being used to better track safety injuries and operational improvements."

~Manufacturing Manager,  
Food and Beverage

### **Best-in-Class Steps to Success**

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- **Continue to invest in an integrated safety system.** While the Best-in-Class are leading the charge in integrating their safety system with their control system, only 40% of them have done so. Expanding the adoption of this technology will enable Best-in-Class companies to gain better control and maintenance of their safety processes.
- **Continue to adopt open protocols.** Only 60% of the Best-in-Class are leveraging open protocols. Open protocols allow seamless transport of data between safety control and their components. This seamless communication will enable manufacturers to gain critical visibility into safety data. Utilizing open protocol will allow Best-in-Class companies to combine best-of-breed hardware to produce the most efficient safety and control system.
- **Implement security solutions to ensure the reliability and security of safety systems.** As manufacturers are recognizing the importance of safety systems and integrating these systems with their control networks (as opposed to isolation), they also need to ensure the security and reliability of their safety system. Therefore, Best-in-Class companies need to continue to invest in security solutions, in particular intrusion detection and strong user authentication tools (where only 65% and 53% of Best-in-Class are implementing respectively) to protect their safety systems from unwarranted attacks. Security cannot be overlooked.

"The biggest challenge is probably educating all workers about the importance of the safety systems that the company is serious about improving. The main strategy is employing a safety training system called ZIP. A huge investment has been made in both time and money. The second strategy is persistence with the safety message. It has been very successful. Most of the incidents that arise now are minor ones."

~Control Engineer,  
Energy Industry

### Aberdeen Insights — Summary

Aberdeen's research has seen the progression and adoption of integrated safety systems in the manufacturing environment. Best-in-Class companies recognize the many benefits that an integrated safety system can deliver. Before an organization plans on implementing an integrated safety system, they need to understand that it takes a combination of organization restructure, defined risk management practices, and the ability to have real-time visibility into manufacturing operations. Indeed, a well implemented safety system can do much more than simply emulate the functions of a traditional safety system.

While budgetary restrictions may dictate an integration/migration strategy for obsolete safety infrastructure, manufactures need to consider the opportunity to "leap frog" over their peers enabled by a more aggressive use of up-to-date technologies to improve process, asset and safety performance. Through their successful implementation of their safety system architecture, Best-in-Class companies are able to achieve a 0.2 injury frequency rate, a 0.09% repeat accident rate, all while ensuring manufacturing productivity with a 2% unscheduled asset downtime and a 90% OEE rate.

## Appendix A: Research Methodology

Between September and October 2011, Aberdeen examined the use, the experiences, and the intentions of more than 120 enterprises that have implemented safety systems in a diverse set of manufacturing enterprises.

Aberdeen supplemented this online survey effort with interviews with select survey respondents, gathering additional information on their strategies, experiences, and results.

Responding enterprises included the following:

- *Job title:* The research sample included respondents with the following job titles: CEO / President (6%); EVP / SVP / VP / Partner / General Manager (7%); Director (7%); Manager (29%); Staff (30%); All Others (21%)
- *Industry:* The research sample included respondents from the following industries: Oil and Gas (36%); Industrial Equipment Manufacturing (14%); Food and Beverage (13%); Energy (13%); Chemicals (11%); Metals, Mining, Minerals (5%); Consumer Packaged Goods (3%); Automotive (3%); Aerospace and Defense (2%)
- *Geography:* The majority of respondents (52%) were from North America. Remaining respondents were from the Asia-Pacific region (15%), Europe (16%); South/Central America (8%) and Middle East, Africa (9%)
- *Company size:* Thirty-seven percent (37%) of respondents were from large enterprises (annual revenues above US \$1 billion); 36% were from midsize enterprises (annual revenues between \$50 million and \$1 billion); and 27% of respondents were from small businesses (annual revenues of \$50 million or less).
- *Headcount:* Fifty-one (51%) of respondents were from large enterprises (headcount greater than 1,000 employees); 26% were from midsize enterprises (headcount between 100 and 999 employees); and 23% of respondents were from small businesses (headcount between 1 and 99 employees).

### Study Focus

Responding manufacturing executives completed an online survey that included questions designed to determine the following:

- √ The degree to which safety technology is deployed in their manufacturing operations and the financial implications of the technology
- √ The structure and effectiveness of existing safety system implementations and safety programs
- √ Current and planned use of safety system to aid operational and safety performance
- √ The benefits, if any, that have been derived from safety initiatives

The study aimed to identify emerging best practices in safety, and to provide a framework by which readers could assess their own management capabilities.

**Table 4: The PACE Framework Key**

Overview
<p>Aberdeen applies a methodology to benchmark research that evaluates the business pressures, actions, capabilities, and enablers (PACE) that indicate corporate behavior in specific business processes. These terms are defined as follows:</p> <p><b>Pressures</b> — external forces that impact an organization’s market position, competitiveness, or business operations (e.g., economic, political and regulatory, technology, changing customer preferences, competitive)</p> <p><b>Actions</b> — the strategic approaches that an organization takes in response to industry pressures (e.g., align the corporate business model to leverage industry opportunities, such as product / service strategy, target markets, financial strategy, go-to-market, and sales strategy)</p> <p><b>Capabilities</b> — the business process competencies required to execute corporate strategy (e.g., skilled people, brand, market positioning, viable products / services, ecosystem partners, financing)</p> <p><b>Enablers</b> — the key functionality of technology solutions required to support the organization’s enabling business practices (e.g., development platform, applications, network connectivity, user interface, training and support, partner interfaces, data cleansing, and management)</p>

Source: Aberdeen Group, November 2011

**Table 5: The Competitive Framework Key**

Overview	
<p>The Aberdeen Competitive Framework defines enterprises as falling into one of the following three levels of practices and performance:</p> <p><b>Best-in-Class (20%)</b> — Practices that are the best currently being employed and are significantly superior to the Industry Average, and result in the top industry performance.</p> <p><b>Industry Average (50%)</b> — Practices that represent the average or norm, and result in average industry performance.</p> <p><b>Laggards (30%)</b> — Practices that are significantly behind the average of the industry, and result in below average performance.</p>	<p>In the following categories:</p> <p><b>Process</b> — What is the scope of process standardization? What is the efficiency and effectiveness of this process?</p> <p><b>Organization</b> — How is your company currently organized to manage and optimize this particular process?</p> <p><b>Knowledge</b> — What visibility do you have into key data and intelligence required to manage this process?</p> <p><b>Technology</b> — What level of automation have you used to support this process? How is this automation integrated and aligned?</p> <p><b>Performance</b> — What do you measure? How frequently? What’s your actual performance?</p>

Source: Aberdeen Group, November 2011

**Table 6: The Relationship Between PACE and the Competitive Framework**

PACE and the Competitive Framework – How They Interact
<p>Aberdeen research indicates that companies that identify the most influential pressures and take the most transformational and effective actions are most likely to achieve superior performance. The level of competitive performance that a company achieves is strongly determined by the PACE choices that they make and how well they execute those decisions.</p>

Source: Aberdeen Group, November 2011

## Appendix B: Related Aberdeen Research

Related Aberdeen research that forms a companion or reference to this report includes:

- *Compliance Management in Environment, Health and Safety*; March 2011
- *A Risk Management Approach for Improving Safety and Productivity*; February 2011
- *Environment, Health and Safety: Managing Risk and Compliance in Manufacturing Operations*; April 2010
- *Asset Performance Management: Aligning the Goals of the CFO's and Maintenance Managers*; November 2009
- *Enterprise Asset Management: Maximizing Return on Assets and Emerging Trends*; June 2008

Information on these and any other Aberdeen publications can be found at [www.aberdeen.com](http://www.aberdeen.com).

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For more than two decades, Aberdeen's research has been helping corporations worldwide become Best-in-Class. Having benchmarked the performance of more than 644,000 companies, Aberdeen is uniquely positioned to provide organizations with the facts that matter — the facts that enable companies to get ahead and drive results. That's why our research is relied on by more than 2.5 million readers in over 40 countries, 90% of the Fortune 1,000, and 93% of the Technology 500.

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