

The Business Case For **PROCESS SAFETY**

2ND EDITION

**CORPORATE
RESPONSIBILITY**

**BUSINESS
FLEXIBILITY**

**RISK
REDUCTION**

**SUSTAINED
VALUE**



CCPS
CENTER FOR
CHEMICAL PROCESS SAFETY
An **AIChE** Industry
Technology Alliance

THE CENTER FOR CHEMICAL PROCESS SAFETY

SINCE 1985, The Center for Chemical Process Safety (CCPS) has helped manufacturers, insurers, government, academia, and consultants work together to improve manufacturing process safety.

CCPS and its sponsors are committed to protecting employees, communities, and the environment by developing engineering and management practices to prevent or mitigate catastrophic releases of chemicals, hydrocarbons, and other hazardous materials.



An **AIChE** Industry
Technology Alliance

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THE BUSINESS CASE FOR PROCESS SAFETY

WHAT SEPARATES THE TOP-PERFORMING COMPANIES IN OUR INDUSTRY FROM THE REST?

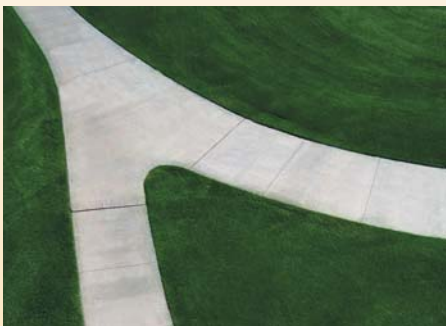
One essential characteristic CCPS member companies display is that they have adopted a rigorous philosophy regarding process safety. This summary of a recent industry-wide study identifies four ways that your business will benefit from implementing a robust process safety program. Process safety is an essential part of achieving manufacturing excellence and increasing profitability and shareholder value no matter the size of the enterprise.

We have seen process safety benefit our business in ways we had not anticipated. We need to share this message with others.

ARNOLD ALLEMANG
Vice President – Operations
The Dow Chemical Company



Corporate Responsibility



Business Flexibility



Risk Reduction



Sustained Value

THE BENEFITS OF PROCESS SAFETY



THIS BENCHMARK STUDY of CCPS member companies, combined with data from other sources, provides conclusive evidence that methodically implementing process safety provides four benefits essential to any healthy business. Two of these benefits are qualitative and as a result are somewhat subjective. You can see them in the way the public, your shareholders, government bodies, and your customers relate to your company. The two remaining benefits are quantitative. These have measurable impact in terms of your bottom line and company performance. All four benefits, when realized together by adhering to a sound process safety system, combine to support the profitability, safety performance, quality, and environmental responsibility of your business.

■ TWO QUALITATIVE BENEFITS

Corporate Responsibility

Process safety helps your company display corporate responsibility through its actions. The heart of process safety lies in consistently planning to do the right things, then doing them right — consistently. Corporate responsibility leads to the second benefit...

Business Flexibility

Corporate responsibility as demonstrated in your process safety management program leads to a greater range of business flexibility. When you openly display responsibility through implementing an effective process safety program, your company can achieve greater freedom and self-determination.

■ TWO QUANTITATIVE BENEFITS

Risk Reduction

A healthy process safety program significantly reduces the risk of catastrophic events and helps prevent the likelihood of human injury, environmental damage, and associated costs that arise from incidents. Although the essence of process safety focuses on preventing catastrophic incidents, the number of less severe incidents is also reduced.

Sustained Value

Process safety relates directly to enhanced shareholder value. When properly implemented, it helps ensure reliable processes that can produce high quality products, on time, and at lower cost. These improvements allow the enterprises that make them to sustain value creation over time.



My colleagues and I on the CCPS advisory board initiated

this project when we sensed a need for a convincing business case that supports a vigorous approach to process safety.

The four benefits identified in the project's resulting study are very broad in scope.

Their effects reach far beyond the realm of financial considerations. The combined benefits promote global manufacturing's long-term growth and success in several ways. Process safety is a fundamental tenet of every successful chemical processing company's operating philosophy. I have seen it benefit our business in ways we had not anticipated. We need to share this message with others—especially smaller chemical manufacturers and the companies that use and distribute our industry's products.

ARNOLD ALLEMANG
Vice President – Operations
The Dow Chemical Company

WHAT IS PROCESS SAFETY?



PROCESS SAFETY is a management system implemented to prevent major incidents involving hazardous materials. It is necessary for managing complex chemical operations. A process safety management system focuses on three important aspects of your business:

TECHNOLOGY

This component includes developing accurate process safety information about your equipment and technology, performing process hazard analyses, developing operating procedures and safe work practices, and then managing changes as they arise. It also includes designing manufacturing processes that are inherently safer from their conception.

FACILITIES

This aspect focuses on the mechanical integrity of your plant's equipment and the software that controls it. It includes preventive maintenance programs, performing pre-startup safety reviews, and aligns with management of change to help ensure continuous safe operation. Good design and maintenance along with periodic safety reviews protect your company's means of production.

PERSONNEL

Involving your employees in building and maintaining your process safety program is the best way to communicate its ongoing importance throughout the organization. Other process safety elements involving personnel include training employees in process hazards and their job tasks, managing contractors properly, investigating incidents to understand their root causes, implementing actions to prevent recurrence, preparing for emergencies, planning effective response, and self-auditing to gauge performance and to identify opportunities for improvement in all three aspects of process safety.

Understanding the skills and knowledge required for a job when making changes in work assignments will help reduce errors and improve safe performance.

The personnel aspect of process safety leads companies to minimize turnover of key personnel at all levels and maximize corporate memory of experiences, best practices, and industry lessons

The nature of our business is one that requires a high level of managerial, technical and operational discipline. The discipline practiced when implementing and maintaining a healthy process safety program easily translates to other business areas and helps address other business risks.



If I had to pick one business issue within the last

12 years that has benefited our company most, I would say it was the advent of process safety. It not only helps prevent incidents and reduce their consequences, it also provides fundamental methods for managing our business. It gives us valuable guidance for operating our health, environmental, and safety programs more effectively and provides structured systems, such as management of change, which we apply in all aspects of our business.

STEVE KEMP

*Vice President – Health, Environment and Safety
Occidental Chemical Corporation*

CORPORATE RESPONSIBILITY

Committing to a dynamic process safety program displays corporate responsibility and social responsibility

COMMUNITIES NEAR your production sites respect companies that care about their employees and the people living nearby, and that contribute to the local government and economy. Implementing a strong process safety program helps your company display the following attributes in a way that will help neighbors and employees understand your commitment to being a responsible neighbor. Proactively managing an effective process safety program displays a high level of corporate responsibility and encourages you to sustain it long-term. It helps with:

- Fulfilling your obligation to protect employees and the community
- Enhancing customer and supplier relationships
- Complying with regulations
- Conforming to industry standards

Displaying responsibility helps a company in many ways:

- It helps your investors perceive a lower risk when they make buying or selling decisions.
- It is the best insurance policy for protecting company reputation and shareholder value.
- It increases the value of your corporate image and brand.
- It reduces concerns within the local community.
- It engages employees at all levels by increasing morale, loyalty, and retention.
- It improves your ability to get insurance coverage at attractive rates.
- It enhances your lenders' confidence thus helping with capital expansion.
- It helps regulators understand your facility's credibility and unique considerations.

Companies of all sizes can benefit by establishing a positive reputation for leadership in the community.

Our small company has always prided itself on its safety record. We recognize we must continuously strive to predict and eliminate the root causes of incidents that may harm our customers, our communities, the environment, or us in order to be a full partner in this industry.



TOM REILLY
Chairman of the Board
Reilly Industries, Inc.

BUSINESS FLEXIBILITY

COMPANIES that manage process safety effectively earn the flexibility to freely manage their businesses and grow profitably, while satisfying all stakeholders — local communities, the public, regulatory authorities, governments, investors, and customers. This business flexibility, or self-determination, is a result of the trust the public and the local community have in you. It is your corporation's license to operate. This analogy is complete in the sense that, as with any license, those who award it can also revoke it.

Any major industrial incident can result in the creation of more prescriptive regulations that will affect the entire industry. After a major incident, every company in a related business suffers a loss of public trust, which may result in increased regulation and compliance costs. The livelihood of every employee of your company — from officers and board members to managers, technical staff, and hourly workers — is on the line when you operate without an effective process safety program.

A company's future existence is at stake after it experiences a major incident at one of its sites. Managing a rigorous process safety management system helps maintain a company's freedom and self-determination, allows innovation, and ensures a greater range of business flexibility. A company's freedom to operate can be severely compromised due to community discontent, regulatory scrutiny, legal complications, and even intervention by a company's own board of directors when key stakeholders sense increased risk.

This flexibility benefits a company by:

- Proving your worthiness to hold a license to operate
- Strengthening and maintaining good relationships with the local community
- Lowering interest rates for financing
- Helping you attract and retain high performance staff
- Helping you obtain approvals for expansion permits or new facilities more quickly — a critical strength when manufacturing new products needed to compete effectively
- Allowing managers to focus on sales and growth, rather than the last accident
- Strengthening and maintaining good relationships with regulators

Demonstrating a strong process safety culture within all levels of your organization gives your company a greater degree of business flexibility.



Safety, including process safety, is a guiding principle for our company. We believe that the traits required to achieve excellence in safety are the same as those required to achieve outstanding results in all other aspects of our business. Safety is simply good business.

RALPH F. HERBERT
Vice President, Engineering
ExxonMobil Chemical Company



RISK REDUCTION

A robust process safety program will help your company reduce risk and avoid loss.

COMPANIES that implement effective process safety programs receive a windfall benefit every year. This income shows up on the bottom line in the form of the major incident that DID NOT occur. Process safety provides unparalleled capacity for enhanced risk reduction. Your company's risk exposure is reduced in the following areas when well-founded process safety systems are in place.

- **Lives are saved and injuries are reduced** — Both the personal impact of human loss and cost of deaths or injuries are painful. A solid process safety program can help prevent these costs.
- **Property damage costs are reduced** — In the U.S., major industrial incidents cost an average of \$80 million each.
- **Business interruptions are reduced** — These losses can amount to four times the cost of the property damage from an incident.
- **Loss of market share is reduced** — After an incident, this loss continues until the company's reputation is restored. Adverse publicity and negative public image can have insurmountable effects.
- **Litigation costs are reduced** — These are unavoidable after an incident and can total five times the cost of the regulatory fines.
- **Incident investigation costs are reduced** — Investigating an incident and implementing corrective actions can cost millions of dollars.
- **Regulatory penalties are reduced** — For many incidents, a fine after litigation can total 1 million dollars or more.
- **Regulatory attention is reduced** — A major incident usually results in increased regulatory audits and inspections.

Any of these items can easily put a smaller company out of business.

How does increased risk reduction capability enhance your company?

Most companies participating in this study observed significant reductions in injury rates due to implementing high quality process safety programs.

- One company achieved a 50% reduction in injuries and fatalities resulting from major incidents (compared to overall industry averages). This saved them over \$5 million per year and an additional savings of \$3 million per year in reduced worker compensation costs.
- Incidents cause operational interruptions. If your plant is not idle due to an incident, you are making product and the business can flourish.
- Incidents divert corporate management's attention from long-term business planning. When these managers have to stop and deal with incidents and other crises, it can distract their ability to concentrate on sustainable growth.
- Your corporate reputation and legacy are protected for future generations.

Implementing an exacting process safety program has helped our company maintain the business flexibility we need to meet the challenges ahead. It has helped us to be free to innovate and grow as needed. The good relations we are able to nurture with neighbors and regulators are essential to this flexibility. These relationships depend also upon our ability to ensure that a viable process safety program is in place at all our plants worldwide.

JOACHIM KRUEGER
Vice President Global Environmental,
Health and Safety
Celanese AG

Effective process safety programs provide industry-wide benefits.

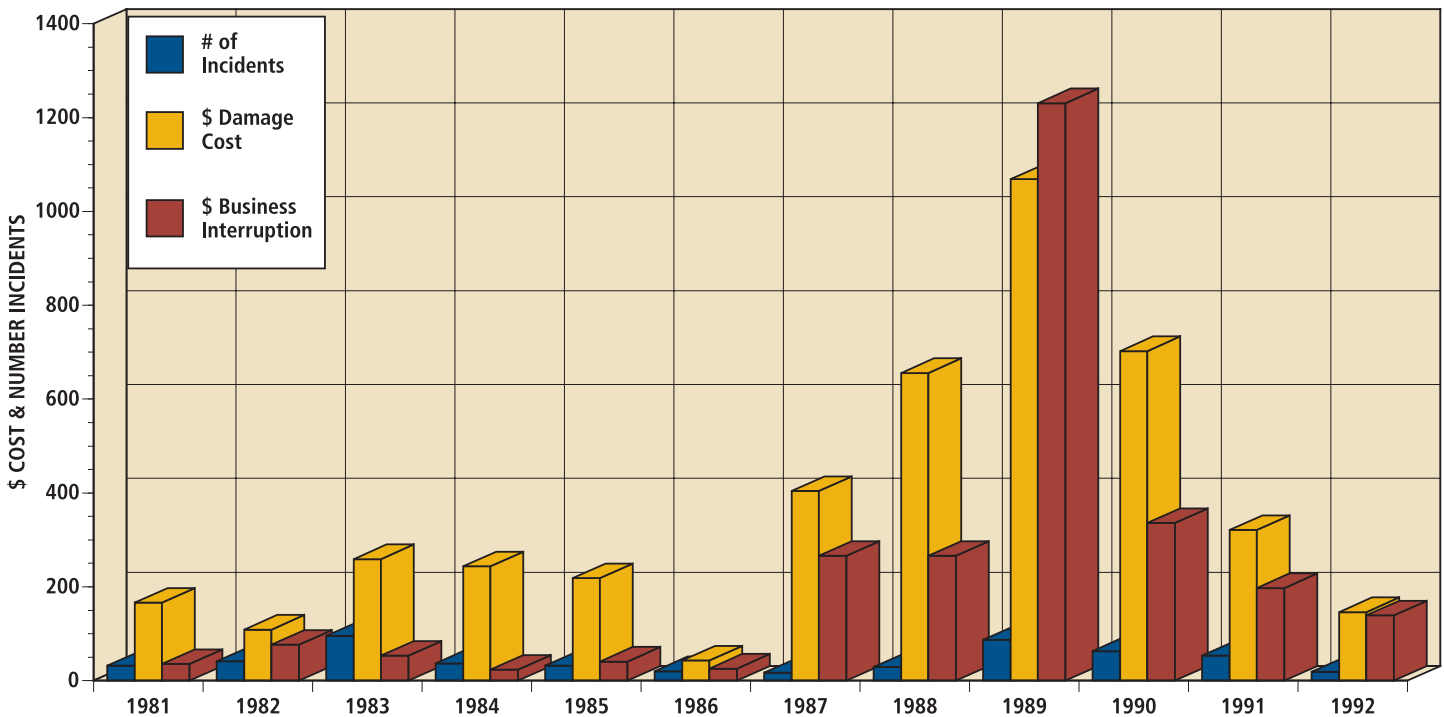
Fatalities, injuries, property damage and business interruption can cause a substantial drop in share price and loss of market share for your company. Disruption of normal business activity can cause a temporary loss of corporate direction by diverting senior management's attention from running the business to overseeing damage control. Additionally, company officers may be subject to personal liability and even criminal charges.

After an incident, a ripple effect can occur throughout a large company and can ultimately traverse the entire industry.

- What happens at your plant in Baton Rouge can affect your plants in Brussels and Beijing.
- An incident at a small, unrelated company can negatively affect the public's perception of much larger, well-managed companies.
- An incident at a key raw material supplier's facility can keep you from meeting obligations to your customers and possibly affect an entire business area.

A major incident can place a company in a position where it is unable to respond to its competitors' business actions. A company in a weakened state may become subject to an undesirable takeover. This situation reverberates throughout the industry.

Material Damage and Business Interruption Costs from Incidents



Source: MIACC (1996) based on data from Swiss Reinsurance Company, Zurich, Switzerland

CREATING SUSTAINED VALUE

Implementing an effective process safety program will create and sustain value for your company and its shareholders. This is a bonus with additional benefits.



At 3M, we have found the benefits of process safety are the obvious ones — a safer workplace, business continuity assurance, and improved employee morale. In fact, we apply process safety to non-regulated processes as a best management practice.

RONALD R. BELSCHNER
Vice President,
Engineering, Manufacturing & Logistics
3M Company

Embracing process safety as an essential part of the way you do business allows your company to achieve a measurable increase in revenues and a reduction in costs. Creating value is a complement to reducing risk and avoiding loss. The value created can be substantial. In some cases, product stewardship requirements make a strong process safety program a necessity for your company to do business. The chemical processing and petroleum companies that participated in this study report the following returns from their investment in process safety:

- **Productivity Increases** — Up to 5% increases in productivity, due mainly to increased reliability of equipment. Increased revenues of \$50 million are reported.
- **Production Costs Decrease** — Up to a 3% reduction in production costs resulting in a savings of \$30 million.
- **Maintenance Costs Decrease** — Up to a 5% reduction in maintenance costs resulting in savings of \$50 million.
- **Lower Capital Budget Required** — Up to a 1% reduction in capital budget resulting in savings of \$12 million.
- **Lower Insurance Premiums** — Up to a 20% reduction in insurance costs resulting in savings of \$6 million.

Process safety helps to increase productivity through:

- Improved reliability and mechanical integrity of equipment, causing fewer operational interruptions
- User-friendly, accurate operating procedures and safe work practices
- Improved team effectiveness through effective employee training programs
- Employee ownership of the systems to help ensure their safety and the safety of the community
- Enhanced troubleshooting capabilities for all types of production issues
- Identifying and addressing safety, operability, and reliability issues before they occur
- Decreased turnaround time for minor repairs or replacement of equipment
- Extended intervals between major turnarounds and reduced turnaround time

Production costs are reduced through:

- Improved yields
- Lower costs to rework off materials
- Lower costs for waste stream disposal
- More efficient staff requiring less supervision
- Engaged employees participating in continuous improvement

Maintenance costs are reduced through:

- Effective written equipment maintenance procedures
- Contractor safety programs
- Repairing or replacing critical equipment before it fails
- Lower maintenance turnaround costs

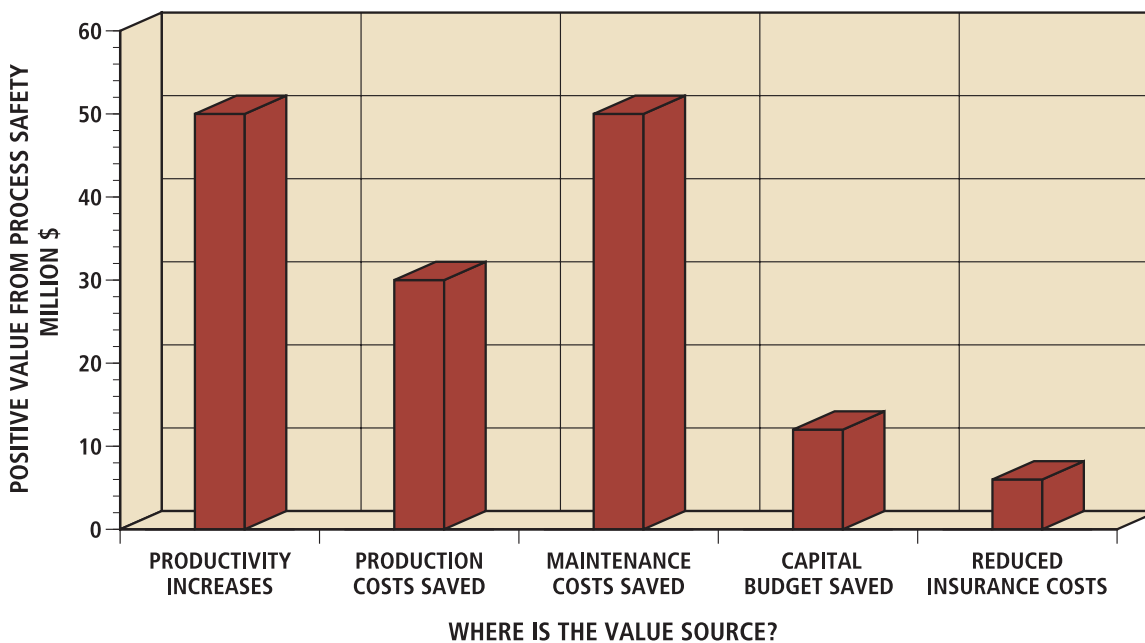
Capital budgets are reduced through:

- Process hazard analyses for new projects and facilities to mitigate risk over their useful life
- Inherently safer process designs that begin in the conceptual phase
- Lower capital expenditures because project teams have up-to-date process safety information

Insurance costs are reduced through:

- Effective emergency planning and response which helps to reduce the loss from an incident and helps prevent minor incidents from developing into a major incident
- Thorough incident reporting and investigation programs to prevent incidents from being repeated
- Reporting and investigation of "near misses" to identify potential problems early
- Lower casualty insurance premiums when your insurers detect that an effective process safety program is in place to lower the probability of major incidents

Sustained Value Data





WHAT PROCESS SAFETY CAN DO FOR YOU

YOUR PROCESS SAFETY PROGRAM also supports other programs. It supports quality, environmental responsibility, industrial hygiene, worker safety, and sustainable development.

Your staff has probably detected the natural synergy between process safety and other business requirements you may face. Implementing a process safety program provides a management system model that can be modified for implementing other programs focused on:

- **Occupational Safety Requirements** — Both internal and governmental
- **Quality Management** — Customer driven quality systems (including, ISO, FDA and others)
- **Environmental Requirements** — Internal, governmental, or customer driven
- **Profitability** — Internal business management systems to help ensure a sustainable, healthy business

Think about it — one common management system model applied throughout an organization can provide a framework for developing the work processes, procedures, and documentation you need for all your safety, quality, environmental, and business commitments. Too often, companies implement a program to comply with one regulation or industry standard and find that another standard or regulation requires a similar element; such an example is management of change. Adopting process safety as the structure upon which to model your integrated management systems will help avoid redundancy and allow productive direction of your company's energies. This logically leads to efficient production and increased shareholder value.

In summary, a robust process safety program will enhance your business in these four ways:

- It displays your company's high level of corporate and social responsibility.
- It allows your company a greater range of business flexibility — the freedom to manage your business.
- It helps your company manage risk and prevent major losses.
- It creates sustained value for your company and its shareholders.



Aside from being the obviously right thing to do from safety and environmental stewardship perspectives, unrelenting commitment to a strong process safety management system is fundamental to a sustainable business model. Undesirable incidents of any sort detract from the value of a business, but a process safety incident has a negative impact on all stakeholders... customers, shareholders, employees, and the communities in which a plant operates. The bottom line is that outstanding process safety performance is a pathway to both financial success and your license to operate.

JAMES B. PORTER
Vice President of Engineering and Operations
DuPont

THE PATH FORWARD

REALIZE THE BENEFITS

Seven steps to achieving business excellence through process safety management:

- 1 Assign personnel who will be accountable — either a process safety manager or team — for ensuring excellence in pursuing process safety throughout the corporation — re-evaluate your program’s effectiveness, estimate your site’s process safety return on investment, and communicate it to the employees and the public
- 2 Adopt a personalized company philosophy of process safety. Use it to establish a management system along the lines of CCPS guidelines and tie it to your company’s core values
- 3 Learn more about process safety by reviewing the literature and other references, attending training provided by process safety professionals, and interacting with other companies — networking with them and participating in industry alliances
- 4 Take advantage of the strong synergy process safety has with your other business drivers — total quality management (TQM), regulatory requirements, and the American Chemistry Council’s Responsible Care® initiative all share common elements
- 5 Set achievable process safety goals that will support the business case presented here over the next one to five years
- 6 Track your performance versus goals periodically
- 7 Revisit your process safety program and modify it every three to five years as needed.



A sound process safety program is critical to our

current and continued success.

Maintaining it requires discipline in the way we design, operate, and manage our plants. To keep our process safety performance at the high level we demand, we must nurture knowledge levels and leadership qualities throughout each business and at the very top of our organization. Our goal is to ensure each employee understands their role in the safe operation of our chemical sites and the value that brings to the Company.

This message extends to our customers, our suppliers, and, in fact, to the entire industry. We simply have no choice but to seek to be leaders in process safety.

TOM ARCHIBALD

*Vice President, Director of Operations & Manufacturing
Rohm and Haas Company*



CONTACT CCPS FOR HELP

HOW THE CENTER FOR CHEMICAL PROCESS SAFETY CAN HELP

Contact the Center for Chemical Process Safety to find out about:

- Our process safety guideline series of books and other publications
- The regular networking and conference opportunities that will put you in touch with experienced industry experts
- The effective training resources we can provide — both traditional training courses and computer-based training
- Peer input to help you build or upgrade your process safety program
- How you can participate in projects that will help our industry achieve prime performance in the area of process safety and remain a safe, vibrant, and profitable business
- How your company can become a CCPS member

Visit www.ccpsonline.org for more information or call (212) 591-7319.

Merck's mission is to deliver medicine to the people. Maintaining a dynamic process safety management system throughout our drug development and manufacturing processes allows our business managers to focus on our mission — delivering needed medicines, without interruption, to patients around the world, every day. Just one significant process safety incident could have unimaginable impact on our employees, our communities, our shareholders, our reputation and, most importantly, our patients. Daily attention to process safety management not only prevents these significant losses, it also helps us avoid minor incidents that would disrupt our operations and the medicinal supply chain.

LIAM MURPHY

*Vice President, Safety and the Environment
Merck & Company, Inc.*

THE CENTER FOR CHEMICAL PROCESS SAFETY

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CCPS Book List

Avoiding Static Ignition Hazards in Chemical Operations
Deflagration and Detonation Arrestors
Electrostatic Ignitions of Fires and Explosions
Essential Practices for Managing Chemical Reactivity Hazards
Evaluating Process Safety in the Chemical Industry, Understanding Quantitative Risk Analysis, 2nd edition
Guidelines for Auditing Process Safety Management Systems
Guidelines for Chemical Process Quantitative Risk Analysis, 2nd edition
Guidelines for Design Solutions for Process Equipment Failures
Guidelines for Engineering Design for Process Safety
Guidelines for Evaluating Process Plant Buildings for External Explosions and Fires
Guidelines for Evaluating the Characteristics of Vapor Cloud Explosions, Flash Fires & BLEVEs
Guidelines for Facility Siting and Layout
Guidelines for Fire Protection in Chemical, Petrochemical and Hydrocarbon Chemical Facilities
Guidelines for Hazard Evaluation Procedures (2nd Edition) with Worked Examples
Guidelines for Investigating Chemical Process Incidents, 2nd edition
Guidelines for Mechanical Integrity Systems
Guidelines for Pressure Relief and Effluent Handling Systems
Guidelines for Preventing Human Error in Process Safety
Guidelines for Process Equipment Reliability Data with Data Tables
Guidelines for Process Safety in Outsourced Manufacturing Operations
Guidelines for Safe Automation of Chemical Processes
Inherently Safer Chemical Processes, A Life Cycle Approach
Layer of Protection Analysis: Simplified Process Risk Assessment
Making EHS an Integral Part of Process Design
Plant Guidelines for Technical Management of Chemical Process Safety
Revalidating Process Hazards Analyses
Safe Design and Operation of Process Vents and Emission Control Systems
Understanding Explosions
Wind Flow and Vapor Cloud Dispersion at Industrial & Urban Sites

**CCPS would like to thank all
the companies and individuals
who contributed to this study.**

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