

Implementation of Process Safety Management into Diverse Corporate Cultures

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Introduction

By the 1960s, DuPont had been operating hazardous processes for over 160 years, but an explosion at the Louisville, Kentucky, operations in 1965 told us we needed to do a better job. Our safety engineers took a hard look at our manufacturing operations and began to assemble the management principles and elements of Process Safety Management (PSM). During the 1970s, following several accidents at DuPont operations in New Jersey, PSM began to take the form we see today.

In 1979, DuPont issued the first corporate standard for Process Hazards Management (PHM). This was later changed to Process Safety Management. After the Bhopal accident of 1984, OSHA and several states began developing regulations for control of major accidents involving hazardous chemicals. The DuPont PHM process was used as a starting point for the OSHA regulations. Beginning in 1986, DuPont began working with other companies to develop a proposal for PHM that in 1991 became the US OSHA regulation 1910.119. At that time the overwhelming majority of DuPont manufacturing operations were in the United States, and thus the PSM process reflected a North American corporate culture.

As DuPont began to globalize operations, the company faced the challenges of incorporating PSM into hazardous operations across the globe. Today, DuPont operates in 44 countries, and at each location with hazardous processes, PSM has been implemented consistent with corporate requirements. These requirements describe **what** needs to be done. **How** PSM is implemented is left up to the various sites, and there are significant differences in the way PSM is put into operation. Some of these differences are a result of cultural adaptations.

In recent years, DuPont has been working with non-DuPont companies to implement PSM at their sites, and this effort has faced additional challenges. This paper will first review the PSM implementation process that we use. It is based on guidance from the Center for Chemical Process Safety (CCPS) and is modified as necessary to meet client needs. This will be followed by examples of obstacles that have arisen.



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The DuPont Implementation Model

Successful PSM implementation requires either adaptations to the local culture or change in the culture, but as Geert Hofstede, the Dutch educator and author who conducted a comprehensive study of how cultures influence values in the workplace, has argued, cultures change slowly if they change at all¹. Therefore, cultural differences must first be recognized, followed by development of a PSM implementation strategy that takes these differences into account. Inability to culturally adapt the effort can result in an organization that does not fully realize the benefits of Process Safety Management.

As shown in Figure 1, the model we use in DuPont for PSM implementation includes four work streams that address organization, process, people and technology. The objective is to meld the existing management process with U.S.-based management process and technology. After a business case for change is developed, a transformation to sustainable improvement is achieved with a Demming-type process.

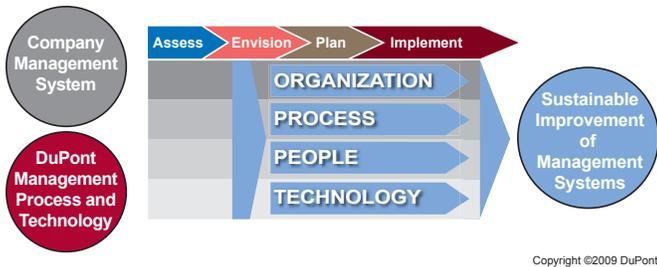


Figure 1. The DuPont PSM Implementation Model

It is important to note that successful implementation of PSM alone cannot guarantee success in eliminating major incidents and achieving a culture of safety. Actions of people are critically important. Employee safety must also be addressed along with any PSM effort.

Addressing Cultural Issues

In 1994, the CCPS published the book *Guidelines for Implementing Process Safety Management Systems*. Based on this information, below are key components that are used by DuPont in the implementation process:

- preparation, planning, and communications,
- an implementation framework,
- a specific attributes workshop,
- a site PSM leadership team,
- PSM element implementation teams,
- a PSM implementation plan,
- putting the system in place, and
- a full element implementation plan.

If the general cultural environment is evaluated early in the project, an implementation plan can be developed that will enhance success and avoid false starts. The specific attributes workshop can be used to address some of the cultural issues that arise.

Hofstede studied business cultures around the globe and developed a model based on five dimensions to describe them. These dimensions are:

1. Power Distance Index
2. Individualism
3. Masculinity
4. Uncertainty Avoidance Index
5. Long Term Orientation

This model was used to understand some of the observations that have been made concerning implementation of PSM in various geographic locations. A description of these dimensions can be found at the Geert Hofstede web site, <http://www.geert-hofstede.com/> and are presented in the Appendix.

Table 1 shows ratings for the Arab World, Brazil, China, India and Mexico for three of the five Hofstede dimensions. The United States is added for comparison. High means above average and low is below average, compared to world average scores.

Dimension	Arab World	Brazil	China	India	Mexico	U.S.
Power Distance	High	High	High	High	High	Low
Individualism	Low	Low	Low	Low	Low	High
Uncertainty Avoidance	High	High	Low	Low	High	Low

Impact of Culture on PSM Implementation

DuPont has helped companies around the world with various components of PSM. While the implementation model remains constant, there are always adaptations for local culture as DuPont addresses organization, process, people and technology.

Organization: PSM Networks

One organizational issue that is addressed during the implementation of PSM is employee networks. DuPont makes extensive use of these. They can be formal or informal, temporary or permanent. These networks are responsible for identifying or developing new and emerging technologies related to PSM, keeping abreast of regulatory developments and recognized and generally accepted good engineering practice, and incorporating these into DuPont standards. These networks also help in developing training required for the implementation of changes.



IMPLEMENTATION OF PROCESS SAFETY MANAGEMENT INTO DIVERSE CORPORATE CULTURES

Some of the key formal standing networks at DuPont include PSM, PHA, Process Technology (process safety information), and Mechanical Integrity/Quality Assurance. When DuPont in the United States implemented the EPA Risk Management Program, a temporary network was formed to assure implementation of the requirements. PSM is also supported by engineering networks such as the Interlock committee, responsible for setting guidance for interlock design. These networks span the corporation, with the majority of resources in North America, but also with global participation.

From the Hofstede dimensions, the low rating for Power Distance and high for Individualism help explain the success of networks in DuPont. People readily take direction from network leaders, and their leadership allows and values network participation. From the corporation perspective, networks allow leveraging of highly skilled resources, particularly for the technical aspects of PSM. This brings business value by allowing the sites to implement all PSM-related requirements with minimum resources. Sites also maintain networks or committees across the site to further leverage resources.

In contrast, the Arab countries, Brazil, China, India, and Mexico have a high rating for Power Distance and low for Individualism. Individuals in these countries accept strong directed leadership but have difficulty accepting direction from others than their direct supervision. Additionally, managers have difficulty allowing their direct reports to spend time doing work directed by others. We have seen cases where people who attend network meetings receive calls from their supervisors asking when they will be back at their “real” job.

In these countries, labor costs are much lower than they are in the United States, so the economic incentive to leverage resources is not as strong. Companies can add or build the necessary PSM expertise within the workgroups, and do not need to rely on network contacts for specialized information or technology. For example, each group can have the expertise necessary within the group to advance dispersion modeling, and not rely on network contacts for guidance.

Process: PSM Standards and Operating Discipline

One of the process issues important for the implementation is PSM governance. The DuPont process for PSM governance starts with a set of policies and standards that describe the corporate requirements for PSM. These documents include the OSHA requirements and provide detail and additional guidance. From these documents, internal audit protocols are developed. These are used for internal corporate audits of site PSM processes.

The low Hofstede ratings in the United States for Power Distance and Uncertainty Avoidance indicate an expected cultural resistance to development and implementation of these requirements. However, the standards are carefully crafted to describe only what needs to be done, and the sites are given considerable flexibility in determining how PSM is implemented. As a result, there is considerable variability for implementation across the United States. Examples include a wide variety of change management processes, with different review requirements, forms, and types of changes reflecting plant process hazards, organization, and past methods of getting things done. This variability is accepted and expected, but the rigorous audit process assures that each of these processes meets the corporate requirements and standards. The audit results and closure of recommendations are closely monitored by leadership. This is done to overcome any cultural resistance to the development of standards and to operating discipline that drives full implementation.

In contrast, high Uncertainty Avoidance and high Power Distance in Arab, Mexican, and Brazilian cultures indicate a strong acceptance of rules. In these cultures, people readily accept the concept of PSM standards, or strict guidance from the company, and implement these requirements better than in other countries.

India and China also rate high in Power Distance but have a low rating for Uncertainty Avoidance. In this situation, organizational relationships tend to be formal but workflow is not¹. The organization may develop standards, but less formal workflow can result in poor quality and inconsistent implementation of standards. Operating discipline may be poor, with lack of clarity for expectations. DuPont worked with a client in India where fatalities resulted from a traffic accident on the manufacturing site. DuPont recommended the site establish rules with severe consequences, including job loss, if these rules were violated. Site leadership resisted this recommendation.

In the oil and gas operations in the Middle East there is significant use of overseas workers, including engineers, operators, contractors, and laborers. Many of these workers come from India, whereas most of the leadership is local. The differences in Power Distance and Uncertainty Avoidance ratings can result in cultural clashes around the issue of operating discipline. The local leadership in these countries sets the rules and mandates that they be followed². The consequences of not following the rules are serious, resulting in job loss and being sent back to the home country. This is a strong incentive, but does result in the desired discipline.

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Technology: Regulatory Compliance. DuPont classifies the PSM elements in three major groups: facilities, personnel, and technology, as shown in Figure 2.



Figure 2. The elements of PSM

These elements differ in two ways from the US OSHA regulations. First is the addition of a requirement for Management of Personnel Change; second is separate Management of Change Processes for Technology and Facilities (identified above as Subtle Changes). Notice the core of the model is management commitment. The importance of leadership for successful implementation of PSM cannot be over-emphasized. The outer ring of was added to the model to stress the importance of Operating Discipline.

Many of the activities within these elements are technical in nature. Companies in the developing economies such as China and India that are initiating a formal PSM process view technology as the intellectual property they want when seeking help on PSM. Implementation of these elements is normally done through the operating, maintenance, and technical engineers in the company. These engineers are highly trained with skills equal or comparable to their U.S. counterparts. They thoroughly understand the technical aspects of PSM.

Yet while the engineers understand the technical aspects of PSM, there can still be formidable difficulties implementing the elements. In counties with high Power Distance and low Individualism, as in many developing economies, engineers look to line management for specific direction, setting of priorities, and resources. In one company, the process developed requires the site manager to sign off every prestart-up safety review (PSSR) and management of change (MOC). This takes time, and when there is pressure to keep production online, poor decisions about what is a change may occur. This can result in a complete by-pass of the change process.

Low Uncertainty Avoidance can also impact technology. Acceptance of uncertainty, coupled with a belief that licensed processes are overdesigned, can result in the modification of process variables beyond those provided in the technology package. In one case, the pressure in a reactor was increased, resulting in a capacity increase. There was no technical documentation to support the change—no MOC or PSSR. Since this action was successful, it could lead to further increases, producing unknown conditions and hazards.

Understanding the technical components alone will not result in successful PSM performance. This must be coupled with strong and continuous leadership commitment and operating discipline. These are the areas where the local culture has great impact.

Conclusions

When implementing PSM, the challenge is not to change the local culture but to implement PSM within the existing environment. There are many examples of successful PSM implementation in cultures outside the United States. Where networks are difficult to form or operate poorly, it may be necessary staff PSM efforts at a higher level. Operating discipline and audit protocols can be established and performance measured. These issues can be overcome with an implementation model that addresses organization, process, people and technology.

The general observations for a particular culture may not fully apply in all situations. There are many factors that affect this, including the influence of western partnerships and joint ventures and education in the West.

Appendix

Description of Three of the Hofstede Indices

Power Distance Index is the extent to which the less powerful members of organizations and institutions (like a family) accept and expect that power is distributed unequally. This represents inequality (more versus less) but defined from below, not from above. It suggests that society's level of inequality is endorsed by the followers as much as the leaders. Power and inequality, of course, are extremely fundamental facts of any society, and anybody with some international experience will be aware that "all societies are unequal, but some are more unequal than others."

Individualism on the one side is its opposite, collectivism; that is, the degree to which individuals are integrated into groups. On the individualist side we find societies in which the ties between individuals are loose: everyone is expected to look after him- or herself and him- or her immediate family. On the collectivist side, we find societies in which people from birth onwards are integrated into strong, cohesive in-groups, often extended families (with uncles, aunts, and grandparents) which continue protecting them in exchange for unquestioning loyalty. The word "collectivism" in this sense has no political meaning; it refers to the group, not to the state. Again the issue addressed by this dimension is an extremely fundamental one, regarding all societies in the world.

Uncertainty Avoidance Index deals with a society's tolerance for uncertainty and ambiguity; it ultimately refers to man's search for the Truth. It indicates to what extent a culture programs its members to feel either uncomfortable or comfortable in unstructured situations. Unstructured situations may be novel, unknown, surprising, and different from usual. Uncertainty avoiding cultures try to minimize the possibility of such situations by strict laws and rules, safety and security measures and, on the philosophical and religious level, by a belief in absolute Truth; "there can be only one Truth and we have it." People in uncertainty avoiding countries are also more emotional and are motivated by inner nervous energy. The opposite type (uncertainty accepting cultures) are more tolerant of opinions different from what they are used to; they try to have as few rules as possible. On the philosophical and religious level, they are relativist and allow many currents to flow side by side. People within these cultures are more phlegmatic and contemplative and are not expected by their environment to express emotions.

References:

1. Hofstede, Geert. "Motivation, Leadership, and Organization: Do American Theories Apply Abroad." *Organizational Dynamics*. (Summer 1980) 42-63.
2. Salem, Ahmad. Personal discussions. General Electric, Abu Dhabi
3. <http://www.geert-hofstede.com/> Feb. 2009



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