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YEAR!



## The Principles Driving Safety & Reliability: A Look at the History of DuPont

by: *Winston P. Ledet*

During my 27 years with DuPont, the safety culture was apparent. It was a part of everyone's job every day. As a result of a benchmarking study in the late 1980's and creation of a System Dynamics model to explain the benchmark results, it became clear that safety and reliability operate on the same principles. Both are significantly affected by defects and both require a commitment from everyone in the organization for improvements to be achieved.

### Beginnings as a Gunpowder Manufacturer

To begin to understand the safety culture at DuPont, you must understand a bit of the company's history. The DuPont company began operations as a family owned and operated gunpowder manufacturer in 1802 on the banks of the Brandywine River in Delaware. For the next 170 years, members of the DuPont family were actively involved in running the company. Many family members worked in the early powder mills, built their homes and sent their children to school buildings within sight of the mills. This made safety more than just a program at DuPont, it was a way of life that kept loved ones and personal property safe.

### Early Incidents that Galvanized the Focus on Safety

The production of gunpowder in the early 1800's was a dangerous business. Fires and explosions were not uncommon. One of the earliest safety innova-

tions used by the DuPont powder mills involved the basic design of the mill buildings. They were constructed of three strong, stone walls, a weak fourth wall made of wood facing the river, plus a weak wooden roof that acted as a "safety valve". If an explosion occurred in the powder mill, the wooden roof and fourth wall would be blown out. The rest of the factory, and people within the factory, would be protected from the blast by the stone walls. The wooden wall faced the river so the boats were locked to the dock when production was in progress; DuPont's first lock out procedure. While this might not sound very impressive by today's safety standards, it was an extraordinarily innovative safety design at the time.

A series of incidents during the first 100 years of operation kept safety concerns in the consciousness of the DuPont family and employees. In 1815, an explosion cost the company \$80,000, more than double the original investment in the entire company. In 1817, they were faced with a more significant loss. Seventy-seven year old Pierre Samuel DuPont, the financial founder of the company, died after working all night to help fight a fire in the mill. The following year, an explosion killed 40 workers and injured many children who were in the school building on the grounds at the time. Later, the death of one of the young favorites of the DuPont family, Alexis DuPont, in an explosion while fighting a fire on the

## Action Team Reduces the Frequency of Oil Changes

At an Operations Excellence Game workshop for BP Gulf of Mexico Matagorda Island, an Action Team was formed to evaluate the possibility of reducing the frequency of main engine oil changes.

Oil changes were being performed on the Waukesha VHP series engines every 1500 hours, about 700 hours sooner than the OEM recommendations of 2200. The Action Team discussed that if they could increase the time between the oil changes, based on oil sampling results, they would experience significant savings.

The team set a goal of increasing the time between oil changes on rotating equipment from every 1500 to every 2000 hours. They put a plan into action to gather data to support this goal and contacted both crews to get everyone on board. They partnered up with Castrol to obtain oil samples and filters and based on those results, they were able to update Maximo with the new PM frequency. After monitoring and tracking, the BP Action Team consisting of Larry Bruce, Rudy Rodriguez and Johnny Davenport were pleased. They were happy to report that with the new monthly oil sampling procedures in place, the annual savings was \$10,000.00 and 50 man-hours were eliminated.

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## Public Workshop Calendar

Throughout the year, The Manufacturing Game® holds workshops for the general public at various universities and/or professional organizations across the country. Contact us for dates. [www.ManufacturingGame.com](http://www.ManufacturingGame.com)

### Conferences of Interest



**Offshore Technology Conference**  
**May 2-5, 2005**  
**Houston, TX**

To register or for more information visit: [www.otcnet.org](http://www.otcnet.org)



**NPRA**

**NPRA Maintenance Conference**  
**May 24-27, 2005**  
**New Orleans, Louisiana**

To register or for more information please visit: [www.npra.org/meetings/maintenance](http://www.npra.org/meetings/maintenance)



**Mark Your Calendars!**

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wooden roof of a powder mill in 1857 also had a significant impact.

The first safety rules in DuPont were established in 1811 and even at that time, DuPont saw line management as responsible for Safety. DuPont first started collecting safety statistics in 1912. The belief that all injuries were preventable didn't actually develop until the 1940's. The "off the job safety" programs began in the 1950's. The standards for safety continued to evolve and became more demanding all the way to the 1990's at which time DuPont adopted the goal of zero injuries. Management had wrestled for years with the idea of setting this zero injuries goal but finally decided that if it was to be believed that all injuries are preventable, how could there be a goal of anything higher than zero. To put DuPont's excellent safety record into a personal perspective, if you as an individual want to beat DuPont's safety rate, you have to work an entire career without getting even a single minor injury. One would be too many.

### The Key to Success

The key to success in the DuPont Safety Program is the deeply held belief that safety is everyone's responsibility – not one designated individual, team or department. Each person must be individually responsible for safety based on the position they hold and according to the circumstances they face. It is not good enough for a plant manager to search for people not wearing proper safety equipment. The plant manager

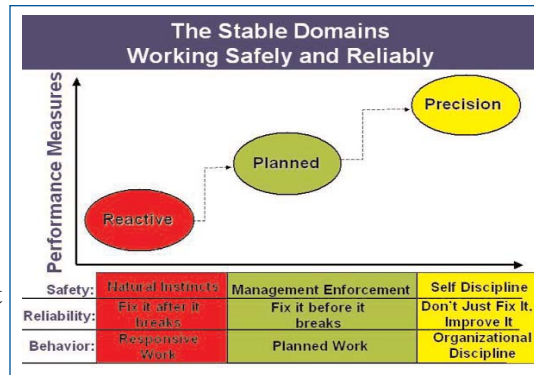
must look at his duties and make judgments about what policies will lead to safe behaviors. This also includes policies about hiring, firing, and development of people along with policies on standards for design of equipment. Operators and mechanics also have individual safety responsibilities. They should not expect to wait for their boss to tell them to wear proper safety equipment.

Discharging that responsibility takes courage to do what is right, integrity to not use safety as an excuse to avoid work or other unpleasantness, and to recognize that an incredible amount of persistence is required. Safety is never finished; you have to do it again and again, every day. This is something that must be learned through experience, but you don't have to wait until someone is hurt. It is important to create places to practice and drill people in safe behaviors like the training of fire fighters.

### Applying the Principles to Reliability

Companies that have achieved high equipment reliability have learned that similar to safety, reliability must be everyone's responsibility. Each person, from the plant manager to the engineers, purchasing agents, operators, mechanics and other support personnel, must be individually responsible for reliability based on the position they hold and according to the circumstances they face. Focused reliability teams and dedicated reliability engineers can be used to make dramatic improvements in concentrated areas, but they will not be able to develop the kind of reliability culture within the entire organization that is the essential ingredient to significant improvement. In addition, there must be a belief that all failures are preventable, just as DuPont acknowledged that all injuries are preventable when they adopted the goal of zero injuries.

The managers must look at their duties and make judgments about what actions and policies will lead to



improved reliability. Managers must increase the urgency around improving reliability. They are responsible for developing and effectively communicating the business case for reliability to

all levels within the organization. They must decide which issues get their attention. Focusing on the most urgent events, typically the breakdowns, sends the unintended message from the man-



## Action Team Tackles Problems with Hydraulic Oil Leaks on Catalyst Pumps

During a TMG workshop at a petrochemical facility on the Texas Gulf Coast in August of 2003, an Action Team was formed. Team members addressed the problems they had been having with hydraulic oil leaks on catalyst pumps and resolved to eliminate the defects.

They first discussed how in the past, when they had been using synthetic oil for a short period of time, the number of leaks had dropped significantly. Even though the natural oil did not dissipate heat or maintain viscosity when in contact with chemicals or water as well as the synthetic oils did, they had returned to it because of the cost. The synthetic oil cost \$500.00 – \$800.00 per barrel versus \$200.00 per barrel for natural.

Continued leaks and mounting frustration with the natural oil made them look again at other options. They want-

ed to consider going back to synthetic oils but had many obstacles to overcome. First, there were many preconceived attitudes about synthetic oil company claims about their product. Also, past experience with synthetic oil companies had not been good. They also needed management approval to switch back to the use of expensive synthetic oils.

The first thing the team did was draft a member of another team to assist them. That person did a lot of work researching and identifying all the equipment that would benefit from the use of synthetic oil. Once they had completed their research, management approval was given to switch back to the synthetic oil for a trial period.

This team, with the help of their Engineering Reliability group, and Operations, are currently monitoring the

improvement results, but current indications are that oil leaks have been significantly reduced. The drafted team member proved to be an integral part of the success of this action team, showing the importance of a cross functional action team and with the change to synthetic oils, they are experiencing better reliability and longer life from the equipment.

The additional cost of the synthetic oil was negated by the achieved improvements. More importantly, the peace of mind, by not having to perform the extra maintenance, was the biggest benefit.



## Revamped Safety Valve Identification System

At a Manufacturing Game® workshop at BP in Scotland recently, an Action Team was formed to address safety valve issues. Team members Michelle McCormick, Maintenance Technician, Alister Young, Performance Support Leader, and Jim Skelton, Shift Availability Supervisor (SAS), discussed the fact that there were potentially safety valves throughout the Grangemouth facility with the wrong identification number tags on them. They also discussed how time was being wasted isolating and removing incorrect valves, and it had even been discovered that in some cases, incorrect valves were being refitted in inappropriate places leading to potential safety issues. They were also concerned with



the underlying problem of Chemical employees and Refinery employees having different systems for identifying a safety valve, which was confusing the issue even further. For example, a Refinery employee identified a valve as “1003812” and a Chemical employee identified the same valve as “D-SV-52”.

The team went into action to both educate employees and create a better, more unified and consistent system for valve identification. During the education process, they encouraged employees to take the time to ensure they were correctly identifying valves prior to isolation and removal. This became important after it was discovered that there were a number of people who simply were not aware of how to correctly identify valves by using the original

numbers stamped onto the casing. They were simply assuming that the scrawled, faded note stuck to the valve actually had the correct number on it. Therefore part of the solution was education and a consistent approach among all of the shifts and teams.

This education process has created awareness through out the Grangemouth facility with both Chemical and Refinery employees and also helped to standardize the system for identifying safety valves. In the six month period after the education and standardization process, incidents of incorrectly identified safety valves have gone from one per month to zero for the entire six months. The 3 to 4 man hours spent on each incident is now being used more productively throughout the facility, giving them more time to eliminate other defects and avoiding the possibility of major safety issues associated with incorrect valves.



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*"Participating in The Manufacturing Game® was a real eye opener. I saw maintenance from a whole new perspective, and it changed the way we think at our company. We still use TMG language and talk about the importance of eliminating the bugs!"*

*- Don Waldrop, TPM Maintenance Manager,  
White Hydraulics, Hopkinsville, Kentucky -  
past TMG workshop participant.*



## TMG News

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agement team to the workforce — that reactive work is the most important. For proactive behaviors to become a prevalent, normal part of the daily routine, managers must actively seek ways to recognize, reward and publicize such behaviors. Operators and mechanics must recognize that defect elimination is an integral part of their daily job. They should not wait for an engineer or manager to tell them to take action when equipment, processes or practices are not functioning properly. Instead they should actively recruit others to help them eliminate identified defects.

For reliability improvement efforts to be successful, the organization must create an environment where the workers can practice proactive behaviors. Most workers have years of reactive habits that cannot be expected to disappear overnight. Creating new habits requires repetition of the new desired actions. The Manufacturing Game® workshop uses Action Teams for this

purpose, giving the participants the opportunity to work as a cross functional team to eliminate a known defect. The behavior of managers must also change to support performance in the Improved Precision Domain. The old "I tell, you do" approach that can be extremely successful in the Reactive Domain will no longer be appropriate since everyone in the organization participates in decision making in the Improved Precision Domain. The role of the manager changes from "boss" to "leader". Their responsibilities need to include encouraging self-generated Action Teams for continued elimination of defects, determining and communicating a vision of the organization's future and developing the needed support systems for front-line decision-making. Accomplishing these objectives is the goal of the Leadership Forum Series, a set of monthly meetings that each address gaining commitment to a specific leadership issue.

In DuPont, we recognized that safety was the responsibility of each individual and required the participation of everyone. Thus the slogan - **Safety, I have to do it myself, but I can't do it alone.** Many organizations are now realizing that the same is true for reliability. Each individual must take personal responsibility for reliability and take appropriate action based on the position they hold and circumstances that they face — through defect elimination activities and the setting of policies and procedures. And it will take the participation of everyone within the organization to achieve higher reliability and the resulting improved performance results.

**Reliability, I have to do it myself, but I can't do it alone.**

