

American Society of Safety Engineers – Middle East Chapter (ASSE-MEC)
9th Professional Development Conference & Exhibition (PDC&E)
February 20-24, 2010
Kingdom of Bahrain
www.asse-mec.org

Case Study for Streamlining Systems and Establishing a Process Safety Culture With Current Day Technology.

Judy Perry/ioMosaic
Perry.J.NH@ioMosaic.com

Georges Melhem/ioMosaic
Melhem.G.NH@ioMosaic.com

Henry Ozog/ioMosaic
Ozog.H.NH@ioMosaic.com

ioMosaic Corporation
93 Stiles Road
Salem, NH 03079
Tel: 603.893.7009
Fax: 603.251.8384

1 ABSTRACT AND KEYWORDS

This paper is to discuss a leading edge information system that is utilized for process safety management systems. The paper discusses one plant's experience going fully electronic on all process safety management systems including a management of change workflow system. Detailed information on hurdles and gains from implementation are provided. A key client partnered with IoMosaic Corporation to implement an electronic system that streamlines the efforts related to process safety management. In this case study, a large emphasis was placed on converting an old "Lotus Notes" system to a fully automated workflow system. The presentation will focus on a specific example of implementing a very no-nonsense, practical software solution for streamlining management of process safety systems.

Software Solution
Process Safety
Streamline
ioXpress
Management of Change

2 INTRODUCTION

This paper outlines one organization's efforts on enhancement of their process safety management systems. In this case study the original process safety systems were established to support and drive risk management and compliance in response to American Chemical Council's Responsible Care initiatives preceding U.S. Occupational Safety and Health Administration's (OSHA's) process safety management (PSM) and Environmental Protection Agency's (EPA) Risk Management Plan (RMP). The facility had migrated away from some of the original baseline expectations and had not kept current with the performance based expectations of others in industry (relative to managing their process safety management systems). Each individual process safety management system, such as pre-start up safety reviews, management of change, employee participation, incident investigations and others were at different modes of maturity. The facility decided they were overdue for system upgrades. They had a definite need to find a system to centralize all elements of process safety with a more robust system utilizing current day technology.

Many organizations are interested in enhancing their process safety culture. Often this includes upgrading existing information management systems to utilize current day technology. Another upgrade interest may include identifying tools to streamline compliance. One main goal for all organizations is to ensure resources are being utilized in an effective, yet efficient manner. A key qualification when providing IT (information technology) solutions is to ensure any process safety system is robust enough to handle a high volume of information. The system shall be accessible and usable by multiple users. Consideration should also be given to the disparity in knowledge at many organizations on understanding functionality of a computer and the associated software solutions. Each of these concerns and desires were addressed in the case study discussed below.

3 OVERVIEW OF THE RESULTS

In this case study many of the existing process safety systems utilized hard copy files and manual dissemination of information. Some of the individual components were managed with the assistance of “Lotus Notes”, which is an outdated IBM program. This paper gives a brief overview on how one facility converted their hard copy files and semi electronic management of change system to a fully automated workflow system. Multiple system enhancements were achieved. Examples include the conversion of Process Safety Information (PSI) from fragmented hard copy files to a readily assessable central repository. This enhancement provides easy access of the PSI, in preparation for Process Hazard Analysis. All PHAs are readily retrievable and organized for audits. In addition all action items, such as those from Prestart up Safety Reviews, MOCs, Incident Investigations, PHAs and Audits are centralized and tracked to ensure efficient closure. Operating standards and other documents are readily available which ensure all elements of process safety management has been included as required by the appropriate regulation and company standard. In addition other important systems such as Job Safety Analysis and Safety walkthroughs have been incorporated into a system with single point access and multiple security levels.

The result is a culture shift which has enhanced compliance, provided a robust system, and is a system which is easily sustainable independent of individuals. The resulting system streamlined compliance for the ever present resource limitations that are reflective of today’s

economy. This paper and presentation is to provide a look at this system that has changed a culture. As this case study demonstrates, the ioXpress knowledge management system with the process safety management modules are a very no-nonsense, practical solution to a very big challenge for the chemical and petroleum industry. The following paragraphs provide a brief overview of the key desires and hurdles experienced during the development and implementation of new technology at the case study location. At the case study location, many of the systems were well established, many were not so well established, and some had no management system structure at all. It was obvious major enhancements were needed.

4 RECOGNIZE THE NEED FOR IMPROVEMENT

In advance of seeking a solution for process safety management improvements, a process safety audit was conducted by the site PSM coordinator to identify gaps and major needs for improvements. Once those gaps were identified, an major effort was launched to communicate the results so management and engineers all understood and agreed there was an urgent need for improvements. As a result of this on site audit, an action item was generated by the site PSM coordinator to find a single system that would help in all areas for process safety system enhancements. Several communications, related to the need for improvement was provided at all levels of the organization. Following these communications a majority of the site would be better equipped with knowledge and be ready when changes were made. This advance communication was key to a successful launch for a new IT solution, as many individuals develop anxieties and are very resistant to change.

5 WHAT WAS NEEDED TO ACHIEVE THE VISION?

To achieve the difficult vision of a major system enhancement based on an accelerated schedule, the case study facility partnered with IoMosaic Corporation. The goal was to develop a system with the facility’s criteria and develop a plan for the change. The criteria established included the need to conform to existing company specific work flows, provide a tool that manages data structure for documents in multiple formats and be able to make adjustments on the fly. The system needed to be structured so workflows and management of information would save time and

money, while achieving better end results than current systems. With the facility being in the U.S. there was also a priority to ensure the system drove compliance with the OSHA's Process Safety Management Standard [OSHA, 1992] and EPA's Risk Management Plan [EPA, 1996]. OSHA had rolled out a National Emphasis Program on PSM in the refineries in 2008 [OSHA, 2007]. OSHA was also planning the rollout of a similar program in the Chemical Industry in 2009. The case study facility wanted to not only improve their systems and provide solutions, but they also needed a framework that could be expanded to facilities all over the world. They set a goal for a fast implementation (weeks), as they also desired being proactive on ensuring a successful on-site visit and inspection by OSHA at their U.S. facilities.

6 THE IOXPRESS SOLUTION

The case study facility and ioMosaic were able to quickly develop a plan and initiate implementation of an IT solution, as ioMosaic's software was already designed for such applications. The ioXpress software solution is a technology which has leveraged a mature process safety knowledge base, incorporated industry best practice process safety systems and combined each with current information management technology. The case study location has implemented a system which is now a business advantage. The system is a tool to ensure process engineer's time is utilized more efficiently, compliance to Responsible Care's process safety code, PSM and RMP is demonstrated, and recognized and generally accepted good engineering practices (RAGAGEPs) are employed.

In addition to viewing the key management systems associated with process safety, interest was expressed by the facility to include other systems which generated action items. This would enable the facility to have a single system to handle action item management regardless of the origination system. A single one stop system would prevent them from maintaining multiple systems. For example: In addition to the standard process safety management system elements (as outlined by OSHA's PSM Standard) [OSHA, 1992], the facility had an active job safety analysis (JSA) program that was utilized to identify key hazards on specific tasks. These JSAs resulted in follow up actions being requested in order to provide additional safeguards to reduce risks for the identified tasks. Additional modules were provided, such

as this JSA module, to simplify action item management across multiple disciplines.

7 ELEMENTS AT DIFFERENT MODES OF MATURITY

An effort was launched to understand which process safety management systems required duplication with technology, and which systems needed developed from a starting point of nearly nothing in place. The results of the on site assessment indicated the core workflow system that was already well established and most mature, was their management of change process. An old Lotus Notes system had been constructed to initiate and track management of change for the process related changes. An independent change system was operating in parallel to handle the chemistry changes or other changes that have the potential to impact product or raw material quality. To stay on top of follow up actions and status of changes, the facility had weekly meetings. All engineers and supervisors were well versed in management of change and followed this system faithfully.

Other systems were not so well established. For example: Pre-start up safety reviews were not being conducted on significantly modified processes, incident investigations were being conducted using a variety of techniques, however there was no standardization of causal analysis or no standard final report form being utilized. On site audits, including the OSHA PSM Audit, were documented using Microsoft's - Word processing and placed in file folders. Action items from the audits were not clearly defined and not properly managed to completion. As discussed here, each element had opportunities for enhancement; some systems with more opportunities than others.

8 WHERE TO START?

Following ioMosaic's initial analysis a team decision was made to use the management of change workflow system as the starting point for enhancement to the process safety culture. The system was functional and well understood, however it had limitations. Most organizations struggle with change. By selecting the MOC workflow system upgrade, a new system could be implemented, while minimizing the changes in functionality and look for the end users. This would be an opportunity to ensure the process engineers and others were on board with the IT upgrade as soon as possible. The key hurdles on the exiting change process, included the engineers being accustomed to implementing

changes prior to all reviews and authorizations occurring (when utilizing the old Lotus notes system), as well as implementing changes prior to action items being closed or without a pre-start up safety review being conducted. In addition changes that were being initiated from major capital projects had not previously been included in the change control system, therefore major steps such as PHAs on capital projects were not being scheduled to enable the designers to implement changes in the final design.

A good understanding of the client’s existing Lotus Notes system enabled ioMosaic to construct a flow chart that outlined the flow path of a change as it progressed from originator to reviewers to the actual implementation. An electronic version of this flow chart was developed with programming rules for each step (or work flow task) provided. The programming rules were based on the current facility’s MOC system. This was to ensure a baseline of familiarity for the users was present; however enhancements to ensure good functionality as well as compliance were also incorporated at the time of programming. In addition, a capital project and PSSR work flow task was added to the workflow path, as they were both gaps in the existing system. This workflow provided a good visual for the case study site and provided a view that was an already (mostly) familiar workflow for the end users. Familiarity introduced a good start to a big change that was underway. Familiarity enabled the end users to get acclimated to a new way of doing things with smaller steps rather than larger steps in the beginning. As an interim step the initial draft workflow solutions was piloted at one Unit in the site. The pilot group utilized the ioXpress workflow solution for one month, in parallel to their old Lotus notes systems. Any concerns or bugs were easily fixed on the fly, as the ioXpress solution was used on web server. This easy access enabled the programmers to make any modifications suggested by the pilot team at the time noted. The resulting changes were immediately seen by the pilot group.

9 AFTER THE PILOT

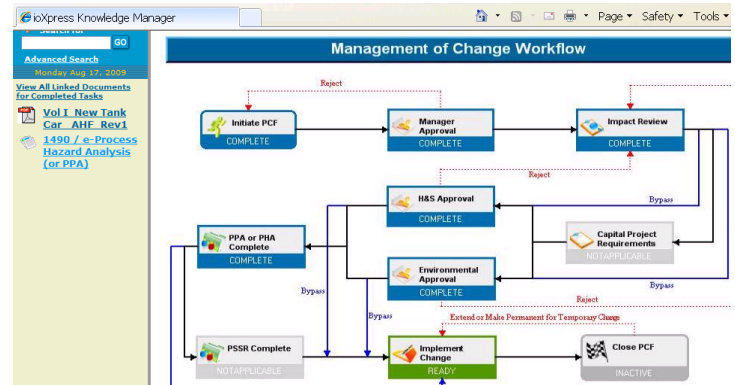
Once the workflow was piloted and a final design for the MOC system established, the case study site saw how there was no longer a need to make multiple phone calls to push changes nor a need to have weekly meetings to understand change status. With the new electronic solution the case study site was seeing how IT solutions, with current day technology has the potential to make their job easier than the old systems they

were acclimated to. A particular gain was when process engineers could go on line and view who in the authorization process was holding up their change. Another key win was when they realized, with the work flow system tied to an overall knowledge management system, all documents associated with the change could easily be viewed with one or two clicks of the mouse verses the old way of finding a hard copy file folder or finding multiple people that could explain what each change was really all about.

The department managers also appreciated being bypassed on changes that did not impact their unit. Managers have so many emails and action items each day, any opportunity for filtering to lighten the daily to-do list it is a welcomed function. A set of screening questions, which was developed by the site, enabled the programmer to direct the workflow process to whom in the process needed to view and authorize each change, bypassing those that did not need to review a particular change. In the site’s “Lotus Notes” system each manager and/or authorizer had to look at every change.

In addition the site process safety coordinator was pleased, as the work flow tasks that had previously been skipped, such as PSSRs and review of capital projects were now incorporated into the system and not easily bypassed. The below figure is an example view (case study site) on a change in progress.

Figure 1: Example work flow at Case Study Site



In Figure 1 above, the grey boxes indicate the work flow step could be bypassed as the change had not affected the group or is bypassed based on type of change. In addition blue boxes indicated the step was completed, while the green box indicates that workflow step is ready for authorization and completion. The documents listed at the left of the figure are the documents tied to this workflow and are direct

links to their location. They are filed for ready reference in one of the knowledge management libraries established by the location within ioXpress.

What was the next key step for enhancing the process safety management systems?

The next step in the process was to ensure a phased in approach was utilized for the other modules (each process safety system is represented by a module in the IT solution – ioXpress). The phase in approach started with utilizing the site's PHA schedule. An expectation was set to document all PHAs using the new software system (HAZOPTimizer), instead of the previous way of documenting in a simple Microsoft "Word" file. Also all process safety information (PSI) supporting the PHA must be uploaded to the ioXpress Knowledge Management system. In parallel to this effort, it was expected all information obtained to support any change (using the new workflow system), was to be uploaded into the new ioXpress Knowledge Management system. In order for all of these references to be logically filed and readily retrievable, a library system was established in ioXpress. The case study location decided on a filing scheme that was simple and logical. Libraries were established for each individual element within the process safety system and each library had categories that were appropriate to the element. For example in Operating Procedures, a category was established for filing of the actual current procedures, and another category was established to file the annual certifications that certify the operating procedures are current. For the PHA library a category was established for archived PHAs, and another for current PHA report filed by individual unit. A partial list of the library organization is displayed in Figure 2 below.

Figure 2: Libraries within ioXpress-Based on PSM Element



In addition, the case study facility was large enough; so that at least one major PHA and multiple smaller PHAs (due to modifications or revalidations) were being conducted monthly. As PHAs are completed they are recorded using PHA software (HAZOPTimizer) that is compatible and partnered with their new knowledge management system. The final PHA report is uploaded and the action items imported with an easy one click to the centralized action item system. This approach was a logical solution for initiating a major migration for converting previously fragmented systems to this single management system. This method was considered much less burdensome for the site, than a concentrated migration effort in a short time frame. At the end of a full year of implementation, there are plans to review status and then make adjustments in the information upload schedule as appropriate.

Gathering and filing process safety information for each high hazard process is typically one of the most daunting and challenging tasks for the engineers. Migration to a form which outlines all of the PSI required for each process, with a supporting knowledge information management system was key to the success of a new culture. However when communicating the need for a change a good visual for the end users, of the different systems (old and new) was provided as seen in Figures 2 and 3.

Figure 3: Old look of PHAs

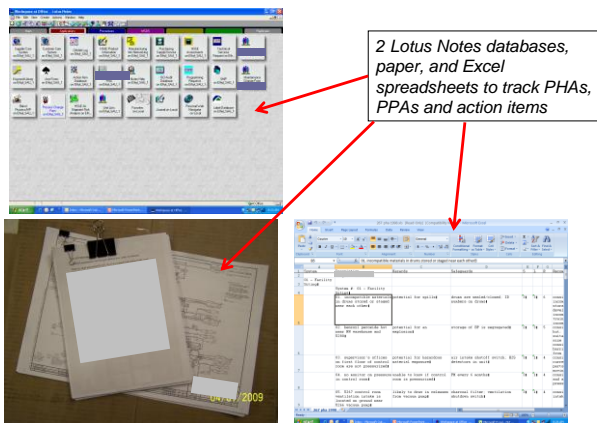
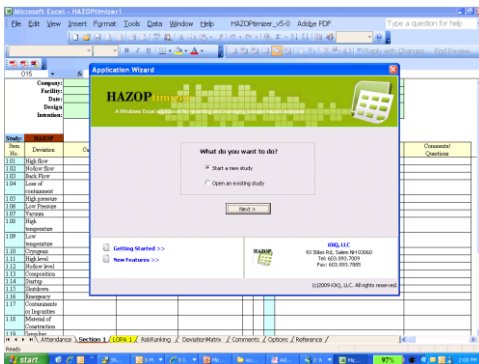


Figure 4: New Look of PHA files



10 MORE CHANGES

The first two systems enhanced (PHA and MOC) were two of the elements that were in the most mature modes on site. Another element that was mature from an application and completion perspective was incident investigations. However the site had not standardized on a single form or the method of analysis. A decision was made that converting to a fully electronic workflow system, had to be a two step process over time for the incident investigation process. The case study site selected to delay converting this system to a fully electronic workflow until they had standardized documentation methods. Based on this decision the first step was to standardize on a form and include causal analysis data that was expected to be recorded for every incident investigation. Not until a form is standardized and fully accepted by the site, can the 2nd step of converting to a fully electronic workflow system occur. An incident investigation form, based on the Center for Chemical Process Safety's publication "Guidelines for Investigating Chemical Process Incidents" [CCPS, 1992] related to incident investigations was part of the ioXpress solution.

This same form is a workflow module within ioXpress, however the workflow functionality was removed until step 1 was completed. The case study site felt confident there was appropriate activity on the investigations; however other elements did not have appropriate activities, so other process safety management system elements became the priority.

11 WHAT NOT TO INCLUDE IN THE SINGLE IT SOLUTION?

The initial scope of the new culture was to have an IT solution for all aspects of process safety. One area discussed, where there was a change in direction is on portions of Mechanical Integrity. This site, as with most organizations, had a centralized maintenance management system (CMMS) that was integral to the work order system for their repairs and maintenance staff. This single element of process safety is so complex, and there have been IT CMMS in existence and use for so many years, it made business sense to maintain an independent system for maintenance management and/or mechanical integrity. The ioXpress solution will be utilized to file mechanical integrity items that are not stored in the CMMS, such as the Mechanical Integrity Standard Operating Procedures or other stand alone documents. The other area where a decision has yet to be made is on Operator Training. There are multiple stand alone software systems for documenting Operator Training and the associated curriculums for job titles. The case study site has maintained a "Yet to Be Determined" status on whether to continue to use their current software for documenting training programs or migrate all records to ioXpress. Training documentation required by process safety is just a small piece of training requirements that exist at most sites today. There is a multitude of issues that require training, in addition to the process safety training. Those include items that are completely unrelated, such as human resource efforts like as sexual harassment training or routine training efforts such as fork truck operator training or respiratory protection training and fit testing. The Operator Training Element is in the "wait and see" mode at the time of publication of this paper.

12 LEAST MATURE SYSTEM WAS PSSR

One of the site's largest concerns was associated with pre-start up safety reviews (PSSR). The PSSR system was not well established, the actual reviews were not occurring as current industry practice and compliance agencies required. This

large gap fueled the need to make the enhancements to the PSSR one of the highest priorities, once the engineers were acclimated to the ioXpress system via the new change workflow rollout. They had a very high energy associated with fixing all aspects related to PSSR and the current culture. As with any change a communication on the “why?” was essential. The Site management team provided audit findings to their groups and communicated that conducting PSSRs was a new minimum expectation on any significantly modified or new process. This expectation was established in advance of the roll out of the new ioXpress system.

The tool to enable management to streamline PSSR was already within ioXpress as a module. The PSSR module is based on a dynamic form, which was constructed based on industry expectations and compliance requirements. In addition a PSSR form is one of the key work flow tasks required in the change workflow system or module. The ioXpress programming prevents the management of change work flow from proceeding to the next work flow task, until the action item to complete a PSSR is noted as completed and is available for ready reference in the knowledge management system. In addition to the actual PSSR form used to record the PSSR, any action items generated as a result of the review are entered into the ioXpress action item management system and noted as pre- or post-startup. As part of the change workflow system, when an engineer indicates readiness for implementing any change, ioXpress validates status on any associated action items. These items are from both the PHA and PSSR. If any action items (that were noted as completion required before start-up) are still open in the action item management system, a prompt box is displayed indicating action items are not closed, and therefore the change can not be implemented.

Authorization of the implementation work flow task in the management of change system is prevented until the action items are address appropriately. This level of modification to the PSSR system is a major upgrade. These changes streamlined the process, so PSSR is not viewed as a hurdle as much as the old manual system quite often had been. However since this is a mostly new task, the process engineers still grumbled on the new expectation, as this is more work. The expectation had to be set by Sr. Site management for the enhancement to occur. A software solution can not fix a system that is fully broken.

13 CENTRALIZED ACTION ITEM MANAGEMENT

Another major enhancement, which was very easy to implement however was very critical, was the auditing function. ioMosaic has ioAuditor, which is a user friendly PSM/RMP auditing tool that enabled the site to have pre-populated audit questions and a software solution for documentation. Previous audits had been captured on “Word” processing, with a manual action item follow up system. ioAuditor has functionality that is similar to “HAZOPTimizer” (the PHA tool) the site had selected, therefore it was very easy to use. As with HAZOPTimizer, ioAuditor allowed the site to audit, record findings and with one click migrate all findings, and follow up actions into the centralized action item system in ioXpress. The “One Stop Shop” concept for all action items, those from audits, PHAs, PSSRs, JSAs, incident investigations and so on, was very appealing to the site. Previously there were dozens of files or old “Lotus Notes” systems to track these audit findings and associated action items. The management team was very appreciative of the reports they could generate with ease, to monitor status of action items in their operating units. As shown in Figure 5 below, the centralized action item system provides information on where the item originated (relative to process safety element), who originated the item as well as priority and when it is due.

Figure 5: Centralized Action Item Management

Action Item ID	Belongs to	Description	Assigned By	Assigned To	Date Modified	Status	Priority
1567	m-Incident Investigation:1321	New Inc Inv. for P&G	Judy Perry	Judy Perry	3/17/2009 9:29:40 AM	Open	A-High
1566	MOC: 290-1371 Remove existing IZ regulator on 267 at south trade dock and replace with regulator nad relief valve - Impact Review	Complete a PHA	Judy Perry	Judy Perry		Open	A-High
1556	MOC: 267F-1370 Change of Chemistry in 267 - Initiate PCR	Consider changing reactor to glass lined vessel to prevent corrosion.	Judy Perry	Judy Perry		Open	B-Medium
1553	MOC: Administration-1331 test - Impact Review	Complete a MCR	Judy Perry	Judy Perry		Open	A-High
1552	cc-Job Safety Analysis:1337	Need to validate oven in 267 and 270 are properly insulated to prevent thermal	Judy Perry	Judy Perry	3/11/2009 6:52:58	Open	A-High

Since the managers no longer had to monitor numerous action item systems, and the engineers no longer received multiple status reports from numerous systems they could spend more time on closing action items, and spend less time meeting and discussing status. Documentation on closure actions also was now auditable, as

ioXpress had an auditing function that notes all history on each action item. The history includes changes, as well as who made the change.

14 WHAT THE FUTURE HOLDS?

With full implementation occurring in mid 2009, there continues to be a learning curve for the site on all of the changes. As history and experience has indicated improving a process safety culture touches numerous systems and each level of the organization. The above description did not even touch the surface for explaining all of the enhancements and the details of the ioXpress system that provided the enhancements. Any change that is this complex will take time. The site will continue to mature each element until each management system is current with industry practices. With the fully electronic solution the younger and more technology advanced engineers appreciate their organization not being behind the times. Often the new era of engineer finds these current efforts motivational.

This site understands the importance of knowledge management and has plans to expand the process safety modules to include environmental management issues, as well as consider a capital project improvement workflow module. In addition the system will be rolled out to the other locations (worldwide) in the next fiscal year. The web server based system will be utilized by the Corporate staff to monitor status of critical issues at every site, to ensure the corporate values associated with process safety and compliance are being demonstrated by closure of action items and proper management of information. Since the system is very robust and the nature of module and forms construction is open to the site, there are other modules and forms that will be added, that the site has not even considered at this point.

15 CLOSING COMMENTS

As with any change there must be commitment by Sr. Management to provide the resources and to set the expectation for the change. Having the proper software solution, is a key start; however a software solution can not be a replacement for individuals doing the right things and making the right decisions. This case study discovered that ioXpress is a tool that enables a site to migrate old, fragmented systems to a streamlined electronic solution. ioXpress achieves the simple task on assisting the individuals at the site to not forget to do things they are supposed to do, as it relates to the details of a successful process safety culture. As many of us have experienced

with incidents in our back yard, the devil is in the details when considering what could go wrong with a highly hazardous process. Information technology solutions help young and unknowledgeable people do the right things, at the right time to prevent that catastrophe we all fear in this industry. As with completing a PHA, "The analysis will only be as good as the PHA team." Implementation of an IT solution, to streamline a process safety culture has to be thought of in the same way "The implementation efforts will only be as good as the team doing the implementing." The key success for this case study was the dedication by the case study site to make a change, the dedication by the programmers to make sure the ioXpress solution fit the facility like a glove and the dedication by the site's engineers and supervisors to ensure a smooth implementation.

REFERNECES

1. Center for Chemical Process Safety (2003). Guidelines for Investigating Chemical Process Incidents (2nd Edition).. Center for Chemical Process Safety/AIChE, NY, NY
2. Environmental Protection Agency 40CFR68 "Accidental Release Prevention Requirements", <http://www.epa.gov/fedrgstr/EPA-AIR/1996/June/Day-20/pr-23439.pdf>
3. Occupational Safety and Health Administration, 29CFR1910.119 "Process Safety Management of Highly Hazardous Chemicals" <<http://www.osha.gov/>>
4. Occupational Safety and Health Administration, CPL 03-00-004, "Petroleum Refinery Process Safety Management National Emphasis Program", 6/7/2007