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FUTURE DIRECTIONS FOR PREVENTION AND SAFETY WITHIN THE CHEMICAL AND PROCESSING INDUSTRIES

Mohammed Saleh Al.Ansari (Corresponding author)

Department of Chemical Engineering, College of Engineering, University of Bahrain
PO box 32038, Sukhair Campus, Kingdom of Bahrain
Tel: +973-3944-1110

Abstract: *It is essential to understand the current trends in regards to future-oriented prevention management within the chemical industry. Concepts that lead to the next generation of properly managing prevention within the industrial chemical areas are discussed in this article. The first concept concentrates on the concerns surrounding integrated design security and safety; the second concept analyzes the concerns associated with collaborating several chemical plants in an effort to increase sustainability of activities and the environment of the locale.*

Keywords: prevention, safety, chemical industries

1.0 INTRODUCTION

In comparison to the first decades of the twentieth century, the amount of plants that presently handle hazardous chemicals has increased enormously as a consequence of the increasing varieties of processes and products required by consumers. Lozano, R. (2007) stated that the adverse sides of this influx, many plants are being built closer to one another, and closer to well-populated neighborhoods. Although it is possible to decrease the amount of non-major accidents, such as lost time incidences and first-aid related injuries, by taking proper preventative measures, it is difficult to decrease major accidents from occurring. In fact, statistics show that the amount of major accident incidences that occur has increased overtime.

According to Gibbs, D., & Deutz, P. (2007) that the Chemical plants did not take the vulnerability of the security systems into consideration, except when they were forced to consider them due to special circumstances. The chemical industry specifically, being subjected to risks that could potentially cause severe accidents to more than one plant at a time, had to include security implications into their daily operations, to ensure that incidents that are intended to cause damage would not wreak havoc on the industry.

Additional research that is ongoing is imperative in order to control man-made hazardous, regardless if these hazardous are intentional or not. This research will help prevent an increase in the amount of accidents that occur within the chemical industries. Little work gone to analyze the frequency on the basis of statistical output rather than descriptive

procedures. This was a need to move forward when the needs to evaluate actual output was. It is imperative to investigate, elaborate, and promote different ways that man-made disasters can be prevented in the processing and chemical industries, both from a safety and security stance. Two important concepts are further discussed throughout this piece of work. The first concept is the utilization of a design-based security and safety mechanisms within chemical plants, along with the relationships that exist amongst security and safety. The second is the possibility of elaborating and introducing collaborative means in which chemical industrial parks can be spoken of.

2.0 DESIGN BASED SECURITY AND SAFETY

The concept of applying preventive measures and risk assessments regarding security and safety are similar to one another, but there are also differences that exist as well. The differences between these two concepts are better understood by obtaining a thorough explanation of the various security and safety risks that exist. CCPS (2000), defines safety risks as "a measurement of injury, environmental damages, or economic losses in terms of the likelihood of incidents and the extent that the instances cause injuries or loss." When defining a safety risk, the definition will often times bear the definition that something accidental is executed. Somebody who intends to cause damage to a chemical facility or steal chemicals proposes a different type of risk, which is a security risk analysis. Security risks are considered to be expressions; they differ greatly from safety risks. Defined, a security risk is " the likelihood that a threat will cause an exploitation or specific type of vulnerability to a particular target or targets to cause a specific type of consequence" (CCPS,2003).

Security and safety risks can be classified as two concepts that are related to one another, but possess a different basis. The two definitions given for safety and security risks are not the only two definitions that exist. Safety is defined in many different ways. Holtrop & Kretz (2008) define safety as a type of protection against the threat of technical and human failure. Hessami (2004) regards that safety is intended to harm individuals by non-intentional events, human errors, or process errors can be these types of non-intentional happenings. Security on the other hand, Holtrop & Kretz (2008) state is a type of protection against a deliberate act evoked by an individual or individuals. Hessami (2004) explains that security causes loss by an intentional act performed by a single individual or a group of individuals.

Security and safety are different in regards to the nature of incidents. A safety risk is something that is done in a non-intentional manner, security risks are intentional wrongdoings. When it comes to security, aggressors are present who are reacting by influence within the physical environment or for personal reasons (George, 2008). Aggressors may decide to carry out their intentional tasks from within a firm or outside of a firm. It can be extremely daunting to determine when a security risk may arise, because

these risks are often times unpredictable (Johnston, 2004). Being able to identify security threats and the developmental measures that an individual or individuals has to go through to create a threat is a challenging and complex task.

The concepts of safety and security differ in the approaches that they take. When it comes to safety assessments, a risk will be detected and evaluated by utilizing probabilities and consequences. When it comes to a security assessment, threats will be detected and evaluated by utilizing vulnerabilities, consequences, and the attractiveness of the specific target (Holtrop & Kretz, 2008). These two different approaches can lead to the requirement for various complimentary proctective measures in regards to security and safety to be taken. The different characteristics that are attached to security and safety could be as when safety is defined to comprise non-intentional acts, the incidences nature does not pose an inherent risk to the firm; No aggressors present and risks associated are rational in nature. While security forms the looks at the incident is caused by an intentional incidence from a human; and; if there is a human aggressor perpetrating the act plus the threat may have a symbolic meaning

In order to avoid a conflicting situation, integrated approached are required. An integrated approach will employ risk assessments prematurely, allowing proper arrangements to be made during a proactive stage. Only by applying an integrated approach, can safer situations, awareness, and integrality exist (Holtrop & Kretz, 2008). Fontaine et al. (2007) states that by integrating security and safety concepts the results will provide a cost-efficient means for protective measures. Safety and security measures can be integrated by utilizing an inherently safer design, because secure chemical processes are the by-products of applying the principles of a safety-related design.

Inherently safer designs are designs that avoid hazards altogether, instead of simply controlling the hazard from occurring. This is done specifically by reducing the amounts of dangerous substances and the numbers of hazardous operations within chemical plants (Herndershot, 2010). The methods used should not focus their attention on evaluations of the proposed designs for safety, instead these methods should emphasize on properly synthesizing a safer plant, which in the end, will also make the plant more secure at the same time.

Safety of chemical processes can be achieved through external and internal means. Inherent safety relates to intrinsic properties of processes, for example, they utilize safer chemicals that will make for a safer operation. The essence of utilizing inherent safety is intended to remove and avoid hazards, as opposed to controlling them by enforcing protective systems (Kletz & Amyotte, 2010).

The inherently safety chemical concept for a facility is something that has been known about for years. However, despite the benefits of this safety measure, which benefit health, safety, and the environment, along with the cost benefits, there have only been a few applications utilized within chemical plant designs. Progress has been made within

this area, but there are still some obstacles that must be overcome in order to make this concept work. Inherently safer design will require a change in approach. Instead of assumptions that large portions of hazardous materials can be kept in a controlled state, there needs to be an attempt to remove the hazardous materials or use alternative benign materials in their place. Changes to actions within the chemical industry are not easily accepted, especially when it comes to shifting the traditional design ideas of plants to rely on specific safety systems. The traditional approaches that have been taken in the past, have proven to be useless. Traditional approaches are not cost-efficient, with adding on additional safety systems, additional staff needed to be hired on to maintain the added features for the entire life of the plant. This increased the lifetime costs of the organization, as well as required ongoing training and keeping up with documentation etc.

The inherently safer design method, which had not been considered in the past had recently become an important method to exercise within processing industries. Inherent safety will not only yield an immense amount of benefits and be cost-efficient, but it will also ensure that plants are more secure, leading to inherently more secure chemical operations. When applying inherently safer design principles, intentional and non-intentional disasters are able to be prevented in a cost-effective mannerism. Understanding the relationships between inherently safer design aspects and security can be a little daunting at first. Each piece that serves a purpose within the chemical plant needs to be critiqued.

Several inherently safer design features include: Intensification, Substitution, Attenuation, Limitation of Effects, Simplification, Layout, Open construction, weak roof tank, software, tolerance of misuse, making status clear, east of control, and incorrect assembly impossible. These features have varying degrees of impacts on plant security systems. However, all of these features need to be considered when applying an inherently safer design to a plants infrastructure which shown in the points that clarified by Moore, D. A. (2010).

The subject of design-based safety has been a crucial point of research for years. Taking all of the inherently safer design features into account can help a chemical company impact their safety and security protocols. The process of designing a piece of architecture with security in mind is referred to as Crime Prevention through Environmental Design, which is often times abbreviated as CPTED. This method entails building a piece of architecture to reduce the opportunities or the fears of crime and overall disorder. Aside from implementing inherently safer designs for chemical processes, another unexplored field of interest is utilizing the CPTED concept for processing industries. By utilizing this approach, within security designs of a chemical industrial facility, different traditional security precautions will be put in place. Barrier techniques such as alarms, locks, gates and fences will need to be added to the architecture of the building. CPTED utilizes the environment to help meet pressing

security goals along with technical and physical protective measures. The concept behind environmental security designs is based on three functions relating to space: (i) Desgination: What is the purpose that the space is intended for?, (ii) Definition: How can the space be defined? What social, technological, legal, and psychological ways can the allotted space be defined? (iii) Design- Is the designed space able to support intended and prescribed human behaviors?

3.0 THE COLLBORATION CONCEPT

Collaboration along with competition helps to provide alternative, otherwise known as simultaneous paths for success. Therefore, when it comes to business and nature, individuals that are in charge of making the decisions must be made aware of collaborating and competing with others are valid corporate strategies. Collaboration is the highest levels of involvement. Lozano (2007) argues on the point that only the highest partnership levels amongst companies will be able to help to balance environmental, economic, and social dimensions that lead to transitioning towards a sustainable society. Even though collaborations are things that many industries know of and appreciate, additional optimization of arrangements is plausible. By entering into collaborative relationships and agreements with other firms, an organization will be able to reap the benefits of other options that would have not been made available to them otherwise. For example, organizations will be able to take advantage of better market access, swapping technologies, lower R&D risks, larger economies to scale, elevated security and safety standards etc. Collaborative arrangements will lead to sustainable situations and solutions. Research suggests that developing long-term arrangements with industrial parts by means of collaboration is hindered by barriers that exist inter-firms. Studies suggest that there are problems that can be related to sharing information that is intended to remain confidential and depending on the assistance of outsiders, possible instability of collaboration can occur. Gibbs and Deutz (2007) believe that with the few examples of networks that they found amongst firms that industrial parks that are within their earlier stages of development are finding linkages to be potential things they may consider in the future, but are not something real that they ponder on today.

In order to use collaborability, two firms (at least), need to collaborate amongst each other to increase the sustainability of their activities and their environments. Collaborability for a specific chemical industry depend how the strengths of sharing knowledge from various plants that increases the support from the public and from authorities, or/and increase in safety. Such is obviously increasing in security, efficiency, and off course eventually increase productivity. But there is also noticeable weaknesses, when few and between structural financing costs, when set up requires alignment and pioneering of all plants involved, apparently when long term visions of all companies. The opportunities that exist increase in long-term know how, purify the public image of chemical industries towards, decrease in long-term costs, and creation of additional business opportunities or uses the by-product to integrate it with additional

expansion to boost the needs and economics. Many managers and CEO's concerns about any threats that might yield to the loss of confidential company information, trust can be violated between firms specially there is what called business intelligence or what looks to be intellectual property, maintaining individual plant independence.

The security levels within chemical industries are enhanced, as proposed by the collaborability concept, companies neighboring the firm would collaborate for a joint investment within the enhanced security measures, they would then jointly work out security programs that would protect all of the premises included. These collaborations would be a lot more effective and efficient than a single plant taking the security approach on their own. Increased know-how in security measures, and equal funding will make keeping the security systems in tow an easier feat to accomplish. Here comes the need for technology transfer polices applications and even technology acquisition could have its signature to reach such concepts.

4.0 CONCLUSIONS

The chemical sector is comprised of various facilities, that all come with their own sets of risks. Major risk factors are known due to the amounts of accidents that have occurred in the chemical industries since their implementation in the early nineteenth century. Additional focus within the chemical industries has been given in an attempt to decrease the amount of risks that the industries face either by internal or external factors. Aside from applying chemical plant safety protocols, additional initiatives have been taken to increase the amount of security within the plants as well. This helps in the prevention of chemical disasters. Utilizing the principles of CPTED and design-based safety within the processing and chemical industries, secure and safer chemical industrial parks and chemical plants can become a reality.

Even though there are a lot of chemical companies that are grouped into industrial parks, security efforts are currently only being taken by individual chemical facilities, as opposed to the whole. At the present time, there are no concepts that are available for increasing the collaboration amongst chemical facilities. But, having to deal with cross-company threats may prove viable in eliminating security risks and preventing disasters caused by malfunction. Management of cross-company hazards need to be developed within industrial parks of the chemical industry.

Pictures are beginning to emerge of industrial chemical clusters that set their sustainability standards by engaging in intensive collaboration efforts. The increased complexity of organizations, chemical processes, and chemical logistics, has increased public involvement, and this is something that chemical plants need to take into consideration. The challenge is going to be developing efficient and effective collaborability concepts within chemical industrial clusters, which will lead to integrated sustainable chemical industrial parks that have long term and solid advantages over their competitors.

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Corresponding email address : malansari@uob.edu.bh