Risk Assessment and Consequences Analysis in Major Accidental Hazard Industries Waste Companies

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Abstract— The pace of urbanization and industrialization in developing countries is rapidly increasing. Unfortunately, regulatory and private-sector control of hazards has not always kept pace. This work identifies the level of emergency preparedness in chemical industries and evaluates the spatial distribution of hazards using a worst-case release scenario. Consequently, we identified potentially exposed urban communities and evaluated the social perception of a hazard. Process industries involve handling of hazardous substances which on release may potentially cause catastrophic consequences in terms of assets lost, human fatalities or injuries and loss of public confidence of the company. To develop a predictive model one has to rely on past occurrence data, as such events are rare, enough data are usually not available to better understand and model such behavior. In such situations, it is advisable to use near misses and incident data to predict system performance and estimate accident likelihood.

Key words: Fault Tree Analysis (FTA), Construction of Fault Trees, Hazard Characterization, Major Concern Classification

I. INTRODUCTION

Risk is defined as a measure of frequency and severity of harm due to a hazard. The hazard in our context is the presence of hazardous materials having toxic, explosive, and/or flammable characteristics with the potential to cause harm to humans (and property or the environment if a broader context is considered). In the context of public safety, risk is commonly characterized by fatalities (and injury) to members of the public. Safety is relative; it is a judgement of the acceptability of risk: an activity is considered safe if its risks are considered acceptable. This definition of safety emphasizes the decision - making process. It recognizes that there is no such thing as "zero risk" because no matter what precautionary steps are taken, there is always some chance of an accidental release of a hazardous substance and a chance that someone will be adversely affected. The objective of risk management is to prevent or reduce the illness, injury or loss of life (or damage to property or the environment) due to the operation of facilities, such as chemical plants, which handle hazardous materials, or transportation corridors with dangerous goods traffic Operating a process plant requires a high level of safety and reliability which is maintained by strict regulatory procedures and the implementation of a strong safety culture within the facility. Negligence towards these procedures may lead to catastrophic consequences for the plant, human life and the environment. For this reason a strong safety system which not only consists of the process units but also creates a culture to respect safety throughout the plant both by the personnel and management is critical. The hazard identification process should be as comprehensive as reasonably practicable; events which are identified as hazardous will form the basis for subsequent analyses and the selection of oil spill scenarios. Hazardous events that are not identified at this stage will be excluded from further assessment. Hazards should be identified whether or not they are considered under control by the organization. Sources of hazardous events, and sets of circumstances which may trigger the events, should be identified whether they are temporary or permanent.

II. METHODOLOGY

A. Fault Tree Analysis (FTA):

In many cases there are multiple causes for an accident or other loss-making event. Fault tree analysis is one analytical technique for tracing the events which could contribute. It can be used in accident investigation and in a detailed hazard assessment.

The fault tree is a logic diagram based on the principle of multi-causality, which traces all branches of events which could contribute to an accident or failure. It uses sets of symbols, labels and identifiers. But for our purposes, you'll really only use a handful of these, shown below:

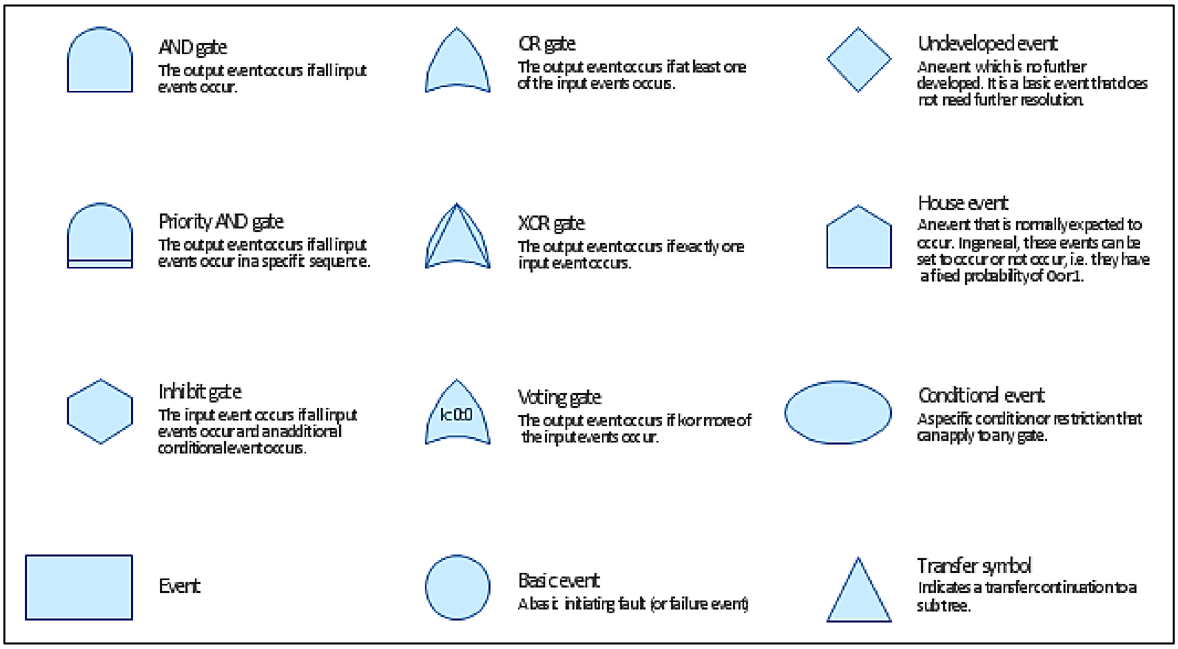

Fig. 1: Fault Tree Analysis (FTA)

B. *Construction of Fault Trees:*

Fault Tree Analysis is used to estimate the likelihood of an accident scenario. This technique starts with a particular undesired top event, such as a flammable material release and fire or explosion from a particular system. It then breaks down the causes of an accident into all the identifiable contributing sequences, and each sequence is separated into all necessary components or events. The presentation of all this information is facilitated by the use of a logic diagram, or 'fault tree'. The fault trees are generally developed only as far as necessary down to a level where failure or event frequencies are known with a reasonable degree of accuracy from past experience or historical data. The elemental parts of a fault tree at the bottom level are known as "basic events".

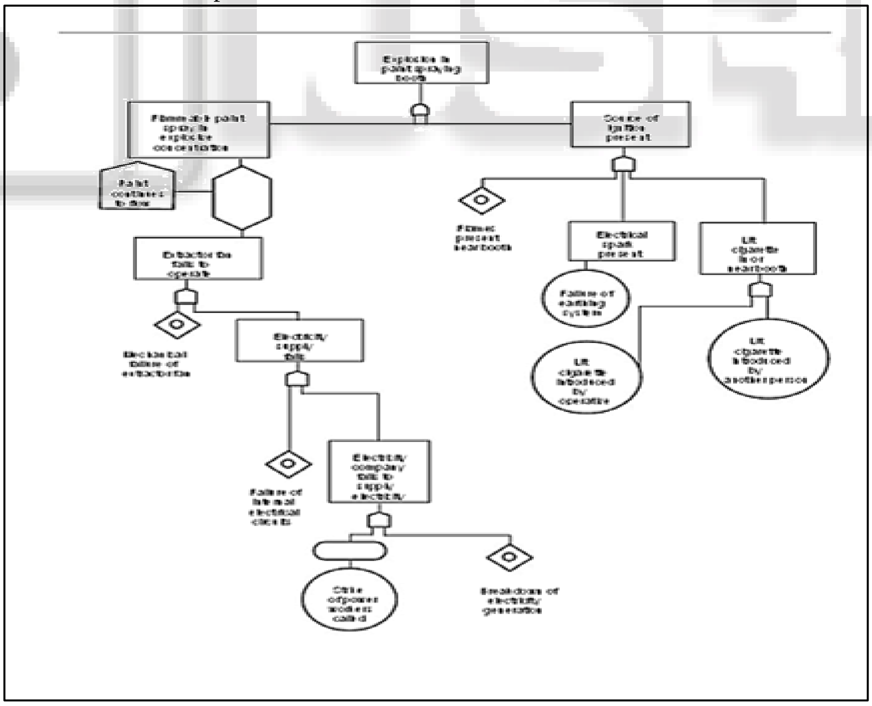

Fig. 2: Simplified Fault Tree for the Top Event: "Explosion in Paint Spraying Booth"

III. HAZARD CHARACTERIZATION

This study classifies chemical hazard internal controls by identifying the degree of fulfillment of the security aspects, followed by the international regulation of hazardous materials locations. The data used in this legislation to classify the level of risk include: accident history, potential threat to public receptors, and effectiveness of emergency response programs and risk management systems. Deficiencies in developing countries regarding industrial regulations put every industry in a certain level of threat due to their internal hazard management. This threat can be quantified through the level of emergency preparedness, which was constructed as shown in Table 1

Data	Level of emergency preparedness		
	High	**Medium**	**Low**
Fire, explosions, and chemical accidents records	Absence of chemical accidents in the last 10 years	No offsite consequences accidents in the last 10 years	Presence of chemical accidents with offsite consequences in the last 10 years
Fire and hazardous material units	Fully integrated and trained brigades.	Lack of updated or training in brigade organization	No brigades
Emergency plan	Completely functional	Deficiencies in emergency plans	Non-functional emergency plans
Affiliation to a hazardous Material local committee	Affiliated	Mid-term integration plans	No affiliation

Table 1: Emergency Preparedness Classification

IV. MAJOR CONCERN CLASSIFICATION

Areas of major concern are obtained by linking the preparedness level of potentially exposed zones, along with the social perception degree of the population, in a geographical information system (GIS). The classification of exposed areas is set by prioritizing those areas where a low industrial emergency preparedness is combined with a low community hazard perception. The lack of hazard emergency management puts the population at a high risk of exposure. The absence of social perception of the community indicates a high level of vulnerability because a deficiency in risk awareness impedes the community from adopting protective activities or demanding governmental hazard control.

V. CONCLUSION

We have to find a superior or safe work process from FTA due to which we have to learn our faults which are possibly happens in any type of process. Due to the FTA we are finds the faults and make the process easier and safer. The example shows that, in this scenario, there happen to be three possible sources of fuel and three possible sources of ignition. An OR situation applies in each case, because it would only need one of these to be present. The example also shows a single source of oxygen (e.g. the atmosphere). In order to prevent the loss taking place, we would first examine the diagram for AND gates. This is because the loss can be prevented if just one of the conditions is prevented. Fault trees can also be quantified. Let's try this on the same example. From previous experience, or as estimation, a probability for each of the primary failures being present or occurring can be established. In this study, the main elemental standards of risk management were evaluated to discover basic deficiencies in hazard control and risk communication. A consequence-based approach was used for classifying the level of protection posed by every facility, considering the degree of internal risk management. The population potentially exposed to chemical risks was evaluated using a social vulnerability methodology to identify chemical hazard awareness in the community.

REFERENCES

[1] UN/ISDR. Livingwith risk. A global review of disaster reduction initiatives. Geneva: United Nations/International Strategy for Disaster Reduction; 2004.
[2] Hufschmidt G. A comparative analysis of several vulnerability concepts. Nat Hazards 2011.
[3] Cardona OD. The notions of disaster risk: conceptual framework for integrated management. Information and indicators program for disaster risk management. Manizales: Inter-American Development Bank; 2003.
[4] De Souza MF, De Freitas CM. Vulnerability and industrial hazards in industrializing countries: an integrative approach. Futures 2003;
[5] Yang P, Tan X, Sun H, Chen D, Li C. Fire accident reconstruction based on LES field model by using orthogonal experimental design method. Adv EngSoftw 2011;
[6] Xi Sun, Tongwen Chen, & Horacio J. Marquez, "Boiler Leak Detection Using a System Identification Technique", American chemical society, 2002
[7] Stephen Michael Elonka, "standard boiler operators' questions and answers", McGraw-HILL publishing company LTD. New Delhi, 1991
[8] A. Raouf & A. Maged "A model to quantify reliability of human performance in man-machine system", pergamon press, New York, 1978.
[9] R. Billinton, "Reliability Evaluation in Distribution and Transmission Systems", PROC. IEEE, Vol. 122, No. 5, May 1975.
[10] B. Ali A. A., "Anew method for reliability evaluation of electrical power system", university of Baghdad, collage of engineering, 2003.