

**THEMATIC SESSION C1:
INDUSTRIAL AND CHEMICAL DISASTERS**

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ABSTRACTS

STATUS OF CHEMICAL DISASTER MANAGEMENT

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Occurrence of chemical accidents and probability of their manifesting in a chemical disaster remains a cause of concern. Unlike emergencies caused due to natural disasters which are difficult to prevent, chemical accidents can be prevented and their impacts minimized by better planning, preparedness and response. The paper deals with the policies, programmes and initiatives and their status in the field of chemical disaster management in the country. While outlining the gaps in strategy, policy and programmes a road map is presented to ensure a comprehensive participatory action plan preparation and management of chemical disaster.

DISASTER PREPAREDNESS IN FERTILIZER INDUSTRY

– A CASE STUDY

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With globalization & rapid industrialization, there emerged a quantum jump in chemical production, handling and transportation of hazardous chemicals across the globe, which is associated with a non-speculative risk of fire, explosion, toxicity, environmental pollution etc. Such emergencies/disasters pose a great threat to human life, flora & fauna. Many such disasters which occurred in past worldwide are eye openers. Chemical disasters are always man-made. As we do not learn from our mistakes, history repeats. Government of India and State governments have imposed many acts rules to ensure avoidance of chemical disasters, effective control of such disasters if they occur and post disaster mitigation and rehabilitation measures.

It is a statutory requirement for each MAH Chemical Manufacturing Unit to ensure effective control measures for averting Chemical Emergency, Emergency Preparedness and Emergency Control Plan (ECP).

Present chemical & fertilizer manufacturing involves a host of intermediates like Ammonia, Nitric Acid etc., and also stores and handles several hazardous chemicals at their site.

This paper lay emphasis on the steps taken by Fertilizer & Chemical Manufacturing units to avert any dangerous occurrence or disaster. If we are really prepared for mitigating chemical disaster, the same preparedness can also be helpful to manage calamities such as earthquakes, floods, storms or even in wars. The paper focuses on the need of an emergency

control plan, hazard potential assessment, preparedness, training, mockdrills, Community Education & Mutual aid group and the regional concerns.

Chemicals are boon for boosting the prosperity and quality of human life. However if not managed proper without understanding them, chemicals can be a bane.

MINE DISASTERS IN INDIA – A CRITICAL LOOK

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Mankind has faced many major disasters from natural causes throughout the history of civilization. The consequences of earthquakes, floods, typhoons and volcanic eruptions – events with potential to kill or injure large number of people and to cause substantial damage to property and environment – have been on record since time Immemorial. As civilization has developed so has the potential for major disasters whose origins lie rather in human activities, increased. In common mining parlance, we are used to call accidents with high (10 or more) fatalities as disasters.

The history of mining has been marred by many disasters killing and maiming a large number of workers, the worst being that at Couriers in France in 1906, when an explosion took a toll of 1100 precious lives. Mines disasters continue to haunt us even today, not only in India but the world over. Explosions in coal mines of China and more recently in Bhatdee Colliery of BCCL, incidences of inundation in Indian coal mines are reminders that the danger of mine disasters is a stark reality.

In India under the impact of successive Five Year Plans, tremendous growth has taken place in the mining sector. New hazards of bigger magnitude are getting added to the mining industry side by side with the traditional hazards. Further, the pressure of population and men's insatiable quest for minerals has lead to therefore no longer confine to the mineworkers but has extended to the general public, giving a new dimension to the problem.

Disaster management is thus an obvious necessity to guard against and mitigate the consequences of major accidents. For effective management of disasters it is essential that a comprehensive action plan evolved through scientific principles and approach is in position. In the development of emergency plans for mining disasters, systematic work started from the early sixties and in some mines emergency plans were framed based on the model standing orders circulated by DGMS. The Coal Mines Regulations, 1957 & the Metalliferous Mines Regulations, 1961, were amended in 1985 to provide for emergency plan for general action for use in time of emergency to be prepared by the management of every belowground mine. Under the Oil Mines Regulations, 1984 also provisions relating to emergency / contingency plan exist.

In spite of the pioneering work done in this regard and the rich pool of knowledge, and the expertise developed over the years and in spite of even quite a few cases of spectacular rescue & recovery operations conducted, the experience in disaster management in most other cases has not been upto the desired level. Most of us have seen that the initial reaction as an emergency is one of chaos and confusion.

In this paper, the authors have examined the present disaster management scenario in Indian mines and have suggested possible course of action in case of emergencies.

**EMERGENCY MEDICAL RESPONSE TO ROAD
TRANSPORTATION CHEMICAL HAZARDS
- CASE STUDY**

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Incidents caused by transportation of hazardous chemicals have a great potential for mass casualty leading to both acute and chronic sequel. Preparedness of hospitals is crucial to any disaster response system. Many are not organized to contribute effectively during such events. Hospitals of Lokamanya Medical Foundation present a single center response experience to transportation of hazardous chemical incident as it has developed a good Emergency Medical Service (EMS) for giving first aid at the accident site, transporting the victim to a hospital and further medical management.

This paper highlights implementation of Medical Response system for the road accidents on 3 major high-ways in the Maharashtra State. It operates Mobile Trauma Critical Care Units (MTCCU) and Rapid Trauma Rescue Units (Two Wheelers) equipped with critical life saving equipment for responding to the vehicles involved in road accidents. Location of accident is automatically identified through an on-line telephone system spread out along the Mumbai-Pune Express way through a Control Room.

In conclusion the system is unique for responding to accident victims through ambulances (both four wheeler and two wheeler) which provide immediate medical treatment. This experience could be discussed to develop the system and guidelines at national level.

STRATEGY PLAN FOR DISASTER PREPAREDNESS FOR OFFSHORE PLATFORMS

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Offshore platforms produce oil and gas from offshore wells. The crude oil and gas from the wells come to process platforms for processing before they are sent onshore. Offshore operators prepare contingency plans for offshore platforms which give brief description of the measures to be taken to minimize the consequences of hazardous events on life, installation and environment.

The main objective of developing a DMP is to visualize the probable emergency scenarios likely to occur and evolve a preplanned methodology of carrying out various emergency-combating plans and to prepare clear-cut procedures for rescuing and rehabilitation.

Response strategy which forms one of the major components of disaster management plan refers to those activities which are enforced immediately on occurrence, during and after an emergency. These plans if put into operation immediately save lives, minimize property damage and improve recovery. For a perfect execution of the response activities the preparedness of the installation to fight with such emergencies has to be adequate. The hardware, tools and other accessories should be easily accessible and ready for use.

The strategy plan lays down the response strategy on the basis of probable consequences of undesirable events and the risk levels envisaged. The methodology adopted in strategy plan is based on visualizing various

probable emergency situations that are likely to occur and their probable consequences. It also involves dovetailing with other plans (contingency plan etc.) to make it more practicable and effective during escalation of the event.

The strategy to tackle such emergencies and the role and responsibilities of various key personnel are described in detail. The organization structure and the delegation of authority and the various functions of key personnel are described here. Initial steps to be taken to control the emergency and the communication network required are also described.

The possible consequences that may arise due to these emergency situations are discussed. Quantitative estimates of damage distances are taken from risk assessment study in each case in order to plan for effective ways of dealing with an emergency, and the priorities allotted to protection in case of an emergency are determined.

Organizational aspects play a critical role in the management of an emergency. They clearly set out the management structure required to establish lines of communication and control. The roles and responsibilities of personnel in their capacity as coordinators of essential services such as logistics, communication, technical support, engineering services, public relations etc. are sufficiently elaborated. The DMP for offshore platforms proposes two control centers one located at regional headquarters onshore and another at site. The facilities and interactions between the two are specified.

Command control and communications required during an emergency are discussed. Specific actions expected to be initiated on occurrence of an undesirable event are suggested giving details of duty personnel involved,

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communication channels to be used etc. suggestions are also provided on compiling situation reports and incident logs.

DISASTER PREPAREDNESS IN OIL SECTOR IN INDIA

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The Oil Sector is growing rapidly along with the increase in GDP of the country. Energy consumption level has gone up tremendously and oil & gas sector is faced with high degree of challenging risk and safety hazards right from exploration, production. This sector has over the years developed a planned Disaster Management System to tackle both Onsite & Offsite emergencies, which has resulted in considerable improvement in handling the incidents.

Oil Industry Safety Directorate (OISD), an institute under Ministry of Petroleum & Natural Gas, Govt. of India, since its inception in the year 1986 has developed more than 100 Standards & Guidelines, which are pertaining to design, operation, and management of fire fighting systems etc, which have helped the industry to prevent incidents of disaster to a great extent.

This paper highlights the development in this regard both in the areas of inbuilt safety and disaster preparedness in oil sector.

**CONTRIBUTION OF MUTUAL AID RESPONSE GROUPS
(MARG) TO DISASTER PREPAREDNESS - MAHARASHTRA
EXPERIENCE**

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On-set time of a Hazardous Material Disasters is dangerously small, ranging between 15 to 30 minutes. Within this timeframe if intervention is not possible, ultimate damage is a certain possibility. With these constraints utmost level of preparedness at facility level is must. However on resources front no site can match with the requirements for even a middle sized scenario of loss of containment, forget the worst. World over additional help for such situations is provided by the off-site agencies, like Police, Fire Brigades, Health Services, Municipal and District Administration. This help is often not available, within reasonable time due to long distances, and difficulties further compounded by state of affairs of road/s around facility, in or to a cluster. Traffic jams and poor communication further add to these woes.

MARG is a conceptually a self help group, formed at the initiative of Directorate of Industrial Safety and Health, (erstwhile Factory Inspectorate) Government of Maharashtra, operating in the clusters having dominance of chemical industries. Groups are voluntary having neither constitution nor rules. While joining a member industry believes a simple principle that if my neighbor needs help during emergency then it is my duty to help on a reciprocal basis, and may be because of that they are working very effectively since 1991.

MARG serves as a collective forum for a dialogue with the community on the issues involved with emergency preparedness. Some groups have come

out with **HAZMAT Directories** under the title “Green Book” giving the details of the facilities, such as hazardous substances handled, contact related information giving the names and telephones of the persons to be contacted for help, type of expertise available and resources being made available for the neighbor if there is a call. Some are very regularly carrying out training for police, medical professionals, fire services, etc. in the area.

MARG has an obvious multiplier effect in preparedness and mitigation. By this arrangement the problems such as paucity of resources, difficulties in logistics and communication with general public have found a viable solution without any cost. MARG has proved itself in many disasters those have occurred, whether in facilities or roads.

**INDUSTRIAL HAZARD REDUCTION THROUGH RISK
PERCEPTION WITHIN ENVIRONMENTAL POLICY
INSTRUMENTS**

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Bhopal gas tragedy, the worst industrial disaster in the history, is especially significant in generating the environmental revolution by triggering the mechanisms to prevent or contain hazards in work or living environment that otherwise may meet vulnerable land-uses and result in major disasters. The worldwide awareness and action in the forms of political, policy and regulatory developments at international, national and regional level, besides scientific, engineering and management delineations for risk assessments, accident analysis, effect & consequence modeling, and mitigation measures.

Environmental Policy Instruments are the strategic frameworks or planned actions that are required to either development of a policy statement or to implement the policy. Hence, the two types of policy instruments, that include legislation, assessment (Environmental Impact Assessment, Environmental Risk Assessment, Health Impact Assessment, Cumulative Impact Analysis, Mitigation Analysis), auditing & review (environmental audit, SHE audit, safety audit, quality audit, EMS audit, environmental review/ safety review), environmental accounts and budgeting, Life-cycle Analysis, Ecological Footprints, Environmental Sustainability Index, have been placed under practice under different mandatory or voluntary and market based frameworks/desires during recent times.

The present papers analysis the current state of treatment of safety and disaster reduction issues within the objectives and procedures of the prevailing environmental policy instruments especially most relevant to developing nations, with aim to delineate the re-designing and integrating the instruments with coinciding objectives and mandates, for adequate treatment of risk perception and disaster management principles on sustainability basis. Paper also suggests the roles to be played by different stakeholders and sectors in minimizing and containing industrial hazards through adapting and enforcing strategic measures.

COMMUNICATION OF RISKS TO COMMUNITY

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Risk communication is a very complex process with strong psychological undertones, which hinges on the purpose for which it is being undertaken, the setting in which it will take place, the cultural and technical environments surrounding it, and the key stakeholders who may be involved.

Risk communication forms an important, perhaps a vital, element in the risk management process. However, at this time the considerable experience that has been gained has not been collected and organised in a comprehensive form to provide guidance and assistance to users. Some areas where help would be particularly welcome include the following:

- How are key stakeholders identified?
- What are the common pitfalls and how can they be avoided? and
- What are some of the techniques of successfully communicating about risks in different situations?

An effective risk communication programme requires an understanding of the real issues and concerns of stakeholders and a demonstrated willingness to address them. The issues and concerns need to be identified through research directly involving stakeholders.

The present paper addresses a model of communication of various aspects of hazards, risks, preparedness and mitigation of a MAH industry to the community.

INCIDENT MANAGEMENT AND COMMAND SYSTEM FOR RESPONSE TO INDUSTRIAL ACCIDENTS

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It has been said that the organization of an industry will always be a key driving force in managing the emergencies. Time management – the ability to organize, prioritize and manage tasks efficiently – offers a basis for the development of an emergency management response strategy to an industrial, accident. A basic truth of emergency response is that whoever first discovers or identifies that an accident has occurred or the designated officer listed in the emergency management plan takes command of the situation – until such time as various functions can be property turned over to others with the appropriate authority, skills, knowledge and training to assume those functions. A well conceived organizations structure, that is publicized and understood by all, will enhance the ability of the emergency manager for smooth transition into the emergency operations mode especially where human resources are at a premium.

The potential for improving the emergency management systems and the effectiveness of individuals responsible for incident management and response can be realized by applying the under mentioned guidelines;

- Choose personnel to fill key position who have capability to become self-starting, self directing and autonomous.
- Make sure all assigned personnel know their jobs
- Choose emergency management system that effectively enhances the organization's ability to perform during an accident
- Make it easy for people to communicate and access the information

- Establish response goals, find resources and train your organization
- Make your emergency response plan effective by supplementing with tools such as procedures, planning meetings and communications for incident mitigation
- Provide ongoing guidance and feedback on performance
- Establish the organizational culture of collaboration not confrontation
- Develop common terminology
- Make senior managers part of the process and designate them a role during accidents
- Make sure managers know-how to manage
- Set strategies and keep it responsive to changes in operations, hazards and regulations

The incident management system (IMS) is exactly what the name implies. The concept of incident management has evolved over the years and has been based on tactical lessons learnt while managing various emergency situations which primarily was developed to provide a unified system for use by all agencies responding to an incident and today its application is widespread.

PREVENTING DISASTERS ARISING OUT OF TANK FARMS BY ENSURING THEIR SAFETY

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The industrial growth in the last few decades has led to the large-scale production, use and storage of petroleum products and chemicals. The tank farms are utilized to store huge volumes of chemicals, which possess inherent hazards, such as fire, explosion and toxicity. There has been number of major fires and explosions in tank farms which led disasters, whose consequences on the neighborhood and environment are well known. There are various codes, standards and statutory requirements for the tank farms to ensure their safety. In spite of the protective mechanisms and devices, accidents do occur with tank farms leading to disasters.

The following are the two types of tank farms: Above ground and underground storage tanks. The above ground storage tanks are classified as atmospheric pressure tanks, low-pressure storage tanks at semi-refrigerated conditions and pressure storage tanks at ambient conditions. The under ground tanks are classified and grouped as atmospheric storage and pressure storage. The safety of these tanks is different from each other depending on the type of storage in addition to the hazard potential of stored chemicals. Hence, it is imperative on the part of the chemical industries to ensure safety of the tank farms to prevent and mitigate disasters arising out of them by adopting suitable strategies and procedures specific to each tank farm.

Hence, This paper discusses on varies types of tank farms, hazards, safety measures and consequences of disasters, and strategies to prevent and mitigate disasters arising out of tank farms.

ROLE OF PROCESS SAFETY MANAGEMENT IN DISASTER CONTROL OF CHEMICAL INDUSTRIES

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The chemical industries have potential to cause disasters whose consequences are not only limited to the workers and management, but also to the society and environment at large. The various chemical disasters that have taken place world - wide both in developed and developing countries stand a proof to the consequences. The disasters in chemical industries are generally due to fire, explosion and toxic release.

Management of safety in the chemical process industries is a complex subject, which requires effective functioning of various elements of Process safety Management. The Process Safety Management (PSM) is the application of one or more analytical methods to identify and evaluate process hazards for the purpose of determining the adequacy of or need for control measures which otherwise may lead to disasters. The Process Safety Management (PSM) consists of the following elements: management commitment, employer and employee participation, processes safety information, process hazard analysis, operating procedures, training, contractor and subcontractor safety, pre-start up safety review, mechanical integrity, non-routine work authorization, management of change, incident investigation, emergency preparedness planning and response and compliance audits. These elements of PSM should be efficiently addressed for prevention of disasters in chemical industries. Hence, this paper deals with the concept, scope and elements of process safety management in preventing disasters in chemical industries.

ROLE OF SAFETY AUDIT IN PREVENTING DISASTERS IN CHEMICAL INDUSTRIES

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The challenge before any Chemical Industry today is Prevention and Control of Occupational Safety Hazards, property damage including fire and explosions and Chemical Disaster. After Bhopal incident, entire world started various research programme and invented lot of new prevention method for effective Disaster Management in Chemical Complexes. In spite of all the control measures, these are not effective because of human failure and lack of maintenance of systems which leads to Chemical Disasters. Hence, we need a system to initially examine various safety systems in Chemical Industries with a view to certify the system and also to find out adequacy of the existing system, operating procedures, competency of people and their training needs.

To prevent Chemical Disaster Safety Audit plays an important role in any Chemical Complex and subjects each area of plant activity to a systematic critical examination with the object of minimizing loss. This paper deals with needs and procedures, types of audits, statutory provisions, demands of audit systems, field specifications, accident investigation and safety audit management along with model safety audit form with the objective of disaster management.

SAFETY & EMERGENCY ISSUES IN TRANSPORTATION OF HYDRO-CARBON AND COMPRESSED GASES

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With the advent of globalization and use of advanced technologies there has been a massive increase in application and use of hydrocarbon-liquids and gases during the last two decades. Of late, more and more number of industries are going for storages of hydro-carbon products like Naptha, Diesel and Furnace Oil for power generation and other applications. Similarly industrial gases like Oxygen, Nitrogen, Hydrogen including acetylene and liquefied petroleum gases find broad applications in industry. Use of compressed natural gas (CNG) & LPG as automotive fuel too has become very popular in public transport vehicles in all major cities in India. This may also lead to substantial import of LNG (liquefied natural gas) thereby creating more storage terminals of LNG in the country. Thus there are already substantial numbers of storage installations of hydrocarbon (both liquid and gases) as well as compressed gases. Safety in transportation of these products upto storage places and connected distribution system is all the more essential. There is therefore need to have proper understanding of related safety issues including handling of emergencies.

Transportation of liquid hydro carbon i.e. petroleum is regulated under Petroleum Rules, 2002 framed under the petroleum Act, 1934. The transportation of compressed gases in bulk by mobile transport vehicles is regulated under Static & Mobile Pressure Vessels (Unfired) Rules, 1981. Similarly transportation of compressed gas filled in cylinders is regulated under of gas Cylinders Rules, 1981 framed under the Explosives Act,

1884. The provisions made under these rules ensure safety in fabrication of road tankers used for petroleum products and mobile pressure vessels as well as cylinders carrying different types of compressed gases.

With regard to safety issues and handling of emergency, it is noticed that the personnel who actually handle or transport hydro carbon and compressed gases are not well aware of the nature and hazard associated with the material and to some extent the remedies available in case of emergency. Therefore sensitized training of personnel including drivers and attendants of transport vehicle need be in place of handling of any emergency.

TESTING OF EMERGENCY PLANS - WHAT NEEDS TO BE DONE IN INDIAN SCENARIO

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A comprehensive programme of testing emergency plans is one of the best means for assessing emergency plans and procedures, for determining readiness of emergency responders, for solving question of co-ordination and clarifying roles and responsibilities, and promoting awareness of potential hazards.

The paper gives legislative background on testing of emergency plans and status of implementation. The paper discusses relationship between emergency preparedness and testing of the plans and various benefits from testing of the plans. It deals with various stages of testing the plans for getting the full benefit in improving level of emergency preparedness and effectiveness in response.

It proceeds further to discuss various stages involved in testing to take full benefit in improving emergency preparedness and effective response in Indian situation rather than carrying out an activity to fulfill statutory obligation.

The paper outlines various methods of testing which can be followed easily and critically evaluates them in Indian situation. It also gives tips for making them cost effective. The paper includes a detailed presentation on a very cost-effective method of testing viz. Table-Top Exercise.

With the above background information the paper highlights observations made by the Council in testing of the plans in relation to the methodology, frequency, attitude at different levels and finally concludes in giving practical recommendations for improvement.

THE BHOPAL DISASTER AND ITS AFTERMATH: A REVIEW

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The holocaust of Bhopal disaster passed its 20th anniversary on December 3, 2004. After the leakage of Methyl Isocyanate (MIC) on 2-3 December 1984 from Union Carbide Factory, decimating sixteen thousand and injuring half a million people, Bhopal has become the symbol of Industrial disaster. The world has taken this incident with unparalleled seriousness including India and everyone had hoped that industrial world would take impeccable measures to ensure safety in industries. Since the disaster many positive steps worldwide have been taken in regards to improvement in process safety and protection of personnel within the chemical plants and the people in the surrounding areas. But the statistics on chemical accidents in India after Bhopal disaster shows a different picture. A closer look on the various accidents indicate that there is indeed a casual attitude by the industries in fulfilling the requirements of the Rule 13 and 14 of the Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) rules. The said rule suggests that there should be an On-site and Off-site emergency plans for the industries but the same has not been implemented. Though industrial safety is not at the level what is desired, there has been a substantial improvement in industrial safety effort in India after Bhopal disaster. However, little progress has been made till date in decommissioning and decontaminating the Bhopal plant. Many plant chemicals are still at the site in sub-standard storage conditions. Contamination of soil and ground water caused by the toxic waste left in Union Carbide's carbides abandoned Bhopal plant poses a new hazard for the people and survivors of the 1984 gas disaster. In this paper, we like to

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take a look at the disaster and tries to identify what lessons can be learnt from the disaster.

DISASTER PREPAREDNESS IN CHLORO-ALKALI PLANT –CASE STUDY

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Chloro Alkali Industry has been one of the major generators of wealth and employment all over the world. In India about 45 % of total chemical industry, depend upon Caustic Soda Industry. Caustic Soda, Chlorine and Hydrogen, the products of this industry are widely used in diverse industrial sectors, either as raw materials or as intermediary or auxiliary chemicals.

The products of chloro Alkali Industry present certain risks at work places. Caustic Soda is corrosive, Hydrogen is highly inflammable and Chlorine is the most hazardous of all these chemicals. There are hazards inherent in the manufacture, handling, storage and use of chlorine. Serious injuries and damages can be eliminated, managed or reduced in chlorine handling, by proper design of system, establishing and following sound operating practices, procedures and systems. This will also result in improved communication, housekeeping, timely maintenance, education of the persons involved, monitoring, auditing, developing, adhering to laid down systems and practices.

A well formulated Disaster Management Plan and involvement of all concerned persons, play a vital role in handling chemical emergencies. Earlier at Century Rayon, during Drills of chlorine leak management, it took nearly half an hour to tackle emergencies. Deployment of innovative means has now reduced the response time to less than 5 minutes! A Demonstration Mock Drill film made at Century Rayon – Chemical Plant was highly appreciated by I.L.O. Geneva. An effective control of chlorine risk at work place is essential to protect workers and surrounding public areas and environment.

Safe Handling of Chlorine, Disaster preparedness and Chlorine Leak management shall be covered in the paper to be presented. It is hoped that chloro - alkali manufacturers, consumers and operators alike, will find it useful in their day to day working and handling of chlorine emergencies.

ELIMINATION OF RAILWAY ACCIDENTS ON LEVEL CROSSING

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Indian Railways is the largest enterprises of Government of India and second largest in the world. It is the largest organization in world controlled by one body. Indian Railways runs more than 11000 trains in a day with more than one lacks of track length. Safety is the foremost consideration in Indian Railways working.

There are more than 40,000 numbers of level crossings out of which about 25,000 are unmanned, where no Railway staff is available to open or close the gate due to economic reasons.

Unmanned level crossing gates are most vulnerable for accident due to negligence and mistake by road users by not following the instructions before crossing the same. In last 5 years there have been 378 accidents on unmanned gates in comparison to 46 on manned gates. Very few people actually know that it is the responsibility of road user to ensure that there is no train approaching and then cross the same.

There is a drive going on to provide road over bridges (ROB) or road under bridges (RUB) on the basis of 50:50 cost sharing with State government and Railways. There is urgent requirement of coordination from State government Departments for early clearance of such schemes from disaster mitigation point of view. There has been distinct advantages of RUB/ROBs due to 100% safety, Cost effectiveness, low maintenance and great saving in signaling and interlocking of gates.

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