NATIONAL DISASTER MANAGEMENT GUIDELINES

CHEMICAL DISASTERS

April 2007

NATIONAL DISASTER MANAGEMENT AUTHORITY
GOVERNMENT OF INDIA

National Disaster Management Guidelines

Chemical Disasters (Industrial)

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National Disaster Management Authority
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Vice Chairman
National Disaster Management Authority
Government of India

FOREWORD

Preparation of guidelines for various types of disasters forms an important part of the mandate of the National Disaster Management Authority (NDMA). Chemical Disaster (Industrial) is one such high priority subject, as it can be a highly traumatic event. At times, it can result in irreparable damage to the environment; both biotic and abiotic, and also cause fatality to a large number of population. Consequently, the work on preparation of comprehensive guidelines on Chemical disasters was undertaken on priority over a year back.

Formulation of these guidelines has involved active participation and contributions of 275 experts, including stakeholders like representatives of central ministries and departments, regulatory agencies, research and development organisations, professionals from scientific and technical institutes/academies like the National Safety Council and various DM institutes and apex industrial associations/consortia of the corporate sector. Help and advice of the officials at the functional level were also taken to incorporate practical aspects of the functioning.

The work commenced with an Extended Group of approximately 60 experts, identifying 'the felt needs' and determining the critical objectives. A Core Group of 8 members, constituted out of this group, thereafter, prepared draft guidelines taking into account the operational, administrative, financial and legal aspects. These draft papers were reviewed extensively, a number of times by the Extended Group, and then finalized in a national workshop held at the Disaster Management Institute, Bhopal.

The underlying philosophy of these guidelines is to build on existing structures and mechanisms. The 'National Disaster Management Guidelines—Chemical Disasters' document calls for a proactive, participatory, well-structured, fail-safe, multi-disciplinary and multi-sectoral approach involving all stakeholder groups, aimed at refining and strengthening the national mechanisms in this field, from stages of planning to field operations. These guidelines contain all the details that are required by the planners and implementers and will help in the preparation of plans by the central ministries/departments and the states.

I take this opportunity to express my deep appreciation of the commitment of various stakeholder groups who extended their willing support and cooperation to our efforts. I am grateful to the members of the Core Group, who put in endless hours of work. I also wish to convey my gratitude to the members of the NDMA, Extended Group, and other experts whose contributions have resulted into the preparation

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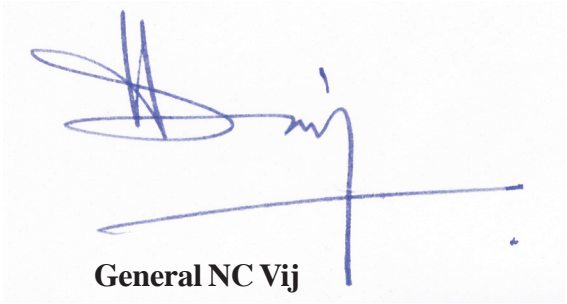
of these guidelines. I would also like to commend the significant contributions made by the Ministry of Environment and Forests, the National Safety Council, Mumbai and the Disaster Management Institute, Bhopal in preparation of these guidelines. And finally, I am pleased to place on record my sincere appreciation for Lt Gen (Dr.) J.R. Bhardwaj, PVSM, AVSM, VSM, PHS (Retd), Member, NDMA, who guided and coordinated the entire exercise.



New Delhi
30 April 2007

General NC Vij
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ACKNOWLEDGEMENTS

I am thankful to the Core Group Members for their untiring efforts in helping the NDMA in the formulation of the National Guidelines on Chemical Disaster Management. I would like to place on record the significant contribution made by the Ministry of Environment and Forests, New Delhi and National Safety Council, Mumbai for helping in designing the format of the document and providing lots of technical inputs from time-to-time. The Disaster Management Institute, Bhopal also deserves special recognition for providing inputs related to On-Site and Off-Site emergency plans.

I would also like to express my sincere thanks to the representatives of the other central ministries and departments concerned, regulatory agencies, R&D organisations, professionals from scientific and technical institutes/academics, technocrats from leading national institutions and apex industrial associations/consortiums of the corporate sectors for the valuable inputs that helped us in improving the content and presentation of the document.

The efforts of Dr. Rakesh Kumar Sharma, Scientist 'F' and Additional Director, Defence Research Laboratory, Tezpur, Assam, and Dr. Raman Chawla, Senior Research Officer, NDMA, in providing knowledge-based technical inputs to the core group, are highly appreciated. Thanks are also due to Mr. Rubaab Sood and the secretarial staff of the NDMA including Mr. Deepak Sharma and Mr. D.K. Ray for their dedicated work during the convening of various workshops, meeting and preparation of the final document.

Finally, I would like to express my gratitude to General N.C. Vij, PVSM, UYSM, AVSM (Retd), Vice Chairman, NDMA and all Members of the NDMA for their constructive criticism and suggestions that guided us in formulating these guidelines.

New Delhi
30 April 2007

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Abbreviations

ADPC	Asian Disaster Preparedness Centre
AERB	Atomic Energy Regulatory Board
AMAI	Alkali Manufacturers Association of India
APELL	Awareness and Preparedness for Emergencies at Local Level
ASME	American Society of Mechanical Engineers
ASSOCHAM	Associated Chambers of Commerce and Industry
BIS	Bureau of Indian Standards
BLEVE	Boiling Liquid Expanding Vapour Explosion
CA (EPPR) Rules	Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996
CAS	Crisis Alert System
CCG	Central Crisis Group
CCR	Central Control Room
CDM	Chemical Disaster Management
CETP	Common Effluent Treatment Plant
CFEES	Centre for Fire, Explosive and Environment Safety
CIF	Chief Inspector of Factories
CII	Confederation of Indian Industry
CIR	Community Information Representative
CLI	Central Labour Institute
CMVR	Central Motor Vehicles Rules
CPAP	Continuous Positive Air Pressure
CPCB	Central Pollution Control Board
CRR	Community Response Representative
CSIR	Council of Scientific and Industrial Research
DAE	Department of Atomic Energy
DCG	District Crisis Group
DCR	District Control Room
DCS	Distributed Control System
DDMA	District Disaster Management Authority
DDMAP	District Disaster Management Action Plans
DEA	Department of Economic Affairs
DGFASLI	Directorate General Factory Advice Service and Labour Institutes
DGFT	Director General Foreign Trade
DISH	Directorate of Industrial Safety and Health
DM	Disaster Management
DMI	Disaster Management Institute
DMIS	Disaster Management Information System
DMP	Disaster Management Plan
DRDO	Defence Research and Development Organisation

DRM	Disaster Risk Management
DTIE	Division of Technology, Industry & Economics
EIA	Environment Impact Assessment
EIP	Emergency Information Panel
EMP	Emergency Management Plan
ENVIS	Environmental Information Systems
EOC	Emergency Operations Centre
ERC	Emergency Response Centre
ERF	Environment Relief Fund
ERRIS	Environment Risk Reporting and Information Systems
ESIC	Employee State Insurance Corporation
FE	Functional Exercise
FICCI	Federation of Indian Chambers of Commerce and Industry
FSD	Full-Scale Drill
GIDC	Gujarat Industrial Development Corporation
GIS	Geographic Information System
GPS	Global Positioning System
HAZAN	Hazard Analysis
HAZCHEM	Hazardous Chemical
HAZMAT	Hazardous Material
HAZOP	Hazard and Operability Study
HPC	High Powered Committee
HPCL	Hindustan Petroleum Corporation Ltd
HSE	Health, Safety and Environment
IATA	International Air Transport Association
ICA	Indian Chemical Association
ICAO	International Civil Aviation Organization
ICC	Indian Chamber of Commerce
ICMA	Indian Chemical Manufacturers' Association (now called Indian Chemical Council)
ICMR	Indian Council of Medical Research
ICSC	International Chemical Safety Cards
IDLH	Immediately Dangerous to Life and Health
IDRN	India Disaster Resource Network
IICT	Indian Institute of Chemical Technology
IIM	Indian Institute of Management
IIT	Indian Institute of Technology
ILO	International Labour Organization
IMO	International Maritime Organization
IPCL	Indian Petrochemicals Corporation Limited
IPCS	International Programme on Chemical Safety
IRPTC	International Register for Potentially Toxic Chemicals
IS	Indian Standards
ISDR	International Strategy for Disaster Reduction
ITRC	Industrial Toxicology Research Centre

LAMP	Local Accident Mitigation and Prevention
LCG	Local Crisis Group
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MAH Unit	Major Accident Hazard Unit
MAHC	Major Accident Hazard Control
MAHCAD	Major Accident Hazard Control Advisory Division
MARG	Mutual Aid Response Group
MARPOL	Maritime Pollution
MFR	Medical First Responders
MHA	Ministry of Home Affairs
MIS	Management Information System
MoA	Ministry of Agriculture
MoC & F	Ministry of Chemicals and Fertilizers
MoC & I	Ministry of Commerce and Industry
MoD	Ministry of Defence
MoEF	Ministry of Environment & Forests
MoF	Ministry of Finance
MoH & FW	Ministry of Health and Family Welfare
MoHI & PE	Ministry of Heavy Industries and Public Enterprises
MoLE	Ministry of Labour and Employment
MoP & NG	Ministry of Petroleum and Natural Gas
MoSRT & H	Ministry of Shipping, Road Transport and Highways
MSDS	Material Safety Data Sheet
MSIHC Rules	The Manufacture, Storage and Import of Hazardous Chemicals Rules,1989
NAC	National APELL Centre
NCDC	National Civil Defence College
NCL	National Chemical Laboratory
NCT	National Capital Territory
NDMA	National Disaster Management Authority
NDRF	National Disaster Response Force
NEC	National Executive Committee
NEERI	National Environmental Engineering Research Institute
NFSC	National Fire Service College
NGOs	Non-Governmental Organizations
NHAI	National Highway Authority of India
NICNET	National Informatics Centre Network
NIDM	National Institute of Disaster Management
NIOH	National Institute of Occupational Health
NOCs	No Objection Certificates
NSC	National Safety Council
OISD	Oil Industry Safety Directorate
PCC	Pollution Control Committee
PESO	Petroleum and Explosives Safety Organisation

PM	Preventive Maintenance
PMS	Pipeline Management System
PPE	Personal Protective Equipment
PPP	Public Private Partnership
PVOs	Private Voluntary Organisations
PWD	Public Works Department
QCI	Quality Council of India
QRMT	Quick Reaction Medical Team
QRT	Quick Reaction Team
QSP	Quick Start Programme
RC	Responsible Care
R&D	Research and Development
RLI	Regional Labour Institute
RTO	Regional Transport Officer
SAICM	Strategic Approach to International Chemical Management
SCG	State Crisis Group
SDMA	State Disaster Management Authority
SDRF	State Disaster Response Force
SEC	State Executive Committee
SMEs	Small and Medium Enterprises
SOLAS	Safety of Life at Sea
SOPs	Standing Operating Procedures
SPCB	State Pollution Control Board
STEL	Short Term Exposure Limit
TOR	Terms of Reference
TQ	Threshold Quantity
TREMCARD	Transport Emergency Card
TTE	Table Top Exercise
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
USAID	United States Agency for International Development
UTs	Union Territories
WAD	Waste Air Destruction
WEC	World Environment Centre
WHO	World Health Organization

Executive Summary

Background

The growth of chemical industries has led to an increase in the risk of occurrence of incidents associated with hazardous chemicals (HAZCHEM). A chemical industry that incorporates the best principles of safety, can largely prevent such incidents. Common causes for chemical accidents are deficiencies in safety management systems and human errors, or they may occur as a consequence of natural calamities or sabotage activities. Chemical accidents result in fire, explosion and/or toxic release. The nature of chemical agents and their concentration during exposure ultimately decides the toxicity and damaging effects on living organisms in the form of symptoms and signs like irreversible pain, suffering, and death. Meteorological conditions such as wind speed, wind direction, height of inversion layer, stability class, etc., also play an important role by affecting the dispersion pattern of toxic gas clouds. The Bhopal Gas tragedy of 1984—the worst chemical disaster in history, where over 2000 people died due to the accidental release of the toxic gas Methyl Isocyanate, is still fresh in our memories. Such accidents are significant in terms of injuries, pain, suffering, loss of lives, damage to property and environment. A small accident occurring at the local level may be a prior warning signal for an impending disaster. Chemical disasters, though low in frequency, have the potential to cause significant immediate or long-term damage.

A critical analysis of the lessons learnt from major chemical accidents exhibited various deficiencies. Laxity towards safety measures, non-conformation to techno-legal regimes and a low level of public consultation are a few such shortcomings. The scenario called for concerted and sustained efforts for effective risk reduction strategies and capacity development under a national authority to decrease the occurrence of such incidents and lessen their impact. Although tremendous efforts have been made to minimise such accidents and to improve emergency preparedness at all levels, substantial efforts are still required to predict the occurrence of disasters, assess the damage potential, issue warnings, and to take other precautionary measures to mitigate their effects. Another pressing need is to properly assess the potential of chemical emergencies and develop tools for emergency planning and response to minimise the damage in case of any eventuality.

Risks Posed by HAZCHEM

Increased industrial activities and the risks associated with HAZCHEM and enhanced vulnerability lead to industrial and chemical accidents. Chemical accidents may originate in the manufacturing or formulation facility, or during the process operations at any stage of the product cycle, material handling, transportation and storage of HAZCHEM. Vulnerability is sometimes compounded due to the location of Major Accident Hazard (MAH) industries closer to densely populated areas. Chemical and industrial accidents generally occur due to technical failures that can be anticipated. The risk associated with them can thus be predicted and reduced effectively by identification of risk areas, risk assessment and designing pre-operative measures. The occurrence of chemical accidents and probability thereof, manifesting in a disaster, remain a cause of concern.

The Genesis of National Disaster Management Guidelines—Chemical Disasters

There has been a paradigm shift in the government's focus from its rescue, relief, and restoration-centric approach to a planning, prevention/mitigation and preparedness approach. It has been realised that effective Chemical Disaster Management (CDM) is possible by the adoption of preventive and mitigation strategies as most chemical disasters are preventable in comparison to natural disasters that are difficult to predict and prevent.

With this renewed emphasis, the National Disaster Management Authority (NDMA) took up the task of strengthening CDM in recognition of the gravity of the risk posed by HAZCHEM. The main stakeholders in the management of chemical disasters are Ministry of Environment and Forests (MoEF; the nodal ministry); Ministry of Home Affairs (MHA); Ministry of Health and Family Welfare (MoH & FW); Ministry of Labour and Employment (MoLE); Ministry of Agriculture (MoA); Ministry of Shipping, Road Transport and Highways (MoSRT & H); Ministry of Defence (MoD); Ministry of Chemicals and Fertilizers (MoC & F); Ministry of Petroleum and Natural Gas (MoP & NG), Department of Atomic Energy (DAE); state governments and Union Territories (UTs) and the chemical industries. As a first step, a meeting of the stakeholders including representatives of Research and Development (R&D) organisations, professionals from scientific and technical institutes, academics, technocrats from leading national institutions and apex industrial associations/consortiums of corporate sectors was convened on 17 February 2006, with a view to pool the knowledge in this multidisciplinary field. A core group of experts was constituted from amongst these participants. Several meetings of the core group were subsequently held and a draft document was evolved for bridging the gaps that were identified. These deliberations acknowledged several initiatives taken up by the government and other stakeholders. The draft document was reviewed by a group of experts on 18 May 2006, for evolving a consensus among various stakeholders including the nodal ministry. Detailed inputs from MAH units and regulators were obtained during a meeting held during 7–8 September 2006, at Bhopal. The recommendations and action points that emerged out of these deliberations have resulted in the development of the National Guidelines for the Management of Chemical Disasters (hereinafter referred to as the Guidelines).

Structure of Guidelines

The present work is an important step in the direction of the development of plans for the management of chemical disasters. The Guidelines have been prepared to provide directions to ministries, departments and state authorities for the preparation of their detailed Disaster Management (DM) plans. These Guidelines call for a proactive, participatory, well-structured, fail-safe, multi-disciplinary and multi-sectoral approach at various levels.

The Guidelines consist of seven chapters; the details of which are as follows:

Chapter 1 provides an introductory brief of risks, vulnerabilities and consequences of chemical accidents; provides an account of causal factors of chemical disasters so as to restrict and contain them; and enlists major chemical accidents—their initiators, and impact on human lives and the environment. The aims and objectives of the Guidelines focus on all aspects of the DM cycle to assist the ministries and departments of the Government of India, state governments and other agencies to prepare DM plans.

Chapter 2 reviews the existing regulatory framework and practises. It furnishes an overview of the institutional framework with details of the monitoring mechanisms and compliance by central and state governments. It also provides an overview of the functioning of research institutes, autonomous bodies, professional institutes, Non-Governmental Organizations (NGOs) and MAH units, their compliance to statutory safeguards, and the efforts of the MoEF in setting up crisis management groups in industrial areas to ensure chemical safety. Various initiatives highlighting substantial work done in the area of emergency response and management systems in installations, storages and transport sectors are also illustrated. A bird's eye view of international best practises and developments within India is also given.

Chapter 3 gives an overview of the salient gaps identified in various aspects of the management of chemical accidents, transport accidents and medical emergencies.

The management of chemical disasters will aim at prevention and mitigation with the introduction of safer process technologies, improved performance of safety devices and reduction of human error. Immediate effects of a disaster can be mitigated through installing engineering systems like scrubbers, flares and venting systems. The various work areas and activities that can be undertaken within the framework of the Guidelines are described in chapters 4 to 6.

Chapter 4 includes comprehensive guidelines for a regulatory framework, code of practises, procedures and standards, testing and information, technical and technological information, preparedness including education, training, creation of appropriate infrastructure, capacity development, awareness generation, institutional framework, networking and communication, R&D, and response, relief and rehabilitation for CDM. The roles and responsibilities of various stakeholders at centre, state and district levels are also described. The salient highlights include:

- Strengthening of the present regulatory framework to meet the defined national policies and aspirations; augmentation of technical support functions.
- A supportive and technology neutral regulation framework.
- Legislation on land-use policy (buffer zone around chemical industry).
- Standardisation of national codes and practises.
- Emphasis on regular safely audit, identification and selection of professional organisations and their accreditation.
- Commissioning and decommissioning of chemical industries.
- Preparation of On-Site and Off-Site Plans.
- Regular testing of emergency plans.
- Need of medical first responders and medical inventory to deal with specialised chemical accidents at the installation site.
- Crisis management plans of hospitals to manage the victims of chemical emergencies.
- Concept of mobile hospital and mobile teams.
- Issues related to public health response, medical rehabilitation and harmful effects on the environment.
- Post-disaster documentation and analysis.

Chapter 5 comprises comprehensive guidelines for installations and storages (including isolated storages of HAZCHEM) that contain good engineering practises for safety, accident reporting, investigation and analysis checklists and safety promotional activities as important tools for effective CDM.

Chapter 6 deals with guidelines related to chemical accidents during transportation of HAZCHEM. The areas covered include:

- Preparation of a highway DM plan.
- Modification of rules pertaining to transport emergencies.
- Specific roles and responsibilities of MAH units, transporters, drivers, authorities and aspects related to emergency communication systems and training of various stakeholders.
- The need for the development of an efficient pipeline management system.

Chapter 7 sets out the approach to implementation of the Guidelines and also highlights the key points for ensuring the implementation of the plans prepared by the central ministries, departments and states. The strategy to be adopted for the important activities to be included in the Action Plan are given below:

- Putting in place a national mechanism for covering all major disasters and reporting mechanisms at the district level.
- Dovetailing regulations governing HAZCHEM safety with the Disaster Management Act, 2005 (DM Act, 2005).
- Establishing a risk management framework criterion for chemical assessment.
- Strengthening of the institutional framework for CDM and its integration with the activities of the NDMA, State Disaster Management Authorities (SDMAs), District Disaster Management Authorities (DDMAs) and other stakeholders.
- Renewed focus on model safety codes/ standards for prevention of accidents at industry level by matching processes and technologies for safety installations comparable with the best available in the world.
- Identifying infrastructure needs for preparing mitigation plans.
- Implementing a financial strategy for the allocation of funds for different national and state/district level mitigation projects.
- Establishing an efficient information network for dissemination of alerts, warning and response messages.
- Identifying/recognising training institutions.
- Strengthening the National Disaster Response Force (NDRF), fire services, medical first responders and other emergency responders.
- Revamping of home guards and civil defence for CDM.
- Developing a national medical emergency plan binding all government, private and public hospitals with unified, well-established triage and other emergency procedures.
- Developing highway DM plans for all the identified stretches, nodal points, and Standard Operating Procedures (SOPs) integrated in the driver's kit.
- Establishing a register of relevant national and international institutes and information exchange programmes.
- Establishing post-disaster documentation procedures, epidemiological surveys and minimum criteria for relief and rehabilitation.
- Sensitising the community on chemical disasters.
- Sensitising all stakeholders, especially the management of MAH units for a more proactive role in prevention of chemical

accidents by instituting regular internal audits of plant safety measures, actuation of On-Site emergency plans and establishment of mutual aid arrangements.

The MoEF, as the nodal ministry, will prepare a detailed Action Plan in accordance with these Guidelines with specific tasks, activities, targets and timeframes that will also form a part of the national DM plan.

In view of the expected time lapse between the formulation and approval of the DM plan, an interim arrangement has also been suggested, highlighting the following features:

- Baseline information on hazard identification and risk assessment in chemical installations and pipelines.
- Incorporation of Geographic Information System (GIS) technology.
- Identification and incorporation of legislative and institutional framework for disaster preparedness with specific and measurable indicators.
- Risk mapping.
- Development and improvement of relevant databases including isolated storages and warehouses.
- Preparation of a National Response Plan.
- Pooling of resources available on transport routes of chemicals.
- Crisis Alert System (CAS) and continued training programmes.

The activities mentioned above will be initiated with immediate effect and will be further intensified in due course of time. An institutional framework for the management of chemical disasters will be set up at the national level, which will integrate and strengthen the existing institutional mechanisms on CDM. For efficient and coordinated management, the state governments will issue guidelines for the preparation of district and local level plans in accordance with these Guidelines. The objective is to evolve an attainable and practical approach for the management of chemical disasters in India with the participation of all stakeholders including local communities for On-Site and Off-Site emergencies.

1 Introduction

Handling large quantities of HAZCHEM in installations, isolated storages, and during transportation, poses the grave risk of a sudden release of copious quantities of toxicants in the environment. There are about 1666 MAH units in India, handling a large number of chemicals as raw materials, in processes, products, and wastes, with flammable, explosive, corrosive, toxic and noxious properties. Any accident involving these may have an adverse impact on both the community and the environment.

Large quantities of chemicals are also stored/processed in industries that are located in densely populated areas. Inappropriate and haphazard construction and the lack of awareness and preparedness on the part of the community further enhance their vulnerability. The potential of heavy losses and adverse consequences on the environment due to a chemical accident calls for further improvement of safety measures in all processes/procedures and the adoption of appropriate methods for handling HAZCHEMs.

The Bhopal Gas Disaster in December 1984 brought into sharp focus the unprecedented potential of HAZCHEM like Methyl Isocyanate in terms of loss of life, health, injury and the long-term effects on the population and environment. It created compelling evidence to approach DM and chemical safety holistically. The era of restructuring with the induction of new HAZCHEM control systems and procedures all over the world in the wake of the Bhopal disaster also resulted in the strengthening of institutional mechanisms at local, district, state and central levels for the management of chemical disasters in India. The consolidation of these institutional mechanisms and the mobilisation of corporate support for the preparation and implementation of emergency plans is an integral part of these Guidelines.

1.1 Sources of Chemical Disasters

Chemical accidents may originate in:

i) Manufacturing and formulation installations including during commissioning and process operations; maintenance and disposal.

ii) Material handling and storage in manufacturing facilities, and isolated storages; warehouses and godowns including tank farms in ports and docks and fuel depots.

iii) Transportation (road, rail, air, water, and pipelines).

1.2 Causative Factors Leading to Chemical Disasters

Chemical disasters, in general, may result from:

i) Fire.

ii) Explosion.

iii) Toxic release.

iv) Poisoning.

v) Combinations of the above.

Chemical disasters may occur due to process deviations concerning the chemistry of the process, pressure, temperature and other identified parameters with regard to the state of the substance i.e., solid, liquid or gas, proximity to other toxic substances and the probability of a runaway reaction due to the incidental mixing of two or more HAZCHEMs with dissimilar properties. In addition, it may be due to hardware failure, resulting in large-scale spills of toxic substances (in any form) due to loss of containment, or an explosion. Further, Boiling Liquid Expanding Vapour Explosion (BLEVE) may occur due to sparks, shocks or frictional forces on the chemicals during transportation.

The effects can be further compounded by the micro-meteorology of the area, wind speed and direction, rate of precipitation, toxicity/quantity of chemical released, population in the reach of release, probability of formation of lethal mixtures (fuel-air or other mixtures) and other industrial activities being performed in closer vicinity.

It is very important to understand that the state of the chemical substance (solid, liquid or gas) contributes substantially to the gravity of the accident and affects control measures. Chemicals in solid form may have devastating effects if their properties are suddenly changed (e.g., sublimation) due to pressure and temperature conditions to which they are accidentally exposed. If solids continue to remain in solid form, the damage will be negligible.

Any human/mechanical failure may cause large-scale spills of liquids or of compressed gases like chlorine or Liquid Petroleum Gas (LPG) which can cause BLEVE and can directly affect human lives and the environment. The release of compressed gases give rise to thermal and cryogenic stresses, which may also impact the surrounding structure or building, compounding the damage.

1.3 Initiators of Chemical Accidents

A number of factors including human errors could spark off chemical accidents with the potential to become chemical disasters. These are:

1.3.1 Process and Safety System Failures:

i) **Technical errors:** design defects, fatigue, metal failure, corrosion etc.

ii) **Human errors:** neglecting safety instructions, deviating from specified procedures etc.

iii) **Lack of information:** absence of emergency warning procedures, non-disclosure of line of treatment etc.

iv) **Organisational errors:** poor emergency planning and coordination, poor communication with public, non-compliance with mock drills/exercises etc., which are required for ensuring a state of quick response and preparedness.

1.3.2 Natural Calamities:

The Indian subcontinent is highly prone to natural disasters, which can also trigger chemical disasters. Damage to phosphoric acid sludge containment during the Orissa super cyclone in 1999 and the release of acrylonitrile at Kandla Port, during an earthquake in 2001, are some of the recent examples.

1.3.3 Terrorist Attacks/Sabotage:

Vulnerability to chemical disasters is further compounded by likely terrorist and warfare activities, which include sabotage and attack on HAZCHEM installations and transportation vehicles. This can occur at sources listed in para 1.1, anywhere, and at any time. Guidelines for the management of chemical warfare agents and chemical weapons of mass destruction will be issued separately.

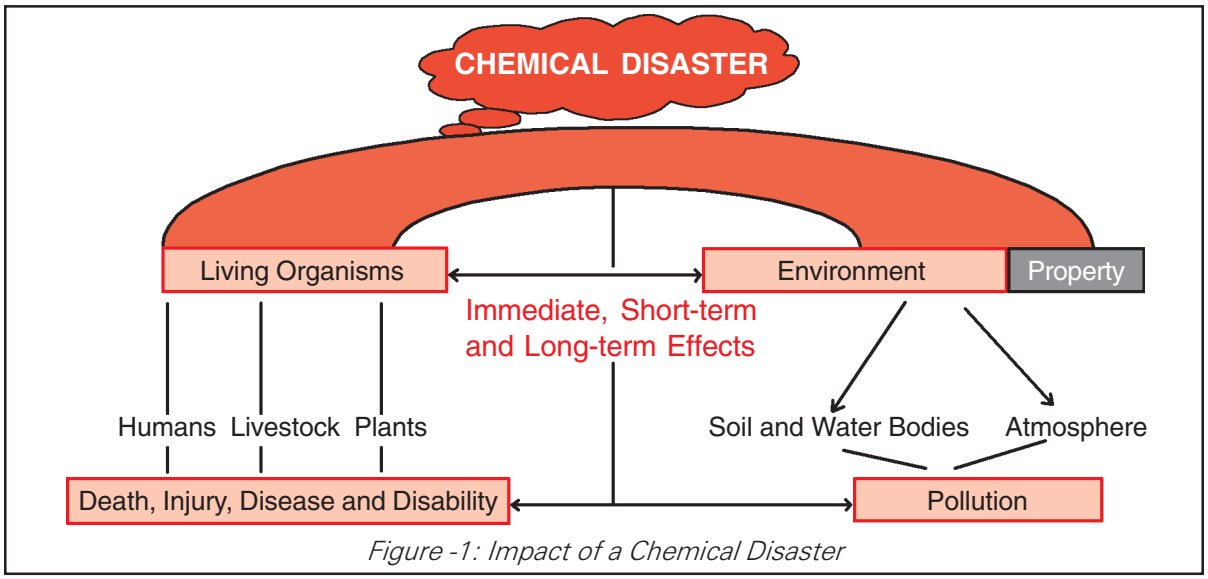

Figure -1: Impact of a Chemical Disaster

1.4 Impact of Chemical Disasters

In addition to loss of life, the major consequences of chemical disasters include impact on livestock, flora/fauna, the environment (air, soil, water) and losses to industry as shown in Figure 1.

Chemical accidents may be categorised as a major accident or a disaster depending upon the number of casualties, injuries, damage to the property or environment. A major accident is defined in the Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989, issued under the Environment (Protection) Act, 1986, whereas 'disaster' is defined in the DM Act, 2005.

1.5 Major Chemical Accidents in India

Following the Bhopal Gas Disaster in 1984, major incidences of chemical disasters in India include a fire in an oil well in Andhra Pradesh (2003); a vapour cloud explosion in the Hindustan Petroleum Corporation Limited Refinery (HPCL), Vishakhapatnam (1997); and an explosion in the Indian Petrochemicals Corporation Limited (IPCL) Gas Cracker Complex, Nagothane, Maharashtra (1990). Over 20 major chemical accidents have been reported in MAH units during 2002–06. Details of these accidents that involved chemicals like chlorine, ammonia, LPG and other HAZCHEMs are indicated in Annexure A.

1.6 Aims and Objectives of the Guidelines

The NDMA is mandated to issue guidelines to ministries/departments and states for preparing DM Plans for holistic and coordinated management of disasters. The Guidelines are intended to focus on all aspects of the DM cycle including prevention, mitigation, preparedness, relief, rehabilitation and recovery.

These Guidelines shall form the basis for the ministries and departments concerned, at the centre and state levels to evolve programmes and measures in their DM Plans. The approach followed shall emphasise chemical safety and risk reduction measures including technical and non-technical preparedness measures, be environment and technology friendly, sensitive to the special requirements of the vulnerable groups and communities, and address all stakeholders involved in the CDM. This is to be achieved through strict conformity with existing and new policies.

2 Present Status and Context

India is amongst the very few countries, which have enshrined the right to live in a clean and wholesome environment as a fundamental right. The Factories Act was enacted in 1948, for ensuring safety, health and welfare at the workplace. Recognising the need to mainstream environmental concerns in all developmental activities, a separate ministry—the MoEF—was created in 1980, and was declared as the nodal ministry for the management of chemical (industrial) disasters. CDM received greater emphasis the world over only after the Bhopal disaster in 1984.

2.1 Regulatory Framework and Codes of Practises

The regulatory framework on chemical safety can be traced to the Factories Act, 1948 and chemical class-specific regulations like the Explosives Act, 1884; the Insecticide Act, 1968; and The Petroleum Act, 1934. Later, an umbrella Act, the Environment (Protection) Act, 1986, was enacted, which also deals with chemical management and safety. A number of regulations covering safety in transportation, insurance, liability and compensations were enacted thereafter. The Government of India has further reinforced the legal framework on chemical safety and management of chemical accidents by enacting new rules and by way of amendments to them (Annexure B).

The MoLE and its technical organ—the Directorate General Factory Advice Service and Labour Institutes (DGFASLI), amended the Factories Act, 1948, in 1987, notifying 29 types of industrial activities as hazardous processes and introduced special provisions for hazardous process industries in its newly added Chapter IV A. Preparation of emergency plans, framing safety policies, constitution of safety committees to ensure workers' participation in safety and health management, notification of permissible exposure limits for harmful chemicals, and establishment of occupational health centres etc., were introduced by these amendments. The working details arising out of these amendments were issued to various state governments as model rules.

A number of chemical specific codes of practises published by the Bureau of Indian Standards (BIS), the Oil Industry Safety Directorate (OISD) and guidelines brought out for chemical accident management by the MoEF are listed in Annexure C.

2.2 Institutional Framework and Compliance

2.2.1 Institutional Framework

The regulations referred to in para 2.1 above provide for institutional framework for enforcement and monitoring of chemical safety and emergency management. It involves various central/state ministries/departments viz. MHA, MoEF, MoLE, MoA, MoP & NG, MoC & F, MoSRT & H, Ministry of Commerce and Industry (MoC & I), Department of Economic Affairs (DEA), Ministry of Finance (MoF), and others (Figure 2).

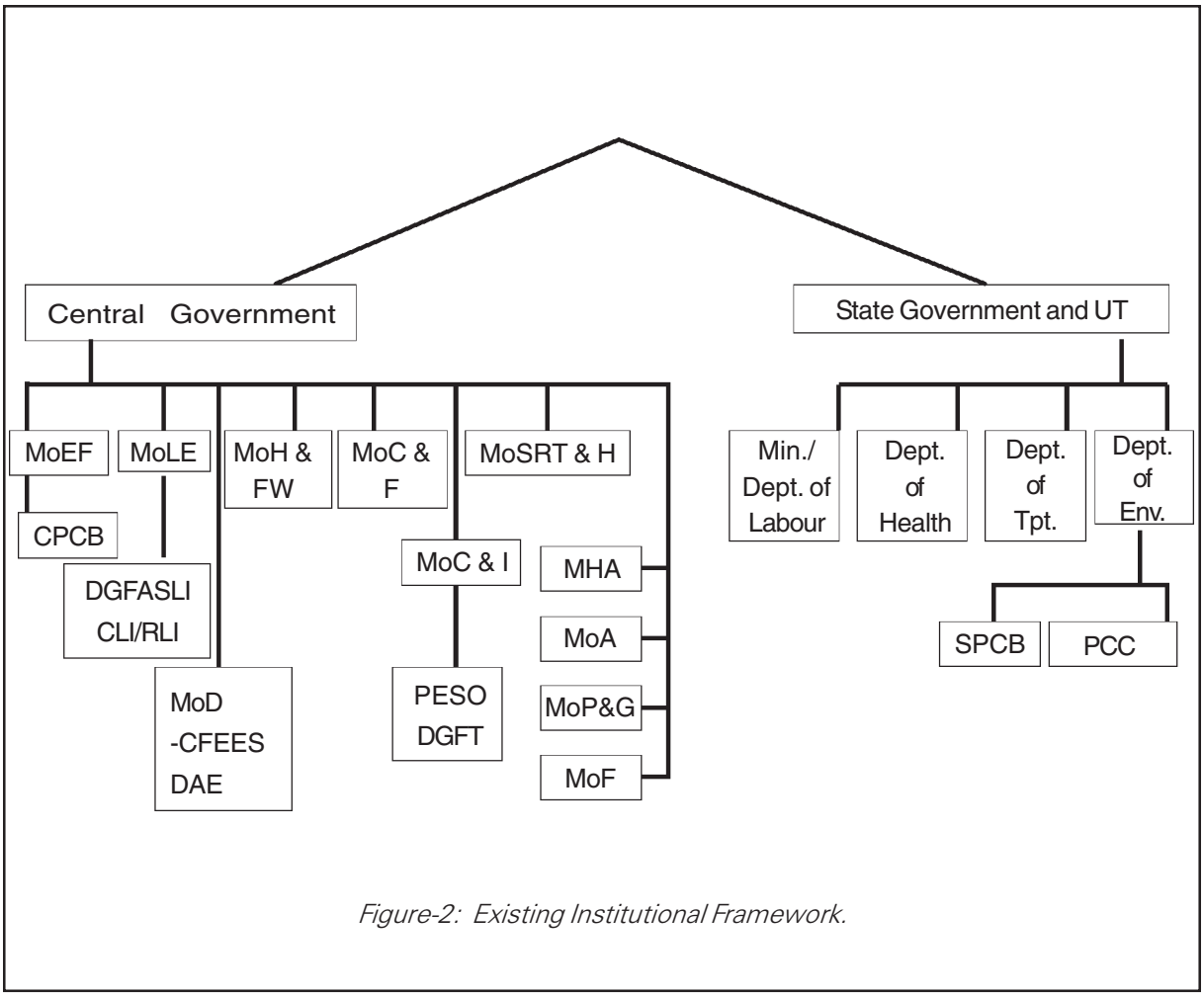

Figure-2: Existing Institutional Framework.

The MoLE, MoEF and MoSRT & H are responsible for enacting regulations. The MoLE through its state entities; the Inspectorate of Factories/Directorate of Industrial Safety and Health (DISH); the Central Pollution Control Board (CPCB) and the MoEF with its state entities, State Pollution Control Boards (SPCBs) and Pollution Control Committees (PCCs) of UTs monitors compliance of the various regulations. The MoLE is assisted in this regard by the DGFASLI and central/regional labour institutes. The MoSRT & H through the Department of Road, Transport and Highways is to ensure the development and maintenance of national highways.

On the other hand, the state governments through their respective state transport departments, transport commissioners/regional transport officers and Public Works Department (PWD) are responsible for the management of the roads and highways in the states.

With respect to petroleum products and explosives, the MoC & F through Department of Chemicals and Petrochemicals and Department of Fertilizers, MoP & NG, and Ministry of Heavy Industries and Public Enterprises (MoHI & PE) through the Petroleum and Explosives Safety Organization (PESO) monitor compliance of the regulations.

The MoH & FW through various hospitals responds to medical emergencies during chemical accidents. For prompt and effective medical response with requisite capacity building in emergency medical services, institutional linkages and statutory backups need to be urgently formalised.

Organisations/agencies like the DAE and Centre for Fire, Explosive and Environment Safety (CFEES) are responsible for preparing Off-Site emergency plans in the DAE and MoD respectively. The CFEES is an authority under the MSIHC Rules for enforcement of directions and procedures in respect of laboratories, industrial establishments and isolated storages dealing with HAZCHEMs in the MoD. Similarly, the DAE is responsible for nuclear installations.

Research institutes like the Indian Institute of Chemical Technology (IICT), Hyderabad; Industrial Toxicology Research Centre (ITRC), Lucknow; National Environmental Engineering Research Institute (NEERI), Nagpur; National Chemical Laboratory (NCL), Pune and National Institute of Occupational Health (NIOH), Ahmedabad, are working in the field of occupational hazard, safety and in aspects related to CDM. Defence Research Development Organisation (DRDO) is working on the field detection kits, personal protection equipment and measures for prophylaxis and therapy.

Limited facilities for the collection of environmental toxicants, released during a chemical disaster also exist in the Council of Scientific and Industrial Research (CSIR), the DRDO, and Indian Council of Medical Research (ICMR) laboratories, as well as in the CPCB, SPCBs, PCC, PESO and recognised laboratories in the private sector.

Autonomous bodies, professional institutes, Private Voluntary Organizations (PVOs) and NGOs play an important role in training and community awareness and also can contribute significantly in response, rehabilitation and reconstruction efforts.

2.2.2 Compliance

Of the 602 districts in India, 263 districts have MAH units. Of them, 170 have clusters of more than five MAH units (hazardous/industrial pockets). As on date there are 1666 MAH units in India. In addition to these, there are a large number of storages of hazardous substances; big warehouses including local factories/storage sites, some of them presently existing in residential areas. On-Site emergency plans are in place for 1628 units. Off-Site emergency plans for 166 districts have been prepared. Twenty-six of them are based on hazard analysis studies undertaken at the initiative of the MoEF. Presently, a mock drill of the On-Site plan by occupiers of MAH units every six months is a statutory requirement. However, only a few mock drills of prepared Off-Site plans have been conducted.

The MoEF has set up a Central Crisis Group (CCG) and a coordination committee at the national level. Further, out of the 28 states and seven UTs, 20 states and three UTs have set up State Crisis Groups (SCG). Nineteen states with districts having MAH units, have set up District Crisis Groups (DCGs), while 17 of the states have also set up Local Crisis Groups (LCGs). Depending on the gravity of an accident, appropriate crisis groups at local, district, state and central levels are activated.

The MoEF has set up a Crisis Control Room (CCR) as part of the CAS, for the rapid exchange of information and for coordination of activities during an emergency. The MoEF is preparing a web-based accident information system for use of all stakeholders concerned, which will have better monitoring and management of chemical disasters. A 'red book' containing duties to be performed by authorities and agencies during an emergency is published periodically and circulated. It contains

names, addresses and telephone numbers of key functionaries of state governments, chief inspectorate of factories, SPCBs, PCC, experts/ institutions, etc.

A brochure entitled, 'DOs and DON'Ts during a Chemical Accident', to educate and enable the community for self protection has been published. Industries have also undertaken awareness programmes for communities residing in the vicinity of industrial units.

2.3 Other Technical Activities/Initiatives

2.3.1 Initiatives in Installations

A) Major Accident Hazard Control System:

In addition to the efforts to strengthen the legal framework by amending the Factories Act, the MoLE through the DGFASLI and state factory inspectorates implemented a project called 'Establishment and Initial Operations of Major Accident Hazard Control System in India'. During the project period, the MAH units were identified and infrastructural facilities were augmented in the Chief Inspectorate of Factories (CIFs), Central Labour Institute (CLI), Mumbai, labour institutes of various states, and Regional Labour Institutes (RLIs), Kanpur, Kolkata and Chennai. Under the Major Accident Control System it is mentioned that the Major Accident Hazard Control Advisory Divisions (MAHCAD) of these institutes provide consultancy services to industries, conduct training programmes and workshops, training the officials of CIFs of various states and conduct joint safety inspections of MAH units with them to enhance safety levels of various installations.

B) Hazard Analysis Studies of Industrial Pockets

A sub-scheme entitled, 'Industrial Pocket-wise Hazard Analysis' has been in operation at the MoEF since the Eighth Five Year Plan. Hazard analysis studies for identifying the accident potential of industrial areas/pockets, their possible consequence and prevention strategies including rapid safety audit of MAH units have been initiated for 107 districts covering 900 MAH units. Out of these, studies of 85 districts have been completed.

C) GIS-based Emergency Management System

A pilot study entitled, 'GIS based Emergency Planning and Response System for Chemical Accidents in MAH Installations in Major Industrial Clusters' in four identified industrial states namely—Gujarat, Maharashtra, Tamil Nadu and Andhra Pradesh has been completed. The system would help existing response agencies in planning for and responding to major chemical emergencies to contain damage to a minimum. Training programmes involving members of crisis groups have been conducted. This project has been extended to the National Capital Territory (NCT) of Delhi, Rajasthan, Uttar Pradesh, Haryana, Karnataka, Kerala, West Bengal, Assam, Madhya Pradesh and Punjab.

D) Environment Risk Reporting and Information Systems (ERRIS)

Another unique initiative is the ERRIS prepared by the Indian Chamber of Commerce (ICC), Kolkata for the chemical units in Haldia and Durgapur in West Bengal. The industry risk management system, ERRIS, was developed under a project funded by the European Union with the technical collaboration of The Netherlands and Italy.

E) Emergency Response Centres (ERCs) and Poison Control Centres

Five ERCs have been established in Manali (Tamil Nadu), Bhopal (Madhya Pradesh), Mahad (Maharastra), Vishakhapatnam (Andhra Pradesh)

and Hyderabad (Andhra Pradesh), which serve as a link between the DCG and the industry during an emergency. ERCs deal with chemical emergencies in a given area and disseminate technical information relating to the chemicals involved. Presently, the ERCs do not cater to emergencies arising during the transportation of HAZCHEMs.

The first National Poison Information Centre was set up in the Department of Pharmacology in 1995, at the All India Institute of Medical Sciences, New Delhi. The main objectives of Poison Control Centres include toxico-surveillance (active survey of the prevailing and potential toxicity risks) and environmental health monitoring. It aims to help detect heavy metal contamination, occupational exposure, food, water, air, and soil contamination.

F) Capacity Development

Financial assistance has been provided for capacity development to the National Fire Service College (NFSC), Nagpur; National Civil Defence College (NCDC), Nagpur; offices of the CIFs/DISH of states including Maharashtra, Tamil Nadu, Andhra Pradesh, Gujarat, Rajasthan and NCT Delhi.

Some other national and regional institutions (viz. National Safety Council [NSC], Disaster Management Institute [DMI]) have also been working in the areas of accident prevention, emergency preparedness and hazardous risk management. The Confederation of Indian Industry (CII), Federation of Indian Chambers of Commerce and Industry (FICCI) and the ICC are other notable leading umbrella networks of organisations of business and industry working in these fields.

G) Control Room Concept

The following five Control Rooms have been set up at the initiative of the industries in the state of Gujarat:

i) Emergency Control Room in Vadodara (registered as a Central Control Room).

ii) Atul Emergency Control Centre in Atul Ltd., Valsad.

iii) Vapi Emergency Control Centre in Vapi Industrial Association, Vapi.

iv) Disaster Prevention and Management Centre, in the Gujarat Industrial Development Corporation (GIDC) fire station, Ankleshwar.

v) Disaster Management Centre, Bharuch in the IPCL Guest House, Dahej Off-Site Emergency Control Room.

H) National Networking of Emergency Operation Centres (EOCs)

The national network of EOCs with links to state EOCs and other state secretariats and the district EOCs at the district collectorate form the main emergency communication network in the country for DM. The National Informatics Centre Network (NICNET) and the Police Network (POLNET) are other important satellite-based networks for emergency communications.

I) Responsible Care (RC)

The concept of RC is a global voluntary initiative of the chemical industry, covering all activities including research, process and product development, manufacturing and sales. It aims at an ethical and behavioral change, going away from a regulatory driven approach to a proactive approach.

RC is now licensed by 52 national industry associations worldwide. The Indian Chemical Manufacturers' Association (ICMA) now called Indian Chemical Council launched the RC initiative in 1992 and at present, 92 chemical industries have become signatories to the RC initiative in India.

J) Mutual Aid Response Group (MARG)

MARG, a voluntary initiative on developing 'mutual aid arrangement' for effective emergency response on a voluntary basis among neighbouring units in an industrial pocket, has emerged during the last decade. This initiative of the association of industries in an industrial pocket, is a forum to mutually help each other by sharing resources to tackle emergencies.

It has been successful in Maharashtra, where 15 MARGs are presently working. This industry initiative is promoted by the DISH, which is the regulatory agency in Maharashtra under the Factories Act. It is also found that some industrial units have entered into formal mutual aid agreements. There is a need for the expansion of MARG initiatives in other states.

2.3.2 Initiatives in Storages

A) Inventory of Isolated Storages

An inventory of 'Isolated Storages' with chemicals and their quantities in the country was undertaken. The study identified 347 isolated storages, of which the maximum were in the states of Gujarat (41), Uttar Pradesh (38), Tamil Nadu (32), Andhra Pradesh (31), Karnataka (25), West Bengal (24), Maharastra (23), Orissa (22), Rajasthan (22), Madhya Pradesh and Punjab (17), and Delhi (14).

2.3.3 Initiatives in the Road Transport Sectors

A) Vulnerability and Risk Assessment of Transportation of HAZCHEM

Risk assessment and vulnerability studies have been completed in 16 stretches of national highways in four states with a high density of hazardous material transportation. Based on the identified risks, mitigation measures including preparation of DM Plans are carried out.

B) Hazardous Material (HAZMAT) Emergency Response Van

The NSC identified and analysed the successful experience of developing and operating HAZMAT Emergency Response Vans by leading MAH units in the Patalganga-Rasayani Industrial Area, Dist. Raigad, in Maharashtra, and published a case study on it. The approach for responding to road transport emergencies represented by this case study is considered practical and cost effective in the Indian situation and needs to be replicated at the national level.

2.4 Parallel International Efforts

2.4.1 International Labour Organization (ILO)

The ILO convention No. C 174, adopted on 22 June 1993, dealing with the prevention of major industrial accidents involving hazardous substances and the limitation of the consequences of such accidents, is directly relevant for CDM in India.

2.4.2 Awareness and Preparedness for Emergencies at the Local Level (APELL) Project

APELL is a tool developed by the United Nations Environment Programme, Division of Technology, Industry and Economics office (UNEP DTIE) in 1988 to minimise the occurrence of harmful effects of technological accidents and emergencies.

The five-year (1992–97) APELL Project was implemented in India by the NSC in selected six high-risk areas in different regions across India.

The APELL project was timely and eminently suited to address the issues identified under the Major Accident Hazard Control (MAHC) project as the groundwork carried out provided a foundation for building the structure of community awareness and emergency preparedness. A systematic

methodology for testing emergency plans was also developed.

The outputs achieved include:

i) Coordinating groups like the APELL setup in all the six high-risk industrial areas.

ii) Positive experience in community involvement.

iii) A systematic methodology developed for testing emergency plans (importance of holding table-top exercise prior to the field drills was particularly realised).

iv) Strengthened technical capabilities at the national and local levels.

v) Further issues identified.

Above all, the APELL approach was institutionalised through the notification of the Chemical Accidents (Emergency Planning, Preparedness and Response) (CA[EPPR]) Rules.

2.4.3 United Nations (UN) International Strategy for Disaster Reduction (ISDR)

The UN ISDR effort is promoting chemical disaster risk reduction by educating and involving the community and civil authorities.

2.5 Recent Major International Developments

2.5.1 The UNEP Trans-APELL Programme

The UNEP APELL Programme is being strengthened as a key vehicle for UNEP work, at the local level in preventing and preparing for natural and other disasters, such as industrial disasters.

The Trans-APELL Pilot Project (started in June 2000) is designed to channelise the proven APELL approach to dangerous goods transport emergency planning in a local community by using the *Trans-APELL Handbook* published by UNEP in 2000. Following the Trans-APELL Workshop organised by the NSC with the participation from all the stakeholders, two initiatives have been undertaken on a pilot basis:

i) To include the HAZMAT Response Training Module in the Curriculum of the Traffic Police Apex Institute and train their trainers.

ii) To conduct awareness programmes for communities living near identified accident prone spots along a major highway. The statutory obligations resting on the road transport operators and the improvement measures taken on the ground for achieving compliance have made the situation particularly favourable to initiate this programme.

To promote the APELL process further, the UNEP is revising, adapting and elaborating new tools and methods to repackage it as a multi-hazard programme for disaster reduction that enables local communities to identify, assess, prevent and prepare for the impact of any type of disaster. A decision to this effect was taken in the UNEP General Council meeting held recently in February 2006 at Dubai.

2.5.2 Strategic Approach to International Chemicals Management (SAICM)

In February 2006, over 190 countries including India acceded to the SAICM—a voluntary agreement to ensure the safe use of chemicals by 2020. India has decided to contribute to the newly created Quick Start Programme (QSP) trust fund. This initiative of UNEP consists of an overarching policy strategy and a global plan of action. There are 192 activities that have been identified for a global plan of action.

2.6 Recent National Developments

2.6.1 Enactment of The DM Act, 2005

In view of the extensive loss of life and damage to property due to natural calamities and the devastating potential of man-made disasters, the union government decided to institutionalise DM, based upon prevention, an enhanced level of preparedness, prompt and effective response and capacity-building aspects.

The DM Act, 2005 provides for the requisite institutional mechanism for drawing up and monitoring the implementation of the DM Plans ensuring measures by various wings of government for prevention and mitigation effects of disasters and for undertaking a holistic coordinated and prompt response to any disaster situation. The Act seeks to institutionalise the mechanisms at the national, state and district levels to plan, prepare and ensure a swift response to both natural calamities and man-made disasters/accidents.

The Act, inter alia mandates:

i) The formation of a national apex body, the NDMA, with the Prime Minister of India as the ex-officio chairperson.

ii) The state governments to establish SDMAs, and also create DDMAs.

2.6.2 Powers and Functions of the NDMA

The NDMA constituted under Section 3 of the DM Act, 2005, has the responsibility of laying down the policies, plans and guidelines for effective DM. As mandated, the NDMA may:

i) lay down policies on disaster management;

ii) approve the National Plan;

iii) approve plans prepared by the ministries or departments of the Government of India in accordance with the National Plan;

iv) lay down guidelines to be followed by the State Authorities in drawing up the State Plan;

v) lay down guidelines to be followed by the different ministries or departments of the Government of India for the purpose of integrating the measures for prevention of disaster or the mitigation of its effects in their development plans and projects;

vi) coordinate the enforcement and implementation of the policy and plan for DM;

vii) recommend provision of funds for the purpose of mitigation;

viii) provide such support to other countries affected by major disasters as may be determined by the Central Government;

ix) take such other measures for the prevention of disaster, or the mitigation, or preparedness and capacity building for dealing with the threatening disaster situation or disaster as it may consider necessary;

x) lay down broad policies and guidelines for the functioning of the National Institute of Disaster Management (NIDM).

The NDMA will be assisted by its executive committee, the National Executive Committee (NEC). The NEC is responsible for implementing the policies and plans of the NDMA. The NEC shall act as the coordinating and monitoring body for DM for the implementation of the National Plan. The NDMA is, inter alia, responsible for coordinating and ensuring the implementation of the government's policies and plans for disaster reduction/mitigation and ensuring adequate preparedness at all levels; coordinating response to a disaster when it strikes and post-disaster relief, rehabilitation and reconstruction.

The NDMA shall maintain, build and strengthen the existing machinery, structure and mechanism. The nodal ministry will continue to be responsible for CDM, and based on the Guidelines issued by the NDMA, will prepare the detailed Action Plan for CDM. Similarly, all central ministries/departments and state governments and UTs shall prepare comprehensive DM Plans that will address all phases of the DM cycle in a coordinated manner as specified in these guidelines. The plans will finally be approved by the NDMA and respective SDMAs as specified in Section 23, sub-section 3 of the DM Act, 2005 respectively. The NDMA will coordinate and ensure their implementation with the help of all agencies concerned.

2.7 Genesis of National Disaster Management Guidelines — Chemical Disasters

As per the DM Act, 2005, the NDMA is required to prepare national Guidelines, based on which the nodal ministry will prepare a detailed Action Plan in consultation with states and other stakeholders for the better and effective management of chemical disasters.

A meeting on CDM was convened by the NDMA on 17 February 2006 with various ministries of the Government of India (MoEF; MoLE; MoSRT & H; MHA), regulatory agencies (DGFASLI), NSC, R&D institutes (Bhabha Atomic Research Centre, Defence Research and Development Organisation (DRDO), Indian Institute of Chemical Technology, Industrial Toxicology Research Centre, National Institute of Occupational Health, NEERI, All India Institute of Medical Sciences, professional institutions (NIDM, Delhi and DMI, Bhopal), apex industrial associations (CII, FICCI) and the DM Authority of the Delhi Government, along with a large number of professionals and experts from the field of CDM.

During the workshop, the present status of CDM in India was discussed and salient gaps were identified. The workshop also identified priority areas for prevention, mitigation and preparedness of chemical disasters and provided an outline of comprehensive guidelines to assist in the preparation of plans by ministry/states. It was decided to articulate the CDM guidelines through a document called the National Disaster Management Guidelines—Chemical Disasters. A core group of experts was constituted to assist the NDMA in preparing these Guidelines.

Several meetings of the core group were held to review the draft versions of the document in consultations with ministries concerned, regulatory bodies and industries to evolve a consensus on the various issues of the Guidelines.

3 Salient Gaps

Chemical accidents pose special challenges in their management. The present status for CDM is contained in various chemical-specific and general regulations. A number of programmes and activities on preparedness, mitigation and response are underway at national, state, district and local levels. Chemical industries have also set up risk reduction measures and initiated resource sharing and other coordinated efforts. R&D activities and standards setting in CDM are also being pursued in various institutions/organisations, as already described in Chapter 2.

While considerable progress has been made in the last two decades in the development and implementation of regulations and programmes for the management of chemical disasters, critical gaps still exist in certain areas. Gaps identified in regulations, programmes, projects, activities and initiatives have been presented in detail in this chapter. The prevention, preparedness, response, rescue and rehabilitation aspects of hazards in industrial installations and the storages of chemicals have been taken into account while identifying the gaps in this area.

3.1 Management of Chemical Accidents

3.1.1. Regulations

The effectiveness of the present regulations can be gauged from fairly successful operational records/ performance of industries. However, the following are the specific gaps identified in the regulations:

i) Based on the Factories Act, 1948 (amended in 1987), the states have notified their own Factories Rules, which need to be dovetailed with the subjects of accident prevention, preparedness and mitigation.

ii) Absence of national regulations on occupational safety and health and medical emergency management.

iii) Harmonisation of classification and definitions in existing regulations including petroleum and petroleum products.

iv) Absence of regulations on storage and transportation of cryogenics.

v) Lack of legislation on risk assessment requirements and classification, labeling and packaging for industrial chemicals.

vi) Need to identify technical competent authorities and standardisation of reporting mechanisms for the status of implementation of various chemical disaster-related activities.

vii) Non-availability of statutes for grant of compensation to chemical accident victims.

viii) Harmonisation and incorporation of international laws in chemical management.

3.1.2 Codes of Practises, Procedures and Standards

A number of codes of practises, procedures and standards governing safety in the handling of chemicals are available. However, these are not exhaustive, do not cover all HAZCHEM and processes and are also not prescribed by the statutes.

The specific gaps in these Codes of Practises, Procedures and Standards are as follows:

i) Lack of national-level risk assessment criteria and acceptable risks for chemical plants viz., failure rate and probability of accidents, etc.

ii) Procedure for conduct of safety audit and safety report preparation.

3.1.3 Statutory Inspection, Safety Audit and Testing of Emergency Plans

A) Inspection System in Factory Inspectorates

There are a large number of industrial units that require inspection and the manpower to do so is limited. Inspection formats and guidelines on follow-up action also require updating. Currently, the departmental inspection manual does not adequately address process safety requirements and leaves much to individual discretion resulting in compromising on safety.

B) Safety Audit

A safety audit is a tool for identifying and rectifying gaps in institutional safety management systems and is currently mandated to be carried out every two years by law. This requirement is often unmet. Problems arise due to inspection by two or more different departments for the same location, for example, the Controller of Explosives, Director of Factories, Pollution Control Board and Fire Service Department. The requirement of a single inspection system has not been established.

C) Commissioning and Decommissioning Plans

There is currently no system in place to report accidents that occur during commissioning and de-commissioning of plants. It is observed that a number of accidents take place during these processes.

D) On-Site Emergency Plan

The testing of On-Site emergency plans every six months is a statutory requirement. A large number of units conduct mock drills shop-floor wise or cover only a few components, while the requirement is for the installation as a whole.

E) Off-Site Emergency Plans

i) A yearly mock drill of district Off-Site emergency plans is essential and mandated. Very few full-scale drills of district Off-Site emergency plans are being conducted in the country, and even those are not conducted as per the norms.

ii) Preparation of SOPs for rescue teams and other QRTs regarding the wearing of full protective gear before entering the hazardous zone and cordoning off the disaster site are required.

F) Medical Emergency Plans

District Off-Site emergency plan should include a separate section on management of medical emergencies, which should also be tested yearly during mock drills.

3.1. 4 Technical and Technological Information

A) Information on Chemicals

The disclosure of information via Material Safety Data Sheets (MSDS) by occupiers to workers on chemical hazards is a statutory requirement. The information in MSDS is generally complex and exhaustive, therefore, supervisory staff and workers find it difficult to comprehend the information available in them.

B) Technical Information

i) Hazard and risk assessment information to first responders, harmonised risk assessment and management principles and case studies of accidents/major accidents/disasters in MAH units are not available.

ii) Case studies of major accidents including emergency response experience and yearly statistics of major chemical accidents are not compiled and published at the national level.

iii) There is lack of clear accessible information on potential chemical hazards and their management for ready use by local authorities. In addition, the officers responsible for issuing No Objection Certificates (NOCs) for establishing a storage facility often lack sufficient scientific knowledge and need to undergo appropriate training.

C) Technology

Some MAH units handling HAZCHEMs are not based on best available technologies. Many of the small and medium units continue to use obsolete and unsafe technologies.

3.2 Preparedness

3.2.1 Education, Training and Capacity Development

A) Education

DM has been introduced as a subject at the school level for classes VIII, IX and X by the Ministry of Human Resource Development. Different modules on DM are required to be developed and placed appropriately at different levels in the education system at the national and state levels. In addition, there is a need to include disaster-related technical education for professionals and medical officers in their respective institutions. Besides chemical sciences and technologies, the basic knowledge of toxicology needs to be imparted at all levels.

B) Training of Emergency Services and District Authorities

i) The existing training institutes in India require up-gradation and strengthening besides adequate funds to be provided by the centre and state governments. Dedicated institutes for training on CDM have not been identified/established. Institutes for imparting training to first responders, authorities and others involved in emergency planning, preparedness and response need to be identified/established.

ii) Specific training modules need to be prepared for CDM with specialised packages for different stakeholders in a time-bound manner. These modules are required to be tested and implemented at different levels of CDM.

iii) The paramedical staff lack knowledge on DM and need to be trained with appropriate knowledge of effects of chemicals and clinical modalities for management of their toxicities.

iv) Self-inspection by the industries and corporate responsibility for safety are not practised; these measures need to be established through the training of trainers.

C) Capacity Development

Capacity in terms of adequate skilled man power, material logistics and infrastructural facilities are grossly inadequate at various levels required in the management of chemical disasters.

i) Infrastructural

a. Adequate infrastructural facilities in installations, monitoring institutions and authorities concerned and their requirements need to be addressed.

b. There is a need to assess individually and collectively the augmentation of infrastructure and financial resources required in institutions associated with CDM.

c. Based on the concentration of MAH units, the requirement and location of ERCs and poison centres need to be identified.

d. The integration of infrastructural facilities with those of existing institutions after providing the necessary resources/expertise for process hazards and chemical disasters is required.

ii) Skilled Manpower

a. Capacity in terms of skilled and trained manpower is required to be built up at the identified institutes/research departments/training centres.

b. Functional integration of various aspects of disasters in the curriculum, and linkage of this knowledge in the initial recruitment and further promotions of the employees.

c. The role of NGOs and the community is required to be defined. Resident Welfare Associations and NGOs needs to be integrated with this training network so as to develop a group of volunteers.

d. Sensitisation of functionaries at all levels about the need, measures for quick assessment and action to be taken during chemical disasters.

iii) Material Logistics

a. The adoption of suitable technologies for CDM need an established mechanism to test, verify and check the technology in a rapid and time-bound manner. Once approved, the same is to be adopted at the grass-root level.

b. Inventory of Personal Protective Equipment (PPE), chemical emergency management kits, relief and response material like ambulances, evacuation vans, fire-fighting equipment including HAZMAT vehicles and other safety-related items need to be identified, tested and established.

3.2.2 Awareness Generation

i) The public at large is the most important stakeholder in DM. The creation of public awareness by MAH installations and the district administration/DDMA and local authorities regarding possible accidents is a statutory requirement. Even though community awareness is a priority area, it has not been adequately addressed.

ii) Public awareness about HAZCHEM, their effects, dos and don'ts during an accident and remedial measures, is grossly inadequate.

iii) Proper guidelines and a code of ethics and conduct is not available for the print and electronic media for handling sensitive issues arising out of chemical disasters. This is necessary for a disciplined, structured and panic-free approach in order to communicate any disastrous event and its immediate consequences to the public.

iv) In awareness generation, NGOs can play an effective role. There is an urgent need for identifying NGOs with experience to successfully help in handling chemical emergencies and strengthening their capacities and capabilities to support effective response during an emergency.

3.2.3 Institutions, Networking and Communication

Institutional framework for providing technical support services at various levels is a key requirement for sustaining proper development and implementation of an effective DM system. These have not been fully identified.

A) Institutions

i) National-level institutions and other academic institutions such as the Indian Institutes of Technology (IITs); the OISD; Atomic Energy Regulation Board (AERB); IICT; ITRC; NIOH; CLI; CLRI; NEERI; NFSC; NCDC; NSC; DMI; NIDM; Indian Chemical Association (ICA); and other professional bodies; industrial and corporate institutions/associations need to be further involved in CDM. The present status and strengths of these institutes need to be assessed and if required, to be strengthened to include disaster-related activities in their training and knowledge development thereof.

ii) Fire services, which are traditionally the first responders, as an institution lacks modern equipment and advance training for strategic response.

iii) Revamping of the Civil Defence and Home Guards is essential for these institutions to play an effective role in DM.

B) Networking and Communication

Effective communication and networking between various stakeholders is currently inadequate at all levels for a successfully orchestrated response to chemical disasters.

i) Human and functional networking is needed at the following levels for coordinated planning, preparedness and response. The communication network shall include:

a. Control rooms at all levels (district, state and centre).

b. Industries (with district/state authorities, and state/national institutions).

c. Emergency functional units identified in On-Site and Off-Site plans and other responders including designated authorities.

d. Institutes/analytical laboratories/ research departments identified by the nodal ministry; other associated ministries (in the concerned subjects) and the NDMA at the national level along with the others that will be identified by the states need to have an effective communication network to quickly assess toxicants/chemotoxins at the incident site and for continuing effective R&D programmes.

e. Road transport and other modes of transportation need to have an established dedicated communication system with all stakeholders and a mechanism (including GIS) for continuous monitoring of the transport vehicle carrying HAZCHEM all along its route.

f. It is required to make available the exhaustive list of HAZCHEMs, their side-effects and related dos and don'ts on the internet.

ii) Coordination between different stakeholders:

a. An effective network based on the roles of different stakeholders in a pre-rehearsed manner is required. The roles and responsibilities of different stakeholders including the first responders as identified in the various

plans need to be further adequately defined and available as ready department-specific guides for better coordination during chemical disasters.

b. Voluntary initiatives of industrial clusters for effective networking and mutual help viz. MARG, need to be encouraged at the national level. District administration/DDMAs, state authorities/ SDMAs, response agencies and the other enforcement agencies need to network with such voluntary initiatives.

3.2.4 Medical Preparedness and Response

Effective medical preparedness and response for a chemical emergency is a priority area. There is a need to address medical preparedness comprehensively at all levels with specific stress on chemical disaster-related aspects.

The salient gaps identified are:

i) Medical preparedness is the weakest link in the emergency response system and at hospitals.

ii) It is essential to develop mechanisms for creating awareness, making available trained medical first responders, decontamination facilities, risk and resource inventory, trauma care, plans for evacuation, mechanisms to maintain uniform casualty profiles, proper chemical casualty treatment kits, mobile teams/ hospitals, hospital DM Plans and preparing and responding to public health and environmental effects.

iii) Non-availability of specific antidotes for chemicals.

iv) Inadequacy of infrastructure for trained medical and paramedical staff.

v) The SOPs for emergency medical response at incident site are not laid down. There is an absence of a separate medical emergency plan in the district Off-Site plan. There is also a lack of documentation of uniform SOPs to be followed during chemical emergencies.

vi) Gross inadequacies in terms of trained manpower and capacity in poison information centres and regional laboratories that are close to disaster-prone areas with detection facilities for HAZCHEM.

vii) Absence of mechanism for medical surveillance.

viii) There are inadequate studies on long-term effects of HAZCHEM and their medical management.

ix) Mechanisms for medical rehabilitation need addressal.

3.3 R&D

Following are some of the areas where R&D activities are required to be initiated, intensified and pursued:

i) Customisation and validation of software for risk assessment and consequence modeling under Indian conditions.

ii) Critical analysis of available technology for acquisition.

iii) Development of need-based technologies for detection, protection (including PPE), monitoring of common toxicants and their effective management.

iv) Development of safer and cost effective alternatives and adoption of safer, affordable and sustainable technologies and processes.

v) Epidemiological studies on high volume HAZCHEMs handled by industry.

vi) To develop and introduce new biomarkers and indicators for chemical toxicants.

vii) Collaborate, update and adopt developing new approaches to detect, evaluate and decontaminate chemical toxicants.

3.4 Response, Relief and Rehabilitation

i) SOPs for all the response functions to be performed by all the functionaries of CDM according to the gravity of the chemical accident need to be developed and integrated into the existing structure and function of crisis management at all levels.

ii) Detailed minimum standards for food, water, shelter, sanitation do not exist at present. There is also the absence of SOPs for providing evacuation, shelter, food, water and relief.

iii) Immediate relief under the Public Liability Insurance Act, 1991 needs to be revisited.

iv) During rehabilitation, there is a need to comprehensively address all the requirements of victims including medical care for long-term effects of HAZCHEM.

3.5 Management of Transport Accidents

The major gaps include:

i) Air, maritime and rail transportation of HAZCHEM needs up-gradation in terms of loading, unloading, containerisation; their contingency plans also need to be revisited and revised to tackle any unexpected chemical emergency.

ii) Specific roles and responsibilities of consignor, consignee, transporters, drivers and authority are required to be addressed.

iii) Transport routes for HAZCHEM from the storage site to the delivery point with SOPs to be followed for transportation are essential to be defined. The safe stoppage points with the safe parking areas and an appropriate time of transportation need to be indicated in the route plans.

iv) The system of communication and training of persons involved in HAZCHEM transportation are grossly inadequate.

v) Highways are prone to numerous chemical emergencies due to bulk transportation of HAZCHEM but still no appropriate highway DM Plan exists. It needs to be comprehensively addressed.

vi) It is essential to address the modification/ harmonisation of legislations to reduce the probability of occurrence of chemical transport emergencies.

vii) The available study material on the specific highways stretches with heavy traffic density of HAZCHEM carriers needs to be replicated on other national/state highways.

viii) A national and state-wise directory of chemical/technical experts needs to be compiled and published for ready reference of traffic police and other service providers.

ix) Emergency response guidance for first responders and highway DM Plans are not available.

x) Fire services lack required technological sophistication and number of HAZMAT vehicles for quick emergency response.

xi) Transporters of chemicals including drivers lack the requisite training to discharge their roles satisfactorily during a HAZCHEM incident.

xii) Traffic police lack requisite training, basic knowledge of relevant statues, use of support tools such as TREMCARD, and their role in emergency response.

xiii) In line with the existing system of fire brigade and police, a network of communication and a four-digit number-based connectivity is essential for ambulance services and hospitals for quick medical response on highways.

xiv) Standardisation in design of vehicles and handling capacity needs to be addressed. Stress on R&D activities to address the designing of trucks and other vehicles carrying hazardous substances from the safety point-of-view is required.

xv) Recording and monitoring facilities of transport vehicles carrying HAZCHEMs on the identified routes need to be provided.

xvi) A statutory authority for inspecting the facilities on these vehicles and their monitoring and reporting mechanism is required.

xvii) In case of disasters, post-disaster cleanup needs to be dealt with.

xviii) Periodical training at regular intervals for drivers and attendants needs to be made mandatory. The syllabus for basic training and refresher courses needs to be designed and updated regularly.

xix) Rules pertaining to the issues of safety of import and export of chemicals needs to be updated according to changing global scenarios.

3.6 Implementation of Existing Regulations and Procedures

Any plan, policy, regulation or guidelines is only as good as its implementation. Lack of compliance and weak enforcement including coordination of CDM has been identified as follows:

3.6.1 Lack of Emphasis on CDM Functions at Various Levels

In order for DM to be effective, focused attention at various levels, namely, designated focal points in the nodal ministries viz. MoEF and MoLE at the central and state levels and designation of an emergency coordinator at the district level are essential. The lack of assigned responsibility, systems for update and clarity in functions currently plague the system.

3.6.2 Deficiencies in On-Site and Off-Site Emergency Plans

The Off-Site plan of a district/pocket is based on the On-Site emergency plans of MAH units in the industrial pocket. The following are some critical deficiencies observed in the On-Site emergency plans:

i) Lack of standardisation of risk assessment methodology.

ii) Non-use of standard terminology.

iii) Non-uniformity in the structure of the plan.

iv) Lack of separate documentation of the Off-Site consequences of an On-Site emergency.

v) Currently On/Off-Site emergency plans are prepared based on the maximum loss scenario. Limits for maximum credible and probabilistic loss scenario have not been evolved at the national level.

vi) Lack of graded response plans.

vii) Lack of medical response plans.

Keeping in view the responsibilities entrusted to the factory inspectorate with respect to chemical industries and management of chemical accidents, and the reliance of the district collector on the factory inspectorate during emergencies, proper infrastructure facilities at the inspectorate are inadequate. The enforcement of the CA(EPPR) Rules is not uniform among different states. The following are the inadequacies in the present system:

a. Non-availability of appointed dedicated staff in the control room.

b. Regular checking of the procedures and systems detailed in the red book.

c. Establishment of information networking with states and districts.

d. Database availability in the control room and updating.

e. The infrastructure facilities and management structure for the control room/ CAS.

f. A system for flow of information in the nodal ministry and from the accident site in the states has not been detailed and documented.

3.7 Liability and Compensation

Mechanisms to deal with social and economic impact of chemicals on human health, society and the environment, including liability, compensation and redress need to be streamlined and strengthened.

3.8 Finance

Planning for adequate financing for disaster prevention, preparedness and management at the states and national levels have not been addressed. The ministries need to regularly earmark funds for activities to strengthen CDM. These issues are required to be addressed on a priority basis so that long-term planning for allotment of necessary finances is in place and the flow of funds is organised.

3.9 Role of Civil Society and the Private Sector

There is a need to promote the role of all sectors of civil society and private sector in the implementation of the Guidelines and DM Plan.

4 Guidelines for Chemical Disaster Management

Guidelines for CDM have been prepared based on the salient gaps identified and worldwide established best practises and techno-managerial advancements in the field. It is expected that these shall re-engineer the existing processes, systems, regulatory framework, institutional and infrastructural network and the related areas and achieve harmonisation of efforts to prevent and manage chemical disasters effectively at national, state and district levels.

The Guidelines have been prepared and arranged in detail in this chapter taking into account the approach of prevention, preparedness and mitigation along with response, rehabilitation and reconstruction.

Guidelines specific for industrial installations and chemical storages, state and district-level functions, preparation of On-Site and Off-Site emergency plans, and management of transport accidents involving HAZCHEM have been dealt with separately.

The Guidelines will be periodically reviewed and updated by the NDMA and if necessary, additional guidelines will be issued.

4.1 Management of Chemical Disasters

Guidelines for CDM are indicative in nature with necessary essential information to help in preparing detailed plans. The guidelines would help to formulate the DM Plan based on the constructive model of Public Private Partnership (PPP) with the governmental agencies so that all the identified stakeholders continue to contribute proactively and effectively in their respective areas for the successful management of chemical disasters in India.

4.1.1 Regulatory Framework

Guidelines to strengthen the present regulatory framework on CDM are required to meet the current national policies and aspirations. These will promote self-regulation and public consultation. The Guidelines will have statutory effect through the DM Act, 2005 and will be binding on the persons concerned with CDM. Under this regulatory framework, technical support functions are required to be augmented so that in-depth information on technology, processes and material safety specifications in line with international standards are provided. Implementation would help in avoiding serious and costly environment problems due to ignorance about the risks associated with chemicals.

Regulation shall be supportive and technology neutral instead of prescriptive. The regulatory framework shall provide for the publication of detailed guidelines and institutional mechanisms for better compliance. Transparency in regulations is critical to implementation and therefore, shall be promoted as is done under various ISO accreditations. This would provide a very important tool and pathway to industries in covering gaps in a time-bound programmes depending upon available technologies and resources.

The Guidelines on the regulatory framework therefore, include the following specific recommendations:

i) National regulation on occupational safety and health shall be prepared.

ii) National regulation on the subject of accident prevention, preparedness and mitigation need to be dovetailed and harmonised with the legislations including the DM Act, 2005.

iii) National regulation on medical emergency management shall be formulated and dovetailed with the existing regulation at central and state levels. Separate guidelines on medical preparedness and mass casualties management are being drafted by the NDMA.

iv) Classification and definitions in existing regulations (including the Petroleum Act and Petroleum Rules) and others like the Indian Electricity Act, and Boilers Act, shall be harmonised with the DM Act, 2005.

v) Regulations on the storage and transportation of cryogenics shall be notified as stresses developed on leakage due to super cooling of the environment in and around storage areas of compressed hazardous gases is a very critical factor in maintaining stability of the entire structural system. Thus, this aspect is required to be fully elaborated and included in the regulatory framework so that damage due to cryogenic stresses can be prevented.

vi) Pipelines carry huge quantities of HAZCHEM both in liquid and gaseous form within and outside the manufacturing/ storage facilities. The regulatory framework has to thus, adequately address safety measures for pipelines and area en-route. The regulations shall also address issues arising out of the emergencies occurring due to gas line/petroleum line failure in the neighbouring industry.

vii) Legislation on 'Risk Assessment Requirements'; 'Classification'; 'Labeling'; and 'Packaging' for Industrial Chemicals shall be prepared.

viii) Factory inspectorates shall be empowered commensurate with their responsibilities. Authorities under Rule 19 of the MSIHC Rules further empower them to issue improvement notices. It is necessary to empower them to take legal actions for non-compliance of MSIHC Rules except for defence and nuclear installations, which are taken care by CFEES and DAE respectively.

ix) Statutes for grant of compensation to chemical accident victims shall be revisited.

x) A scheme for giving good performance awards to industries for achieving exemplary safety standards and statutory compliance shall be developed and implemented.

xi) The International Register for Potentially Toxic Chemicals (IRPTC) was established in 1976 at Geneva by the UNEP to help, assess and control the proliferation of chemical hazards. Over a period, it was felt that the volume of information to be processed, organised and disseminated on chemicals was large. A National Register on potentially toxic chemicals, manufactured/used in India will be maintained using the institutional framework.

xii) Most PPE is imported and expensive. These include life-saving devices, heavy equipment for salvage and extrication, chemical suits, fire entry suits, etc. Cost-cutting measures like reducing/waiving of import levies for these items need to be encouraged. It is also necessary to develop new indigenous industrial establishments to develop PPE. Gas masks and other PPE developed by the DRDO shall be adopted

by industrial units and response forces, wherever applicable.

xiii) The changes and modifications in the regulatory framework shall also be based on common elements and principles derived from regional and global instruments and drawing upon experience already gained through their preparation and implementation. Special efforts shall be made regarding the exchange of information on banned/severely restricted chemicals in international trade for the protection of human health and the environment at a global level.

xiv) The regulatory framework shall provide for instituting broader and more frequent information exchange on other systems, involving consultation with other countries to gain experience on alternative procedures.

xv) Governance is an important issue that needs to be addressed through a multi-sector and multi-stakeholder approach in pursuing the safe handling of chemicals and management of disasters. There is, therefore, a need to recognise and address:

a. Participation of stakeholders in all aspects of decision making related to the mitigation, relief and rehabilitation of victims of chemical disasters.

b. The gaps, overlaps and duplication in chemicals management activities and DM and the need for enhanced coherence, consistency and cooperation to ensure efficient and effective use of available resources at the district, state and national levels.

c. The mechanisms to deal with the social and economic impact of chemicals on human health, society and the environment, including liability, compensation and redress shall be streamlined and strengthened.

xvi) The legal provisions shall be enacted in the regulatory framework to give priority to emergency medical care over the forensic issues required to be handled by the police.

xvii) A land-use policy shall be prepared and strictly implemented. A legislation on the buffer zone (or to be referred as 'no man's' zone) will be introduced so that residential/ slum colonies are not established in proximity to industries. The already settled residential colonies need to be relocated.

xviii) Proper and safe disposal of hazardous waste shall be ensured as per existing regulations.

xix) The rules pertaining to the issues of safety of import and export of chemicals will be reviewed and updated in accordance with changing global standards.

xx) The provision of establishing check-posts for checking the fitness of carriers/vehicles carrying HAZCHEM shall be established.

xxi) Units holding quantities marginally lower than those specified for MAH units including Small and Medium Entrepreneurs (SMEs) will also be documented. At present, such units are not considered as MAH units. All other regulatory and safety mechanisms shall be made applicable to medium and small-size industries that deal with HAZCHEM. As per existing regulations, the Off-Site and On-Site plans stress upon MAH units only. Emergency plans shall also be developed by SMEs and practised as a part of the overall DM plan of the district.

xxii) Provisions to be made to penalise the defaulter units after inspection by an expert technical committee for the relevant subject.

4.1.2 Codes of Practises, Procedures and Standards

Procedures for the conduct of safety audits need to be strengthened. Standardised national criteria

for risk assessment/management of installations are not currently available. In their absence, a standard method is not available to study and monitor the consequences and draw conclusions. Mechanisms shall be developed on risk assessment/management prescribing a standard criteria and methodology. Such mechanisms will be updated regularly.

In addition:

i) There is a need to develop scientific understanding of the functions and behaviour of HAZCHEM, which is central to achieving risk reduction.

ii) Risk reduction measures, derived by scientific methods and consideration of social and economic factors, are needed to reduce or eliminate the harmful effects of chemicals and the consequences of a chemical disaster.

iii) Novel methodologies for identifying hazards in an installation, contemplating consequences of catastrophic failures and identifying the vulnerable population are required to be adopted and updated regularly.

iv) Adherence to risk reduction measures and improving the existing ones are essential to prevent the adverse effects of chemicals on the health of people and environment.

v) The pace of development of safer alternatives and adoption of safer, affordable and sustainable technologies and processes shall be accelerated.

4.1.3 Statutory Inspection, Safety Auditing and Testing of Emergency Plans

A) Inspection System by Regulatory Bodies

A proforma shall be developed to standardise the inspection procedures and reporting mechanism by each state factory inspectorate. Some of the issues to be addressed in developing the proforma include:

i) It shall be developed in consultation with technical and scientific experts in the relevant subject area.

ii) A department manual shall be prepared by the factory inspectorate for each type of hazardous unit to be inspected.

iii) It shall cover all the important parameters for each activity carried out in a particular type of unit.

B) Safety Plan for Commissioning and Decommissioning

A hazardous unit shall be obliged to submit its commissioning and de-commissioning plans to the factory inspectorate.

C) Safety Auditing

Presently, conducting risk assessment, preparing safety reports and annual safety auditing by an independent expert is a statutory requirement under the MSIHC Rules, 1989. To ensure proper quality in these areas, it is necessary to develop and put in place a certification/approval system for the experts who carry out these activities and for the institutes who will provide training to such experts for obtaining certification. Such a system can be developed by the MoLE, MoEF and the Quality Council of India (QCI) in consultation with technical institutes.

There is some inconsistency between the MSIHC Rules and the State Factories Rules in respect of the above activities regarding periodicity of audits and approval of auditors. A uniform system is required to be developed throughout the country.

D) Regular Testing of Emergency Plans

i) SOPs will be laid down at the district level for designing mock drills. Regular mock drills of both On-Site plans by the industrial installations and Off-Site plans by the

district administration/DDMA shall be conducted. There will be some award schemes for achievers as motivation to ensure compliance of safety provisions for all stakeholders.

ii) Standardised protocol will be developed as a part of the National Plan for use at the national level for emergency plans; these must always remain fully tested and able to deliver.

iii) Effectiveness and prompt functioning of the main stakeholders in the Off-Site emergency plans is the key to panic-free management of accidents. Establishing response time for initiating full-scale action by the identified responders to ensure effective management.

4.1.4 Technical and Technological Information

A) MSDS shall be made available for all chemicals irrespective of the quantity held including for those chemicals which arise as by-products.

i) An authentic but simplified version of information on HAZCHEM through MSDS is needed for ready use on the shop floors, both by the supervisory staff and workers.

ii) The MSDS will be displayed in multiple languages i.e., English, Hindi and the regional language and/or the vernacular language and shall be prominently displayed at strategic places like shift office, notice boards, security gates and also on the tankers.

iii) Dos and don'ts and periodic training capsule of MSDS on relevant chemicals will be given to all stakeholders including the local police and municipal fire brigades and industry.

B) Use of International Chemicals Safety Cards (ICSCs) developed under the IPCS, a joint activity of the World Health Organization (WHO), ILO and UNEP, shall be promoted at the national level.

C) Realistic documented versions of major accidents/disasters which have taken place in India (including emergency response experience and yearly statistics of major chemical accidents) shall be compiled at the national level by the nodal ministry and published so that persons/ organisations concerned are able to draw lessons from these tragic experiences.

D) District administration/DDMA will also evolve a mechanism for third-party evaluation of CDM plans for future learning.

E) MAH units handling HAZCHEM shall be encouraged to use best available and safe technologies.

4.2. Preparedness

Preparedness refers to the activities necessary to build and sustain performance across all of the other domains required for effective DM. These include a range of time-sensitive tasks that need to be undertaken involving efforts at all levels of government and within the private sector. One of its major component is medical preparedness.

The guidelines for medical preparedness and response will serve as broad principles for preparing hospital DM Plans and emergency medical response plans so that effects of HAZCHEMs can be minimised in terms of morbidity and mortality in the event of mass causality due to chemical disasters. The MoH & FW will ensure the incorporation of all these chemical-specific guidelines for medical management in the 'all hazard' medical management plan. The industry will ensure the establishment of medical setup requisites for the management of an On-Site

chemical emergency. All stakeholders of CDM will ensure that these plans are included as part of the main DM Plans at the level of central, state and district authorities and industrial installations. The quality of preparedness will be assured through proper training and mock drills. The major areas of preparedness are given below.

4.2.1 Education and Training

A) Education on CDM is necessary for all the stakeholders. Disaster-related topics shall be included in the syllabi of professional colleges at appropriate levels.

i) Regular educational programmes in the form of symposia, exhibitions and demonstrations shall be encouraged.

ii) Educational programmes shall be conducted in various languages according to geographical locations. Disaster-related manuals and pamphlets will be published in the vernacular so that they can easily be understood by less-educated people.

iii) Electronic media will be used to impart educational knowledge to the community at large.

iv) Disaster-related education material will be available for all stakeholders at various levels.

B) In the long term, DM education could be concurrently added in the curriculum of all students starting at the secondary education level. Some advanced content could be part of the curriculum of professionals and administrators who have critical roles to play in On-Site and Off-Site emergencies. The minimum criteria of educational qualification of unskilled worker in MAH units shall be upgraded to the senior secondary education level. The State Factory Inspectorate will have requisite technical knowledge to adequately address all the issues pertaining to CDM in industrial audits and minimum standards shall be laid down.

C) Training plays an important role in proper implementation of various disaster-related activities. SOPs will be laid down for first responders who form a very important component of DM, both at Off-Site and On-Site locations. Training will also be imparted to other stakeholders from industries, regulatory bodies, district/state authorities. The training programmes will be conducted at national, state and district levels by specific government and non-government institutes including the NIDM, and other academic institutes. Technical training plays an important role in understanding the probable root causes that can lead to a chemical disaster at installation sites.

Specific guidelines on training are as under:

i) Specialised training will be conducted for all connected personnel in the industry, fire brigade, police, medical institutions, transporters and community leaders for active role-playing during emergencies and for the general public towards the maintenance of calm and poise during a chemical disaster.

ii) Retraining programmes shall be conducted for all stakeholders at regular intervals.

iii) There is a need to strengthen the existing training institutions and set up additional training institutes in fire, risk assessment, certification, safety audit and emergency planning etc.

iv) Orientation course on the effects of industrial chemicals for medical management will be carried out for rural hospitals and primary health centres.

v) Periodical mock-exercises for On-Site and Off-Site emergencies as part of the training schedules for both industries and district authorities will be conducted at regular intervals. Mock drills shall be conducted regularly in accordance with the MSIHC Rules/CA(EPPR) Rules for checking the

response time. Mock exercise/drills will also be conducted for small and medium industries at periodic intervals.

vi) It is necessary to have technically trained professionals in the state/district administration with reasonably long tenures of service to maintain continuity and those who are replaced will be trained.

vii) All the workers employed in an industry will have a sufficient induction period for training prior to the actual job.

viii) Tools/techniques will be devised for measuring the competence of trained personnel.

4.2.2 Creation of Appropriate Infrastructure

Creation of proper infrastructure both in On-Site and Off-Site plans will serve as a strong back-up for the management of chemical disasters.

The infrastructural facilities will stress on the following areas:

A) Identification, budgeting and time-bound provision of infrastructural facilities in installations individually or collectively for achieving good engineering practises, backup facilities, monitoring and recording facilities and facilities for On-Site management of emergencies. These include:

i) Centralised control system with monitors installed on the periphery of installations, or cluster of installations.

ii) Public address system.

iii) Setting up of anemometers with continuous recording system and back-up installations of wind sox at vulnerable locations.

iv) Fire Tenders.

v) Provision of adequate quantity of foam and any other suppressant for control of vaporisation of spill or leak of compressed gas.

vi) Ensure availability of a sufficient quantity of fire extinguishers at various locations.

vii) Availability of well-equipped emergency medical rooms with requisite number of ambulance van(s) sufficient to shift On-Site casualties. The ambulance(s) shall be parked at an identified area preferably at perpendicular locations for continuity of emergency operations in case of toxic release.

viii) Emergency crew availability round the clock.

ix) Adequate PPEs.

x) Hotline telephone connection with nearby emergency services.

xi) Mutual-aid service in clusters.

xii) Alternative power back-up. Any other installation (chemical) specific facility.

xiii) New industries shall be established in such a manner that clustering of similar chemical- based units are evolved together in the same geographical area.

xiv) In specialised industries (MAH units) like ordnance factories, bomb disposal squads shall be available in the unit and a 'no fly zone' will be declared for such industry.

B) Preparation and inclusion of a 'Resources Directory' with complete details (source, availability, person/officers to be contacted, phone numbers, addresses etc.) is to be made available.

C) In the context of small-scale industries and other industrial clusters being promoted by the government, it is suggested that resources pertaining to DM be provided in proportion to the risks being assessed.

D) Mobilisation of resources from other districts/ states during emergencies needs to be built within On-Site and Off-Site plans.

E) Identification of infrastructural facilities for Off-Site responders for efficient management of industrial (chemical) disasters and transport emergencies is an evolutionary process in line with the economic and industrial growth of the country. The major guidelines for Off-Site infrastructure include:

i) Trained manpower, sufficient inventory of equipment (including PPE) and an effective communication system available with the police, fire, medical and other responders. Sufficient stock of antidotes and availability of beds in earmarked primary/secondary health centres/hospitals. Training of additional paramedics and ensuring their availability for emergencies.

ii) A well-laid road network around installations and minimum congestion.

iii) Minimising population sprawl around the industrial clusters.

iv) Efficient and leak/spill proof rail carriages/ wagons/sheds.

v) Facilities of good broadcasting, law and order control, evacuation transport, rescue and relief facilities, emergency shelters and assembly points to be identified/built up at district level in a time-bound manner.

vi) Development of medical capabilities for handling focused industrial toxic release.

vii) For road transport, identification and training of community leaders en route highways for further community training.

viii) Setting up of communication, and first-aid points en route highways and other roads commonly used for transport of HAZCHEMs.

ix) Augmenting of point-to-point ambulance services on highways.

4.2.3 Capacity Development

Capacity development requires the all round development of human resources and infrastructure for establishment of a well-focused and functional organisation and the creation of a supportive socio-political environment. Proper attention is to be paid in development of infrastructural facilities in terms of trained manpower, mobility, connectivity, knowledge enhancement, and scientific up-gradation for all stakeholders concerned with the management of chemical disasters. Capacity development is an important component of preparedness for the management of chemical disasters.

Special emphasis will be given to capacity development in the following areas:

i) Empowerment of DM authorities at state, district and local levels, with special reference to CDM.

ii) The regulatory agencies shall also develop their infrastructural facilities and technical expertise beside capacity building in pre-, during and post-disaster monitoring and analysis.

iii) Supported regulatory framework for gradual transition to self-regulation and public consultation.

iv) ERCs shall be updated to define basic minimum standards, and their number shall be commensurate with the vulnerable population in focus. Establishment of ERCs in highly industrialised areas/pockets shall be made mandatory under the CA (EPPR) Rules, 1996. The responsibility to establish and run the ERC shall lie with industry/ industry association. ERCs shall be integrated with medical, fire, civil defence, poison and other chemical detection laboratories, NDRF, SDRFs, police, traffic

police and other emergency responders and subsequently, the newly evolved integrated system shall be adapted into the district DM Plans. ERCs will also cater to transport emergencies involving HAZCHEM.

v) First responders shall be clear regarding their roles and preparedness for emergencies and must be suitably empowered.

vi) Specialised chemical facilities for the collection, identification, detection of HAZCHEMs need to be established close to chemical disaster-prone areas. Efforts shall also be made to develop their full capabilities.

vii) Dedicated/specialised transportation for different emergency services.

viii) Capacity building for medical preparedness is very crucial for the management of chemical disasters and, therefore, requires the commitment and full involvement of the present medical fraternity and available facilities. There is a need for substantially augmenting these resources to take care of mass casualties at various degrees of severity. Requirements include:

   a. A fully equipped ambulance van for the transfer of casualties is the primary requirement.

   b. Emergency mobile vans at all vulnerable locations.

   c. Specialised hospitals, poison and trauma centres all around the country.

ix) Availability of adequate technically trained manpower in industries.

x) Latest safety hardware, software and instrumentation.

xi) Emergency equipment required to deal with disasters will be procured on a shared basis in a notified industrial area.

xii) The CCR concept shall be promoted up to the district level and a wide-area network-based communication up to the central level will be established. The availability of trained manpower at such control units ensures effective handling during/following a disaster. Concepts like MARG and RC will be promoted at different levels to develop them as important aspects of the existing system.

xiii) Effective and simplified communication networks as a dedicated fail-safe communication system to the important stakeholders in the On-Site as well as Off-Site emergency plans shall be established.

xiv) Information databases and their public access and response system.

xv) The pilot study GIS-based emergency planning and response system for chemical accidents in MAH installations in major industrial clusters shall be developed into a national-level programme. The initiative needs to ensure the participation of all stakeholders starting from town planners, district authorities, institutes involved in DM planning to the corporate sector and national agencies involved in digital mapping etc.

xvi) The civil defence and home guards can be effectively utilised in chemical emergency management after some basic training. Their skill, functions and temperament are attuned for effective use in emergencies. An exercise in revamping the structure, functions and practises of home guards and civil defence, and redefining their roles in DM shall be carried out.

xvii) Procedures and actions for response agencies especially fire service, police, home guards, medicos, paramedics and community leaders needs to be updated.

xviii) The number and capabilities of poison centres shall be augmented. To start with, at least one centre each will be planned for each state. Ultimately, every district of the country will have at least one such poison centre.

xix) Expert institutional framework to deal with specific chemicals at every stage.

xx) Adequate training to trainers at industry, factory inspectorate, responders, district authorities and community levels.

xxi) Identification of professional bodies and employment of professionals and technocrats for critical safety evaluation of chemicals.

xxii) Specific research institutes working in the field of chemical sciences, CDM, toxicology, and related biological fields shall be identified and updated to perform research on newly introduced chemicals to produce viable MSDS (if not existing), ways of protection, antidotes against different chemical derivatives of the original compound, case studies at installation levels, development of skilled manpower that understands differences at the micro-research level that will be eventually used to develop a safety system. Dedicated R&D centres and other institutions will work within such an integrated system.

4.2.4 Awareness Generation

A well-informed community is an asset both for industry and local authorities. Rapport with the community creates tremendous goodwill for industry. Effective two-way communication contributes to proper understanding and prevents the probable conversion of a small incident into a potential disastrous event. A strategy for community awareness on HAZMAT is given in Annexure D.

Key suggestions include:

i) Select target groups with the help of district administration/DDMA and community leaders.

ii) Critical management teams at various levels responsible for community awareness need to be created.

iii) Mechanisms for surveillance, thereby identification of targeted community and mutual help groups/associations needs to be established.

iv) A standardised strategy needs to be adopted for identification of vulnerable locations, development of specific hazard information, warning mechanisms, simple basic advice sheets, family DM Plans, information and actions as a concerted response using all modes of media and promotional events.

v) The concept of 'Emergency Action Advice' shall be adapted into a standard format using graphs and pictures so that the illiterate population also understand the response portion of the DM Plans.

vi) Communication channels for community participation shall be established.

vii) Community awareness programmes shall be based on the best practises that have been successful in the recent past.

viii) The information provided will be simple, correct and need-based. The information to be passed on to the community should be properly perused and vetted by local district management establishments and a community representative shall be appointed by the crisis group/district administration/DDMA.

ix) Community awareness shall be regularly conducted by local organisations.

x) Ensure participation of designated Community Information Representative (CIR) by industry and DDMA in the generation of community awareness.

xi) Ensure periodical training of community educators.

xii) Create facilities of appropriate slogan display boards and audio-visual shows for sensitisation.

xiii) Local welfare associations and panchayati raj institutions will be included in the emergency preparedness programme.

xiv) Use of visual and print media for enhancing awareness among people regarding chemical disasters will be encouraged.

xv) Public awareness about HAZCHEM, their effects, dos and don'ts during an accident and remedial measures will form a part of community awareness.

xvi) The community will be educated on the urgency of action and immediate relief for clean water, food, hygiene, sanitation and shelter and the laid-down minimum standards.

xvii) All community awareness programmes will be conducted in coordination and partnership of authorities of district administration and industry.

4.2.5 Institutional Framework

An institutional framework for providing technical support services at various levels is a key requirement for sustaining proper development and implementation of the DM system. Industries shall extend help in training and building capabilities of responding agencies, and during an emergency shall provide their expertise, trained personnel and equipment.

i) It is necessary to identify and prepare a comprehensive list of national-level institutions to provide necessary technical inputs to different stakeholders:

a. Identification/establishment of institutions for the development of technology, processes, practises, procedures and other measures for improvisation in chemical safety.

b. Needs of these institutions shall be assessed and necessary resources including international technical inputs will be provided to them.

c. The states shall also ensure that the designated institutions in their states shall have sufficient resources to assume responsibility and continuation of work on chemical safety.

d. States may designate some institutions as competent authorities for different purposes such as for information exchange, or for some specific industrial chemicals with underlying purpose of improving their safety in manufacture, storage, transportation and import.

ii) A register of designated national and international institutions will be maintained and updated by the nodal ministry.

iii) These institutions shall be assigned:

a. To develop training modules (package of training courses) for trainers of different target groups that would be emulated by other identified institutions in the country for developing capabilities at different levels.

b. To develop an information exchange system.

c. To work on novel technologies and initiatives especially on the preparation of safety data for chemicals.

d. To focus on specific chemicals imported in the country for the purpose

of research and analysis in the quantities likely to affect human health and environment.

e. The post-disaster documentation by the identified bodies shall be done at national/state/district levels.

f. Comprehensive epidemiological study/ cohort studies on the effects of chemical disasters on the environment and public health will be carried out by these identified institutes in the disaster-prone areas so that baseline data is available for the development of preventive and mitigation measures.

iv) Indian industry associations and federations namely, CII, Associated Chambers of Commerce and Industry (ASSOCHAM), FICCI, ICC, Alkali Manufactures' Association of India (AMAI), etc., shall volunteer for R&D work and also for further transcending information to industries in augmenting safety measures.

v) The enforcement agencies shall be updated with the latest information technology. The software required for risk assessment/ consequence modeling shall be available to the nodal ministry/CCG, state authority/ SDMA and district administration/DDMA. Necessary training based upon latest scenarios need to be properly evolved and imparted to the respective officials.

vi) Liaison and rapport with International Institutions like the United Nations Development Programme (UNDP), UNEP and WHO need to be established to keep abreast with their R&D activities on risk reduction in the chemical industry and to study the adaptation of some of the studies in the Indian context.

vii) A large number of institutes shall be encouraged to increase the number of seats for grants of diploma in industrial safety. A network of designated national institutions shall be created for transparent and vetted conclusions. This would bring about uniformity and quality in the training system for the regulatory agencies, industry, consulting organisations and professionals, etc.

4.2.6 Networking and Information

An information and networking system will be developed as part of DM Plan at district, state and national levels, which will be regularly updated and manned round-the-clock. A framework sufficiently robust, yet flexible, shall be evolved to provide necessary information availability for all stakeholders.

i) The information networking system with the states and the districts needs to be established on a priority basis. All the departments concerned will have a control room as a part of the networking system.

ii) At the national level, India Disaster Resource Network (IDRN) is already functioning as a nationwide electronic inventory of essential and specialist resources including both specialist equipment and specialist manpower resources for disaster response. The IDRN shall be updated regularly in integration with the control room in the Hazardous Chemical Management Division at the MoEF. This will include a list of equipment and resources categorised by type and by the functions it performs. Contact addresses and telephone numbers of the controlling officers-in-charge of the said resources will also be included and updated. Except for some critical data, the rest will be available for public access.

iii) An exclusive CDM website needs to be developed and maintained by the nodal ministry, states and districts that will

contain comprehensive databases on HAZCHEM used nationally and internationally. Data shall also be available on important subjects like regulations, side-effects of HAZCHEM and their antidotes. The website shall also be accessible to the industry and public at large.

iv) Hazard analysis in industrial pockets is already operational, on-going and supported so that it can be completed in a time-bound manner. The existing data and new data that emerges will be used in drafting the new and updated district DM plans.

v) MARG at the industry level will also be part of the networking system with industries and state/district authorities.

vi) Print and electronic media require awareness and education for information transfer to the community. SOPs and a code of ethics for print and electronic media is necessary for a disciplined, structured and panic-free approach for quick communication to the community of any disastrous event and its immediate consequences. The media shall play a supportive role especially for:

   a. Mobilisation of resources.

   b. Dissemination of useful information that can help the community in managing the effects of disasters.

   c. It can provide information about relief and rehabilitation measures, medical support sites and other functions so that the sufferings are minimised and people receive latest information about their relatives and friends amongst the disaster victims. The entire exercise shall be done without encroachment on the independent functioning of the press and media but for curbing rumours and provocative statements.

vii) There is a need to develop a regular programme or a dedicated emergency channel for the quick flow of information to the community.

4.2.7 Medical Preparedness

Medical preparedness will include the recognition of the impact of chemical disasters, and shall focus on injuries, illness and public health problems including psychosocial trauma that results in their wake. It shall address integration of medicine and public health with On-Site and Off-Site emergency plans, and crisis management at the hospital. Medical preparedness shall also address the necessity of planning and practise, exercises involving local, district, state, central government and voluntary agencies. It must include problem solving, based on the past experience of disasters. Employee State Insurance Corporation (ESIC) hospitals will also play an important role in the medical management of chemical disasters. Medical preparedness shall address the following facets:

A) Creating Awareness

All medical and paramedical staff shall be made aware about the type of illness, injuries, burns and other health problems caused by various toxicants and their preventive prophylactic and therapeutic measures. Awareness programmes will also be conducted for the employees of the industry and community in the vicinity of the chemical industrial installations and storage.

B) Creation of Trained Specialised Medical First Responders (MFRs)

Adequate medical and paramedical staff shall be trained in first aid and resuscitation measures as an essential component of On-Site and Off-Site emergency plans and for transportation emergencies. Specialised MFRs of the NDRF and

the SDRFs shall be trained and kept ready to supplement paramedical teams of the district administration/DDMA and other authorities responsible for the medical management of casualties. All members of the medical and paramedical staff team will carry out regular mock exercises based on the specific SOPs prepared for chemical casualty management.

C) Creation of Decontamination Facilities

Decontamination facilities need to be created in the On-Site and Off-Site emergency plan of MAH units. A mobile decontamination facility including a personnel decontamination vehicle and site decontamination vehicle also needs to be created so that it can be readily available to move to the site of incident.

D) Uniform Casualty Profile and Classification of Casualties

Medical officers will design a prototype of casualty profiles and their antidotes, based on the type of toxicants. A uniform profile will also be made for secondary injuries so that the treatment can largely be standardised.

E) Risk Inventory and Resources Inventory

A list of all the toxicants and their hazardous effects on the health and environment must be prepared at all levels for medical management plans both in On-Site and Off-Site plans. Inventory of antidotes, other prophylactic/therapeutic measures and medical equipment shall also be prepared and stocked at the hospitals. Data on chemicals being used and their antidotes shall be made available to the patient evacuation authority and also in the hospitals which are required to treat the victims. All the identified hospitals would have adequate stock of PPE including respirators.

F) Plans for Evacuation

A patient evacuation plan with a flow chart must be made, keeping the meteorological conditions in view. The plan will be further strengthened by creating an adequate number of ambulances/specialised ambulances fitted with resuscitation equipment to maintain vital parameters during evacuation. Resources for special ambulance helicopters, ambulance trains, etc., will be strengthened at all levels and a proper resource inventory will be prepared for the purpose. The ambulance shall have SOPs for treatment procedures and a list of specific antidotes. Acute health risks must be defined and known to paramedical staff, who are accompanying the patients in the ambulance. Vital parameters (like pulse, blood pressure and respiration) and intravenous drips of disaster victims shall be monitored and maintained during their transfer to hospital. It is essential to emphasise that medical persons at the site shall be used for their expertise, and activities like search and rescue, fire and chemical fighting shall be done by civil defence, fire services, police, NDRF, SDRFs and other stakeholders.

G) Proper Chemical Casualty Treatment Kits

A kit containing antidotes to various toxicants and resuscitation drugs need to be prepared. Gudel airways are one of the essential components of the kit. The concept of a mobile lab is required to be introduced in the long run so that the type of toxicants and their by-products can be identified at the site itself. Knowledge of the exact nature of the chemical will facilitate proper antidote administration and effective treatment for early recovery.

H) Crisis Management Plan at the Hospitals

A crisis management plan will be prepared by all earmarked hospitals. The responsibility for preparation and implementation of the plan lies solely with the medical superintendent of the

hospital. Establishing decontamination facilities, training medical personnel, creating awareness of toxicants and their antidotes and collection of biological samples like blood, urine (to be frozen) shall form part of the crisis management plan. A decontamination room is to be established in the hospital. All chemical casualties have to be taken first to a decontamination room. Stocking and turnover of antidotes needs to be maintained. A specialised laboratory for chemical analysis is to be established at the state level. A contingency plan is to be made ready for bed expansion. Wards must have bio-waste disposal facilities also. All earmarked hospitals would have a hospital disaster plan specifying the roles and responsibilities identified for managing chemical disasters. This shall include identification of a hospital incident command system, the command nucleus, the quick response teams, etc. The contact details of the members of the command nucleus and quick response teams, shall be available with the medical superintendent and district administration/DDMA.

A group of specialists like neurologists, hematologists, gastroenterologists, chest physicians, ophthalmologists, reconstructive surgeons and dermatologists must be fully trained to handle immediate and long-term effects of chemical disasters. Paramedical teams must also be trained to provide nursing care to chemical casualties. A sufficient quantity of medical stores i.e., antidotes, antibiotics, other drugs and life-support system/equipment must be available at the hospitals. The availability of oxygen, continuous positive air pressure (CPAP), ventilators, dialysis facilities, blood and IV fluid for transfusion must be stocked. Hospital staff shall also be trained for the accurate accounting of morbidity and mortality data. The medical superintendent must be able to forecast the enhanced numbers of doctors and paramedical staff required at the time of a disaster. The state will identify at least two hospitals which would be strengthened to cater to chemical disasters. These facilities would be extended over a period to all districts, the districts with clusters of MAH units shall be given priority. The identified hospitals will have detection, protection and decontamination equipment, and indoor beds to treat at least 50 victims including 10 critical beds in intensive care units exclusively maintained for such a purpose, strictly following proper isolation/ air barrier protocols.

The identified hospitals will develop proper facilities for disaster victim identification and management of dead bodies.

I) Mobile Hospital/Medical Team

The mobile hospital/medical team shall be trained in the health-care delivery system of the district administration/DDMA to manage patients with minor injuries at the incident site and will evacuate only those patients requiring hospitalisation. This will not only provide prompt medical care but will also relieve the pressure from the hospital. The capacity of a mobile hospital depends on the magnitude of the disaster and population to be treated.

J) Preparedness for Public Health and Environmental Effect Response

i) Preparation of a toxicology database with information on specific chemicals.

ii) Availability of information on diagnostic facilities, general and specialised treatment facilities, specialised sources of expertise.

iii) Information on specific antidotes and other medication and where they are stockpiled must be made available.

iv) The public health response team consists of a physician, toxicologist, environmental specialists, public information experts, community and medical representatives.

v) Awareness about safe water, standards of proper hygiene and sanitation, availability of food and nutrition.

vi) Poison control centre shall be strengthened.

4.3 R&D

R&D is mandatory to revisit, revise and update information at regular intervals, to capture the knowledge at national and international levels, and provide it to the different stakeholders involved in CDM. This is also applicable to:

- updating of equipment
- industrial technologies
- need-based equipment
- knowledge about newly emerging toxicants and their clinical management.

Continuous R&D activities in the area of CDM system are needed. This can be achieved through participation in national and international conferences, consultation with technical and professional bodies and making arrangements to impart this knowledge to different stakeholders.

In view of the above, the nodal ministry will ensure the R&D activities to be incorporated at all levels by establishment of research activity cells i.e., national/state/district levels including industry and other stakeholders identified in Off-Site and On-Site DM Plans. These activities shall include:

i) Consultation with advisors, consultants, and young researchers/trainees/research fellows for keeping a track of national and international developments.

ii) Appropriate feasibility and regular studies to capture the knowledge base and advise the authority.

iii) Critical analysis of technology initiatives and development of need-based technologies for detection, protection (including for improving PPE so as to make it suitable for Indian tropical conditions), monitoring of common toxicants and their effective management shall be given top priority.

iv) These knowledge workers shall be encouraged to interact with other subject experts by participating in national/ international workshops, meetings and symposia and training courses so as to apprise them of the latest happenings.

v) Good laboratory practises shall be established.

vi) Special need-based courses could also be drawn up with the help of professional bodies and advance teaching/training institutes in India and abroad.

vii) The pace of scientific research in the areas of technological information, results of hazard and risk assessments, socio-economic methodologies and the tools to develop and apply science-based standards, harmonised risk assessment and management principles needs to be accelerated for improving chemical safety management systems. The approach may provide for more efficient use, substitution by less hazardous chemicals, in a time-bound programme.

viii) The R&D approach, in-house at industrial level and through sponsored work at the institutional level requires to be augmented with designated R&D institutions functioning independently to generate and provide material safety data which has withstood scrutiny. The financing of such institutions shall be partly allocated by central and state government funds through environmental levies, viz., cess, environmental funds, consent and testing fees etc., and partly by industries.

ix) IITs, Indian Institutes of Management (IIMs) and other engineering and management colleges/institutions which are actively taking up industrial projects will be encouraged to open up separate facilities for R&D on safety aspects of chemicals/ processes.

x) Pilot projects can be undertaken for newly emerging toxicants (produced

directly or as by-products) and to test the new technologies developed in India or abroad.

xi) Customise and validate computer software by professional organisations.

xii) Develop safer and cost effective alternative technologies for operations.

xiii) Research activities could also be extended to the field of nanotechnology-based biosensors and development of newer biomarkers for detection of exposures (metals, pesticides, other chemicals and conjugates), effect (alteration in enzyme activity, molecules, receptors) and susceptibility (levels of enzymes involved in metabolism of chemicals, receptors and other chemicals).

4.4 Response, Relief and Rehabilitation

Disasters of major dimensions require prompt and effective response mechanisms and dedicated operations of long durations for relief and rehabilitation. A coordination between national, state, district bodies, institutions and industries to develop an integrated teamwork is a key component of relief and rehabilitation measures. Rehabilitation will be comprehensive and will take into account all the measures that will lead to normalcy in relation to financial, education, shelter, social and health aspects. All the states/districts shall address adequately the standards of relief and rehabilitation and the funding strategy for continued development and implementation of mitigation practises at the local level. It is essential to have a unified relief policy for all DM Plans (natural or man-made) at national, state and district levels that is updated from time to time.

4.4.1 Important Elements of Response

Efficient and quick response to disasters depends upon the state of preparedness of all the stakeholders of On-Site and Off-Site emergency plans. The response activities shall be a multi-hazard concept so as to minimise the impact of the disaster in terms of life, environment and property. In the case of CDM, it becomes specific in some areas.

i) It is essential to classify the disaster on the basis of magnitude of probable severity and level of control required, i.e., Level 0, Level 1, Level 2, Level 3:

   a. Level 0: No disaster situation. This is the level at which surveillance, preparedness and mitigation activities must be carried out.

   b. Level 1: A district level disaster, within the capabilities of the district administration to deal with.

   c. Level 2: A state level disaster, within the capabilities of the state government to deal with.

   d. Level 3: A National level disaster, requiring major direct intervention of the Central Government.

ii) The response plans shall be based upon the level of disaster and SOPs shall be available with all emergency support functions in accordance with the level of disaster and shall be clearly mentioned in the district DM Plan.

iii) In addition, it is recommended to define the alert, local area emergency, general emergency and the indicators for notification of any event that is unusual. A well-established signal/warning system along with the declaration of emergency and the emergency activation pathway to be adopted according to the level shall be in place to develop the preventive strategies at the installation site, Off-Site areas and transport emergencies etc. The alerts and indicators should be integrated into the response plans at different levels.

iv) The community acts as a first responder in all hazards but in the case of CDM, the community must be made aware that the issue of specialised self-protection is required to be addressed. Thus, community-level awareness and training programmes can save a number of lives in real-time scenarios.

v) Quick mobilisation and reaction of first responders for search and rescue, medical emergency response, fire and other activities are the major components that shall be worked out at a micro level in the risk zones of industries.

vi) An incident command and technical coordination system for specific disastrous situations shall be identified, made available, tested and incorporated in the district DM Plan.

vii) Emergency response activities, incident reporting protocol, incident verification and assessment, indicators about declaration of emergency, role of emergency support functions, systems that give an indication about the end of an emergency, general guidance procedures, functions to be performed by different emergency control rooms, communication by identified experts and action by authorities in accordance with the level of alert etc., will also be clearly mentioned in the DM Plans.

viii) Communication back-ups shall always be available with different stakeholders including an alternate wireless-based communication system and satellite system.

ix) The various response agencies including fire, police, NDRF, medical authority and other stakeholders shall have their laid down detailed response procedures on their role and responsibilities, infrastructure, manpower, prevailing practises and other related logistics. They shall have their emergency management plans integrated in the district/local emergency plan in advance.

x) The district authority will ensure the availability of relief material (including medical relief), rescue and search, medical teams and integrated approach with the prompt response of various responders and other services. The inventory of all emergency logistics shall be made available on the web by using the IDRN database.

xi) Specific SOPs will be prepared for safe translocation of population if the intensity of the disaster needs complete evacuation. While preparing SOPs, care shall be exercised to maintain a balance between the probability of occurrence of panic and promptness in response.

xii) The civic responsibilities including identification of victims, safe disposal of dead bodies, preventing the spread of contamination and post-disaster psychosocial care shall also be dovetailed into the practise of various responders.

xiii) The response plan will also include security and safety provisions. Development of infrastructure including EOCs, control rooms and other networks and training of specialised responders, equipping them with latest state-of-art equipment and rehearsing their activities via mock exercises/drills are the key issues for preparedness for an effective and prompt response.

xiv) Establishing the minimum time taken for corrective action by physical presence and operation of designated mobile hardware, equipment and manpower of trained industrial personnel and other first responders.

xv) Response time is different for different industries depending upon many factors including lethality of chemicals and micro-meteorology of the region. However, an attempt shall be made to bring down the response time to a practical minimum duration. One such tool is mock drills and development of a healthy competitive pro-active approach for safety among industries.

xvi) Testing of response plans by mock drills on the basis of a pre-calculated response time in the DM Plan, the response procedures of authorities/team members will be checked by conducting regular On-Site and Off-Site emergency drills.

xvii) The role of press and electronic media shall be integrated in a disciplined manner so as to help in developing an effective alert system, evacuation plan, public guidance and dissemination of disaster-related screened information to avoid unnecessary panic.

4.4.2 Emergency Medical Response

Emergency medical response plans will be incorporated in all On-Site and Off-Site plans for prompt medical care. Adequate infrastructure for trained medical and paramedical staff along with SOPs for chemical emergencies shall be ensured. Existing poison control centres, poison information centre, Environmental Information System (ENVIS) centres and ERCs shall be adequately available in close proximity to the disaster-prone area and obligatory capacities should be built.

A) Emergency Medical Response including, Rescue, Relief and Remedial Measures

In case of chemical disasters, the crisis management at hospital shall be immediately activated by triggering inbuilt mechanisms for prompt emergency medical response. The steps taken in the first few minutes will determine the effectiveness of disaster mitigation. Quick Reaction Medical Teams (QRMTs) with PPE will reach the accident site immediately along with resuscitation, protection, detection and decontamination equipment and materials. Resuscitation, triage and evacuation work must be done as per SOPs. In hospitals the disaster victims shall be decontaminated and kept in a clean special ward. Initially, based on early symptoms, the type of chemical is assumed, symptomatic treatment initiated and an antidote administered. Blood is then analysed to find out the exact chemical agents and further course of treatment is decided. All supportive treatment must be given in the hospital immediately. The hospital casualty room should be well-equipped with resuscitation equipment like oxygen cylinders, suction apparatus, airways, laryngoscopes, ventilators, pulse oxymeters, defibrillators, life saving drugs, antidotes, auto injectors and dressing material.

B) Post-disaster Public Health Response

This is one of the prime responsibilities of the medical authorities. They must ensure availability of safe water supply and clean food along with maintenance of hygiene and sanitation by proper bio-waste disposal. Water testing and food inspection must also be carried out before consumption.

C) Post-disaster Documentation and Research

These documents will be prepared by a medical administrator. During response in hospitals an information centre will provide information to the public, to relatives of victims, and media. This will include warning guidelines, dos and don'ts, and the status of patients in the hospital. Dissemination of information to electronic and print media will also be carried out by the medical teams. Documentation, lessons learnt, follow up and research programmes should be used as feedback for future improvement. A research analysis is

required to find out the success and failure of the DM Plan. A pilot study is to be carried out to understand the causes of failure that need to be addressed in future plans.

D) Medical Response to Long-term Effects

The knowledge creation of long-term effects on the exposed population will help in the management and prevention of disease. In the post-disaster scenario some of the casualties will develop sequels due to chemical injuries. These cases may need regular follow-up, medical care, reconstructive surgery and rehabilitation. Close monitoring is required to identify and treat long term health effects like blindness, interstitial lung fibrosis, genetic disorders and neurological deficiencies etc.

4.4.3 Relief and Rehabilitation

i) Immediate provision of relief to affected people in cash and kind for the loss of life and property, shall be done in a sensitive manner to assuage the feelings of sufferers.

ii) Establishment of properly documented procedures for economic, social and medical rehabilitation.

iii) Judicious use of allotted finance for achieving optimal social and economic rehabilitation.

iv) Rehabilitation at alternative locations is necessary for temporary/semi-permanent dwellings.

v) Reconstruction and restoration of infrastructure shall be achieved at the earliest. The restoration of normalcy and day-to-day functioning is an important factor for consideration. Infrastructure for the long-term follow-up of surviving victims is an essential measure. The strategies will be adopted keeping the same in mind.

vi) Under the Public Liability Insurance Act, 1991, MAH installations are required to take third-party insurance policies for providing relief to accident victims due to a chemical accident On-Site. The Act also provides for an Environment Relief Fund (ERF) to accident victims and enables payment of relief over and above the insured amount. The MAH units pay an amount equal to the premium to the ERF. The implementation of the Act needs to be strengthened. Statutory provisions shall be strictly implemented. Further, the insurance sector will be encouraged in strengthening the transport emergency management effort by providing statistical information and financial support. For vehicles carrying HAZCHEMs, special insurance provisions for driver, attendant and vehicle will also be evolved.

vii) The district administration/DDMA will also evolve an appropriate mechanism to provide compensation to non-governmental people including the community, if they are injured during any humanitarian activity.

viii) Medical Rehabilitation.

The psychological impact of a chemical disaster manifested as psychosocial trauma including psychological reactions, post-traumatic stress disorder and other psychological ailments in displaced disaster victims, needs to be addressed. Counseling by psychologists and psychiatrists for those suffering from mental trauma is an essential element of medical rehabilitation.

The relief and rehabilitation measures will be prompt and best achieved by the collective and constructive action of all stakeholders.

4.5 Guidelines for CDM at State and District Levels

Disaster events are normally faced by districts and if the level of accident is high, then states and

the centre have to step in to mitigate the disaster. At the state level, the preparedness measures shall be adopted and implemented in a similar fashion to that at the centre. State DM abilities shall be self-contained as far as possible, to tackle chemical disasters in an effective manner. The Guidelines issued by the NDMA in terms of function, finance and various activities will be integrated into the state DM Plans. It is necessary on the part of the state to safeguard the community in all aspects and by all means from any unexpected emergency.

Broad guidelines for state functioning include:

A) Preparation of State DM Plans

i) The plans will be prepared in accordance with Section 23 of the DM Act, 2005.

ii) The risk reduction framework shall be prepared on the basis of dynamic quantitative risk assessment of multi-hazard components of disasters using different methodologies.

iii) The State Plan shall indicate the measures and corresponding funding strategy for all the components of the DM cycle.

iv) Chemical risk-based micro zonation of states will prioritise the areas for capacity development during each phase.

v) The State Plan is based upon the all-hazard approach and its superimposition, with a development strategy to be adopted for the future.

vi) The definite pre-, during- and post-disaster plans shall be prepared and integrated on the basis of probabilistic simulation models of chemical disasters.

vii) The State Plans will identify the roles and responsibilities of each stakeholder involved in different disasters and the experts/ resources available in the same or neighbouring states. Schedule 5 of the MSIHC Rules, 1989 (amended in 2000) specifies the roles of authorities and emergency services. Annexure E illustrates the important roles and responsibilities of a few stakeholders in CDM.

viii) The State Plan shall give specifications about the large scale procurement of various DM equipment like HAZMAT vans.

ix) The State Plan shall be practical in approach, community-centric and regularly updated to fill the critical gaps.

B) The state shall ensure that strict regulations will be in place and shall be implemented in an effective manner such that a balance between industrial growth and protection of community and environment from the short and long-term consequences of this expansion can be met.

i) Industries select various sites for putting up their operations after critical evaluation of a number of parameters like proximity to natural resources (raw material, mineable ores, agriculture produce, bio-mass, etc.), power and water availability, assimilative capacity of the environment and infrastructure development, besides the proximity to large markets for finished goods. Chemical industries have to conform to a number of fresh guidelines for establishing their units at a particular location, including carrying out comprehensive environment and risk impact assessment studies for safeguarding the population in the vicinity during normal operations, or in the case of accidental toxic release. Industries also prepare Emergency Management Plans (EMPs) and Disaster Management Plans (DMPs) for continuously improving the operation with regard to environmental and safety criteria. States will ensure all these criteria have been met prior to establishment of a new industry.

ii) A state must also ensure that once the industry has been allocated a site, population clusters will not occur in close proximity to these industries.

iii) The states need to develop a strategy based on PPP for the development of buffer zones all around the industry in an effective manner and establish Off-Site responding agencies at an appropriate distance from the new installations.

iv) The state has to direct the district administration to monitor the safety provisions including the emergency medical response components at the new installations and also support the district financially to develop Off-Site safeguards.

v) It would be ideal to relocate the existing industries especially the MAH units away from proximate inhabitants though it may not be feasible in all cases. The alternative is to relocate the population settlements and if this is also not possible, the safety-related provisions to improve environmental and safety systems will be developed to minimise the impact of the industrial operations on the external population.

C) States need to spell out the specific areas of concern on safety measures within the industry and thereby formulate stricter DM Plans. Some of these guidelines at state and district levels include:

i) Process safety code of management practises based on principles of safety in design according to sound engineering practises; built, operated and maintained properly and periodically reviewed for conformity.

ii) Process safety, an interdisciplinary effort has four elements: management leadership, technology, facilities and personnel (including community). The practises include process safety from the design stage through operation, maintenance and training. Safe On-Site storage of chemicals is an essential element of process safety which also provides for transparency in documentation and installations and recognises communities interests for their participation.

iii) Management leadership is provided through policy, participation, communication and resource commitments in achieving continuous improvement of safety performance. Audits for compliance, measurement of performance, implementation of corrective actions; investigation, reporting and follow up of each incident are important elements.

iv) Similarly technology, facilities and personnel provide for periodic safety reviews, complete documentation, upgradation and identification of knowledge and skills of plant personnel necessary to perform each job.

v) States have also to formulate guidelines on transportation, storages and in all other identified areas under the national guidelines for instituting self-regulation models in industries with the help of knowledgeable and experienced personnel available with the regulatory bodies and the expert institutions. Monitoring at the state level for On-Site and Off-Site safety provisions would continue to be looked after by designated regulatory agencies through their technical personnel with the help of a well-prepared check list/audit format. Review of progress of implementation of the guidelines at all stakeholders' level shall continue along with continuous technical and strategic discussions, and exchange of information.

vi) States shall strengthen ERCs at state, district and local levels as well as crisis

groups for effective functioning by providing full-time technical personnel, software and hardware for 24-hour monitoring and providing assistance during On-Site and Off-Site emergencies in a more focused and planned way. All these groups will have MSDS on all HAZCHEMs (both in soft and hard copies) listed in the MSIHC Rules. Investment in manpower, equipment and other facilities for the crisis groups, important responders to the emergencies and the community (for temporary and permanent relief, rescue and rehabilitation) shall be made through a well-planned time-bound programme, so that after the final implementation no gaps exist. The role played by the state authority/SDMA and district administration/DDMA shall be well understood and communicated to all concerned in the industry, ERCs, crisis groups and state, district and local authorities for their maximum contribution and coordination.

The success of the guidelines and DM Plans for prevention and management of chemical disasters depends on constructive action taken at local and district levels in activities including planning, budgeting, training, institutional support, infrastructural development, management of emergencies, relief, rescue and rehabilitation, jointly by industries, district authorities and the community as a whole.

The state will allocate the funds judiciously based upon a mission-mode approach to achieve the targets in a time-bound manner in different phases of development. The micro functioning of the state plans can be inferred as the district DM Plans. It shall specify all the recommendations indicated in the state system in an implementation pattern. DDMA has been empowered by the DM Act, 2005 and also given the responsibility to prepare themselves to respond to any disaster.

4.6 Preparation of On-Site and Off-Site Emergency Plans

Essential elements of the framework of the On-Site emergency plan shall be kept in mind while designing the DM Plan. The pre-defined framework would be useful for a medium to large-scale industry. The framework may be modified depending upon whether it is a small-scale unit or mega-scale complex. A summary of a few suggested elements of an On-Site Emergency plan is given in Annexure F. Every On-Site emergency plan will have a section for use in preparation of Off-Site emergency plans (Annexure G).

The district emergency authorities have a statutory responsibility for the preparation of the district Off-Site emergency plan based on inputs from the On-Site emergency plans of the industries in the district/industrial pockets. The district collector is required to prepare and update the Off-Site emergency plans for the industrial pockets. However, in practise they are not made by involving all the stakeholders including the community. A process of discussion with all stakeholders represented on these bodies, for consensus to develop an appropriate Off-Site plan for proper execution during an emergency is essential.

The Off-Site plans are made with varying contents and structure although some guidance is available from the contents provided as a schedule[1] to the MSIHC rules, 1989, as amended till date and in the form of a guideline[2] that has been prepared under the CA(EPPR) Rules, 1996. The plan exists mostly on paper, to satisfy the legal requirements. There is no standard format available at the national level for the structure of the Off-Site emergency plans. Medical emergency plans as an integral part of the

[1] Schedule 12 to The Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 amended till date.

[2] A guide to the Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996 and On-site and Off-site Emergency Plan, WHO, 2001.

Off-Site emergency plan have not been addressed in either of the rules mentioned above. The following approach needs to be kept in mind while standardising the Off-Site plans:

i) Standard structure of the Off-Site emergency plans shall be developed at the national level by referring to the above stated Rules.

ii) The aspect of the medical emergency plan being an integral part of the Off-Site plan, shall be addressed appropriately. The nodal ministry (MoEF) with the help of the Health Ministry shall strengthen the infrastructure facilities and improve the response time to best achieved standards.

iii) The plan is needed to be practical, based upon management of the scene and shall encompass issues of hot, warm and cold zones.

iv) The plan shall specifically spell out the basis of scenarios and there will be no confusion in deciding maximum credible loss scenarios or worst case scenarios. Risks shall be dovetailed with the risk scenarios of the district Off-Site plans so that the plan has practical implications.

v) There shall be a specific provision to specify the criteria of safe zone/buffer zone/ Land-use pattern around the industry. Preferably, the buffer zone shall be maintained by the hazardous industry itself and these points will be considered as an interface between the Off-Site and On-Site plans.

vi) Certain industries located at the boundary/ overlapping boundary are generally over-looked due to overlying responsibility. Thus, clear-cut responsibility shall be assigned to the district administration for such units.

vii) The preparation of these Off-Site plans will have a time-bound schedule and time will be given to a district to prepare them depending upon the number of industrial clusters, vulnerability and population size involved.

An Off-Site emergency plan consists of the following broad elements:

- Identification of hazards and hazard analysis.
- Concept of operations.
- Proper and detailed hazard analysis is the starting point for an Off-Site emergency plan. Off-Site emergency plans are based upon the On-Site emergency plan of the MAH unit. A summary of the results of hazard analysis of the scenarios having Off-Site consequences along with templates shall be included in the plan.
- Emergency response procedures Including procedures for quick response to medical emergencies, transport to assembly points/shelters, evacuation, temporary/final rehabilitation and relief, both physical and medical.
- Training.
- Infrastructure and resources.
- Details regarding the following shall form a part of the document:

    a. Site-specific data such as geographical features, meteorological data.

    b. Demographic data.

    c. Description of MAH installations, likely accident scenarios and other relevant information.

    d. Summary results of release consequence calculations along with the use of templates.

    e. Important telephone numbers.

    f. Resource directories.

All the emergency plans (On-Site, Off-Site and medical emergency plans) shall be perfectly dovetailed so that the critical response time under each plan immediately complement each other, helping in minimising impact and suffering in case

of Off-Site emergencies. The following guidelines are suggested to improve the implementation of emergency plans:

1. The existing LCGs/DCGs will be empowered by providing a separate budget allocation, manpower, infrastructure, communication equipment and other resources. When new industries are approved, the state must upgrade the DM Plan to be commensurate with the additional risk and requirement.
2. Database availability and updating in the control room is to be improved.
3. The infrastructure facilities and management structure for the control room/ CAS will be strengthened.
4. A system for flow of information in the nodal ministry and from the accident site in the states shall be detailed and documented.
5. Every Off-Site plan shall also lay down provisions for the management of waste generated due to disasters related to transport accidents and industrial events. It is necessary to dovetail the associated risks and evolved mechanisms to handle such hazardous wastes.
6. Mock drills shall be conducted regularly for evaluation of all the above aspects. The responsibility to conduct mock drills shall be fixed on the chief coordinator of the district administration/DDMA.
7. In Off-Site emergency plans covering the coastal authorities, the port authorities will also be an effective member of the team.
8. There should always be an alternative nodal officer for emergency support function units in the Off-Site plan. In addition, a ready reckoner of each department's role in brief will help the concerned staff in better understanding of their role.

5 Guidelines for Industrial (Chemical) Installations and Storages

5.1 Industrial (Chemical) Installations

A prime area of concern is the strengthening of the industrial systems for the prevention and management of chemical accidents. Such provisions shall be established to continuously re-engineer (improve and upgrade) the system. As a part of government policy, it is envisaged that the present regulatory inspection and monitoring framework will evolve measures to encourage self-regulation, public consultation and PPP. These activities would develop credibility at all levels.

The important guidelines are listed below:

5.1.1 Good Engineering for Safety

This is applicable for the prevention and minimisation of all disasters—both man-made and natural. In the context of industrial disasters, good engineering is the first step in achieving safety. The setting up of new industries by an occupier shall be done in consultation with the state inspectorate, considering all parameters including geographical, seismological, demographic and environmental factors. The process engineering and control including detailed evaluation at the design stage are essential inputs for safety.

Engineering methods to control hazards include:

i) Change of processes: to shift to less hazardous processes.

ii) Change of material: to shift to less hazardous material.

iii) Change of equipment: to replace machinery before the expiry of residual life.

iv) Detailed engineering of each equipment under requirement, capacity, specifications and regular maintenance of history sheets for fault analysis.

v) Regular testing of critical equipment/ storage vessels through non-destructive testing (radiography, thickness survey, hydraulic testing etc.).

vi) Isolation and enclosures: Storages will be isolated and enclosed to minimise the impact of weather conditions (heat radiation, thermal and cryogenic stresses) and will be directly connected to containment including Waste Air Destruction (WAD) systems.

vii) Hazard and Operability Study (HAZOP) and Hazard Analysis (HAZAN) studies for early identification of hazards; regular structural audit.

viii) Management Information System (MIS) is a significant area for monitoring at the management level. It is divided into three categories:

a. Checking normal day-to-day operations; compliance of statutory requirements; monitoring reports; and reporting of exceptions to the top management.

b. This deals with emergency control systems (chemicals and fire contingency plans), training and retraining of employees, transporters, drivers and cleaners, stockists, distributors, retailers, community

leaders, consumers, first responders—the police, fire services, home guards, civil defence, NDRF, SDRF and medics/paramedics. This also covers HAZOP/HAZAN studies, regular appraisal and updating.

c. Provision, maintenance and regular upgrading of safety including PPE; maintenance of daily check charts of PPE, work permit system (including stoppage, start-up chemical manufacturing/storage equipment hardware).

5.1.2 Accident Reporting, Investigation and Analysis

i) The basic concept is the 'Principles of Examination'. The examination will aim at identification of operational difficulties, fault in design, and inspection procedures after an accident.

ii) There is a need to synthesise a prediction model that can spot problems/difficulties prospectively as well as retrospectively.

iii) To identify principal causes of accidents or near misses.

iv) To identify deficiencies in the process/operation/hardware/instrumentation.

v) To find out and critically evaluate unsafe practises requiring correction.

vi) To find out and finalise needs for engineering revision.

5.1.3 Safety Promotional Activities

Accident prevention needs proactive and reactive participation of all activities like:

i) Installation of sensors and monitors, their regular maintenance and calibration at the plant perimeter to trigger alarms to the plant personnel as well as public.

ii) Safety competitions, exhibitions, film/video shows, seminars, debates.

iii) Celebration of Safety Day/Week.

iv) Safety hoardings at strategic points.

v) Frequent visit to other model industries.

vi) Institution of chemical safety award system.

5.1.4 Other Areas of Attention

Efficacy of safety systems shall be checked daily and listed with special emphasis on the following:

i. Provisions of two-to-three tier safety.

ii. Early-warning system.

iii. Two-to-three tier power back-up system for safety of equipment/provision.

iv. Start-up and shutdown procedures.

v. Daily exceptional reporting for top management based on status of full preparedness/compliance according to latest internal safety audit; internal audit highlights; high accident potential jobs, actions or conditions to be dealt on priority basis. The audit shall indicate shortfalls according to accident potential.

vi. Best maintenance and preventive maintenance practises.

a. Regular improvisation of safety systems based on global success stories.

b. Toxicology (complete MSDS as ready reckoner for warnings/ instructions).

c. Mock drills of warning alarm systems.

d. Instrumentation.

e. Written down preventive maintenance and breakdown maintenance practises and check listing of each on a daily basis.

f. Regular (daily basis) trials of stand by systems.

g. Key points to be kept in mind while setting SOPs for safety include:

   1. Use of danger and information tags.
   2. No substitutions of tags from one another.
   3. Information or instruction tag shall be used to convey special instructions for the equipment.
   4. The instruction tag shall not be used where a danger tag is required to identify a particular equipment as that equipment, if operated can cause an accident.
   5. The operator/shift officer shall assume responsibility for the use and removal of danger tags.
   6. Locking out of chemical plant equipment.
   7. Colour codes will be devised for locking.
   8. All locks will be placed on a breaker with a process until work is completed.
   9. The principle of isolation of equipment under maintenance repair without exception.

Based upon the actual inventory of HAZCHEM, adequacy of the preparedness and response is required to be established in the plant. It is essential to develop the DM capabilities both within the plant perimeter and in the vicinity on the basis of the dynamic quantitative risk assessment analysis. Meteorological data like wind direction shall be either obtained from concerned functionaries, or generated in-house for the proper management of chemical emergencies.

The best engineering practises practised the world over like those followed by the American Society of Mechanical Engineering (ASME) and others shall be modified and adapted in the Indian context under the authority of the BIS. Some of the major features of chemical safety procedures practised are shown in Annexure H for ready reference.

5.2 Storages

The storages of HAZMAT in an installation, or isolated storages are major sources of chemical disasters. The existing legal regulatory requirement provided through The Petroleum Act, 1934 and The Explosives Act, 1884, the Static and Mobile Pressure Vessels (Unfired) Rules 1981, the Gas Cylinder Rules, 2004, the MSIHC Rules, 1989, and the Factories Act, 1948, and various rules framed by the states give comprehensive guidelines to all installations and storages for the purpose of maintenance and operation of storage, tank farms and vessels. However, there are some glaring gaps with regard to safety, containment and neutralisation of toxic spill and release at the installation and storage site. Necessary provisions need to be enacted for fail-safe safety measures.

Important guidelines for installations and isolated storages are:

i) Factories/Storages having Off-Site consequences need to be treated at par with MAH factories in view of the probability of occurrence of accident due to the risks associated with bulk storage of HAZMAT.

ii) Standards in respect of design and construction with provisions for maintenance shall be laid down. The design shall be so formulated such that there would not be any effect of micrometeorological factors like temperature, pressure, humidity, air flow and protection from static charges.

iii) The storages of large inventories of HAZMAT should go with corresponding safety, containment measures, good engineering and environmental practises. Better safety and containment measures for safety release installations should be used, like valves, rupture discs and monitors etc., to protect the storages.

iv) At the installation level, storages require a risk assessment strategy addressing all the risk areas including the following components:

   a. Safety and security provisions.

   b. Pipelines transferring the HAZMAT to other plants/locations, or outside the premises.

   c. Instrumentation especially—Distributed Control Systems (DCSs).

v) Comprehensive guidelines are available for safe storages, testing and monitoring of storage vessels and areas, and for checking the residual life of vessels, pipelines and other equipment used in storage of HAZCHEMs. In addition, a testing system, its frequency and a certification system also exist. However, there is an urgent need of critical evaluation and review pertaining to the following areas:

   a. Defining and ensuring the limits of quantity of HAZMAT as per the capacity of storage facility.

   b. Simultaneous storage of non-compatible hazardous and toxic material.

   c. Restriction of keeping storage vessels open to the sky due to the impact of weather conditions on the content of storage vessels.

   d. The concept of residual life with regard to depletion of various tolerances etc., needs to be re-evaluated from time-to-time, as many other factors and stresses responsible for the breakdown of vessels appear with ageing.

   e. Proper and adequate provisions of safety to cater to thermal and cryogenic stresses will be taken care of during the designing mode.

   f. A full-scale containment and neutralisation system shall be established for HAZCHEM that are not manufactured but stored in bulk quantities for in-house use. Such HAZCHEM include liquids like ammonia in ice manufacturing, LPG, furnace oils, compressed gas including chlorine in the pulp and paper industry, oxygen in Common Effluent Treatment Plants (CETPs), hydrogen in vegetable oil manufacturing and other inflammable fuels used in industries.

   g. Special provisions including the usage of lightning arrestors for gases (such as hydrogen that can make an explosive mixture with air, running the possible risk of exploding) as lightning acts as a catalyst for such a reaction.

   h. Ensure availability of a stand-by power supply system which shall operate in the case of failure/disruption of the main power supply and simultaneously requiring containment/neutralisation of stored liquid/gaseous chemicals to a designated place.

6 Guidelines for Transport Accidents

HAZCHEMs are transported across international borders. Hence, there is a need to comprehensively address the safe transportation of hazardous substances whether they are transported via air, ship, railways, roads or pipelines etc.

Petroleum products are transported via water, land and using various vessels like tankers, cylinders and others, making it a vulnerable area covered under The Petroleum Rules, 2002. The salient features of the Rules in the safety context are illustrated in Annexure I.

The Guidelines for transport accidents will address issues pertaining to bulk transportation of chemicals both by road, rail or marine means and safe transportation of petroleum products including combustible gases through pipelines. Comprehensive rules and guidelines under various acts provide for safe transportation of HAZCHEMs or dangerous goods. Transportation on land under the Petroleum Rules has laid down safety requirements for tank vehicle, tank capacity, engines, electrical installations etc., and has also highlighted restriction on loading/unloading of tank vehicles. Transportation on land is also covered under Explosives and Gas Cylinder Rules and under the Static and Mobile Pressure Vessels (Unfired) Rules. Self-certification for pressure vessels shall also be strengthened.

The coverage under the Motor Vehicles Rules and under the MSIHC Rules is also quite comprehensive. However, the issue also relates to state governments. Regulations for the transport of dangerous goods have received a lot of attention from the UN, which has framed rules for such movement (given in Annexure J). The UN has also circulated an Orange Book for classification, packaging, marketing, labeling and documentation for transport of dangerous goods which are universally adopted. These can be visited to adopt relevant acceptable practises in the proposed DM Plans.

6.1 Air Transportation

Air transport of dangerous goods is required to conform to the International Air Transport Association (IATA) Dangerous Goods Regulations which govern the packaging and labeling of HAZCHEM.

A set of technical instructions for the safe transport of dangerous goods by air was also issued by International Civil Aviation Organization (ICAO) in 1982–83.

6.2 Maritime Transportation

Maritime transportation of dangerous goods follow The Merchant Shipping (Carriage of Cargo) Rules, 1995, under The Merchant Shipping Act, 1958, and the conventions of the International Maritime Organization (IMO); Maritime Pollution (MARPOL) Conference; and Safety Of Life At Sea (SOLAS) Convention. There is also a UN committee of experts, which is part of the international efforts to standardise handling and carriage of dangerous goods.

Accidents for marine transportation mostly take place while handling packages of dangerous goods which are a potential hazard within ports. Major incidents involved highly inflammable gases/liquids, or highly toxic substances which pose serious threats to public safety, damage to property and port operations. External assistance is needed for tackling these emergencies. In the port area, a major dangerous goods incident is initiated by:

i) Dropping/toppling during loading/ discharging/stacking operations.

ii) Collisions during transportation.

iii) Being hit by other vehicles during storage.

iv) Prolonged undetected leakage.

Containerisation and rules governing thereof are very important for the maritime transportation of dangerous goods. Economic benefits of containerisation include reduction in port time, reduction in inland transportation (cost and risks), less transit time and consequently less inventory costs. An International organisation has provided the definition of containers and type of containers under which tanks are also defined for bulk liquid and compressed gases transport (Annexure J). The use of freight containers also substantially reduces the hazards of dangerous goods. However, the parties exposed to the inherent risks of loaded containers are the intermediary agencies and their personnel like road vehicle drivers and helpers, rail workers, dock and terminal workers, ships and board crew, and other handlers like packers.

6.3 Rail Transportation

Railways have their own safety manual for the transportation of hazardous goods containing the necessary information as well as resource contacts en route, such as the Red Tariff No. 20 prepared by the Indian Railways Conference Associations. The same needs to be strengthened keeping all requirements for management of transport accidents in view. There will be increased awareness of railway personnel dealing with transportation of HAZCHEMs. Rail transport of dangerous goods, specially petroleum products, also follow the international code of labeling in transportation. However, toxic and hazardous gases/ liquid are not generally permitted in bulk quantities in transportation as practised in developed countries.

Rail safety in general and related to the transportation of petroleum products requires to be addressed in a more transparent manner so as to match the level of mechanisation, on-line transmission of information and instructions, en route safety provisions for fire and explosion control and medical services, as well as for creation of trained skilled manpower to work in tackling emergencies with minimum loss and casualties. It is essential to prepare a complete response plan in coordination with the nodal ministry for simulated chemical disaster(s) based upon the risk assessment of the routes and connected resource availability, specifying the incident command system and SOPs for various identified stakeholders. The various modes of relief and rehabilitation of the victims shall also be integrated into such plans. It is also required to mark the railway routes loaded with HAZCHEM and a mechanism will be built by the railways so that the control rooms of the district continuously receive information about the HAZCHEM, time of stay or transition and related readiness at the district level.

6.4 Road Transportation

Road transport carries the bulk of dangerous goods in India while sea transport handles the import and export of dangerous goods. Presently, road transportation of dangerous goods is a very weak area under prevention and management of chemical disasters and, therefore, needs to be adequately addressed by the MoSRT & H, with the

help of the MoEF in fine-tuning the present legislative framework by introducing fresh rules, guidelines and facilities for the prevention and management of transportation emergencies through a focused approach of all the responders including the community, in the proximity of highways.

For safer transportation of dangerous goods, the guidelines are as follows:

6.4.1 Recommendations for MAH Units

MAH units are not only the recipients but also the consignors of HAZCHEM. It is in their business interest that the goods dispatched, reach the destination safely, in time and without any problem en route. Their role is by far the most important in terms of improving the status of implementing various legal requirements. Keeping this in mind, the following are the major recommendations for the MAH units (consignors) of HAZCHEM.

i) Check driver's license for its validity, provide a certificate to the effect that he has successfully undergone the requisite training for transportation of hazardous goods and endorse his license, authorising him to drive vehicles carrying HAZCHEM.

ii) Check documents and inspect vehicles with check lists.

iii) Implement vehicle entry, loading/unloading check list.

iv) Check compatibility with material last transported with the one intended to be loaded.

v) Place appropriate fire extinguishers.

vi) Provide separate earthing to tank and hoses.

vii) Provide stop blocks to prevent rolling of vehicles. Loading/unloading operation to be carried out under supervision.

viii) Make the driver read the Transport Emergency Card (TREMCARD) while the loading/unloading operation is carried out.

ix) Seal and lock valves after loading. The Emergency Information Panel (EIP) should be checked and if found inappropriate, new panels should be pasted on all three places. Appropriate class labels should be pasted.

x) Communicate the route and scheduled halts to driver and transporter.

xi) Implement a computerised system for records. Although it may not be possible for all the units to implement such computerised systems, alert security staff and proper maintenance of records can easily achieve the objective. Train security staff in checking the documents and vehicles.

xii) Selection of transporters should be on the basis of their credibility rather than solely on quotes.

6.4.2 Recommendations for Transporters

i) Need to take a proactive role in keeping their vehicles fit, providing necessary fire extinguishers, PPE, antidotes, emergency kits, spark arrester and training to drivers for safe transportation of hazardous goods.

ii) Careful driver selection.

iii) Vehicle maintenance, display of appropriate EIP and class label, proper painting.

iv) For transport of dangerous goods, the endeavour should be to find dedicated transport tanker vehicles or at least for dedicated use of specific material only. Interchangeability at times may cause mishaps/accidents.

v) HAZCHEM should also be lettered in the vernacular for better understanding by the public at large.

vi) Ensure availability of all relevant documents and inform the driver of the chemical being

transported, associated hazards and safety precautions to be taken during the journey.

vii) Provide route map to the driver (finalised in consultation with the consignor) and a timetable for each trip.

viii) Loading and unloading of dangerous goods is a specialist activity and should be handled by competent persons identified by transporters and their accountability should be defined in this regard.

6.4.3 Recommendations for Drivers

Trained and experienced personnel of MAH units are not normally available at accident site en route to transport. The response of driver, cleaner, public and response teams are therefore, of very high significance. Drivers on the other hand, are the weakest link in the entire process of HAZCHEM transportation due to the lack of proper training, low level of education, lack of awareness of the applicable legal requirements and a host of other factors such as rash driving, drinking habits, tendency for pilferage to make a quick buck, etc. All the efforts of consignors, transporters and authorities are diluted if the driver does not have safe driving habits, parks the vehicle incorrectly and/or leaves his vehicle unattended. The rules applicable to drivers for improving the level of safety in HAZCHEM transportation as per Central Motor Vehicle Rules (CMVR) are fairly comprehensive and proper enforcement can definitely bring about the desired change.

i) Driver training and involvement in mock drills are necessary and must be initiated on a priority basis.

ii) The driver should be trained to maintain a record of inspection round the clock at least every two hours, to check the pressure, temperature of the product to see that no leaks are developed and to check the temperature of hubs and tyres or to spot any other abnormality in the vehicle.

iii) The drivers and cleaners should necessarily maintain and use PPEs to meet specific requirements during chemical spills/accidents.

iv) Driver training efforts must be updated, specifically for non-petroleum tankers, where training is lacking.

v) Though it is mandatory to keep fire extinguisher(s) and a first-aid box in the driver's cabin, sufficient attention is not given in training the driver in their use. Even the selection of the correct fire extinguisher for different types of fires is unknown to the driver. The fire extinguishers should be related to the HAZCHEM being transported, which makes dedicated use of the vehicle important.

6.4.4 Recommendations for Authorities

The primary concern regarding non-compliance by the consignors, transporters and drivers is the lack of enforcement of the applicable legal requirements and also lack of awareness amongst the stakeholder.

The MoSRT & H have introduced ambulances en route on some of the major highways to operate point-to-point transfer of casualties for first-aid and treatment. This facility requires further strengthening and extension on all the highways across the country under a time-bound programme with a maximum target of seven years. The implementation of the Rules 131–133 of CMVR, 1989, providing details of responsibility of consignors, transporters and drivers of the goods carriage transporting HAZCHEM shall be strengthened. Further, the states can also put additional restrictions in the permit condition while granting permits to the transporters.

i) Training:

   a. Comprehensive training of inspection staff issuing fitness certificates

regarding design codes, their requirement for the inherent safety of the container and the vehicle, etc.

b. Traffic policeman should be more stringent for HAZCHEM transporting tankers and must see to it that these tankers do not violate any rules. Moreover, a traffic policeman should not allow these tankers in crowded places/routes, for any reason whatsoever. Traffic policeman could be allowed to penalise the driver in case of illegibility of the emergency information panel and also if the class label is missing from the front and rear of the vehicle.

c. Comprehensive training of the traffic inspectors regarding the applicable legal requirements.

d. Training of inspectors regarding HAZCHEM as per the CMVR so as to make them understand the consequences of non-compliance.

e. Elaborate training programmes for community leaders, panchayats, NGOs and other identified prominent persons in the areas is necessary after a directory of information (containing the names, addresses, telephone numbers, etc.) is prepared. A small booklet in the vernacular on dos and don'ts for the local public should be brought out and circulated.

ii) Narrow roads increase the traffic density, the travel time and also the accident potential. Infrastructure in terms of proper roads and lights in population pockets needs to be provided for safe HAZCHEM transportation.

iii) The highway patrol should ensure the smooth flow of traffic on the highways and highway rescue squads need to be set up at critical locations for rendering prompt response during accidents.

iv) Police awareness about the provisions under the CMVR requires a major initiative, as it is poor. Police academies could be used for the purpose and special drives aimed at police forces should be made.

v) The regulatory authorities, mainly the police, are not adequately aware of the CMVR HAZCHEM provisions and are therefore not able to enforce the rules sufficiently. This is necessary and must be accomplished on a mass basis.

vi) Communication System: the HAZCHEM transported from a source unit to the ultimate destination will have a dedicated consignment tracking system within and also be linked to fire, police and emergency control rooms including medical services. The mechanism will be worked out with the due diligence of all stakeholders and in consultation with all authorities concerned.

vii) Global Positioning System (GPS) type communication and information management systems for HAZCHEM fleet tracking, monitoring and accident management has already started in the country by large corporate houses such as Reliance, mainly in Gujarat and Maharashtra. The drive must be widened to cover all HAZCHEM stretches and to transporters who should be explained the benefit of such systems. Such a system should be strengthened and the information instantly available and the facility should be spread over for transfer of information at a number of locations in CCRs.

viii) The Regional Transport Officer (RTO) should carry out the proper verification and examination of the tankers/trucks before issuing a new license/permits or the

renewal of older ones. After the issue of the permit/license it is also important to check/stop tankers during transit and verify that all requirements are being met.

ix) The condition of the transport vehicle should be very sound with regard to tyres, brakes, steering system, lighting, indicator system, and especially a leak-proof fuel and fail-safe wiring circuit to avoid explosion risks. Procedures for examination of vehicles carrying HAZCHEM should be strengthened.

x) Traders and small transporters are not able to match the performance of MAH units and large transporters in terms of safety. Special drives aimed at them in particular must be made at the national level.

xi) The resources for combating emergencies on the route are higher than average—their upkeep is also encouraging as is the level of enthusiasm. The efforts need to be sustained through various drives and imaginative ideas.

xii) A drive to encourage transporters to install tachographs must be started so that errant drivers can be identified—standardisation is important for acceptance and this must be done. Transporters must be made to understand the benefits. Having a clause in the CMVR that is blatantly violated is not encouraging. This may be taken up also during renewal of permits.

xiii) Comprehensive guidelines under different regulations on 'Training the people who matter'; 'Grounding vehicles during loading and unloading'; and on 'Product specific precautions' exist. These should be regularly updated, more widely circulated and mandated under the DM plan.

xiv) The transportation of chemicals should not be allowed on highways which are not well laid out or are damaged.

xv) Strict rules on compliance for tanker vehicles (overfilling and underfilling) should be enforced.

xvi) The tanker vehicles carrying chemicals that are affected on exposure to sun/heat leading to over-pressure/leakage should be identified and transported in heat insulated tanker vehicles.

xvii) A network of medical response centres/ hospitals, ambulance services for first medical response on highways should be established and publicised so that the people are aware of such arrangements. A single telephone service (a 4-digit telephone number) in line with the existing 3-digit system for the fire brigade and police should be established for use at the national level. On the highways, the name and telephone number of emergency services like police, fire brigade and ambulance should be prominently displayed at regular distances.

6.4.5 Highway DMP

As transportation accidents can occur away from the city limits, or from the MAH units where response facilities are available, the results of consequence analysis clearly indicate the need for preparation of highway DM plans.

In addition to the normal Off-Site plan, the following elements should also be addressed:

i) Special precautionary measures should be laid down for the transportation of dangerous goods involving highly flammable material. Accidents resulting from flammable goods encompass large areas in the proximity and also result in BLEVE where the vapour explosion can have cascading effects on other passing vehicles.

ii) During the transport of hazardous goods, there are certain dos and don'ts on mixing. An indicative list of don'ts include: corrosive liquids with flammables, charged storage batteries with Class A explosives, detonating primers with explosives, poison label material with food stuff etc.

iii) For prevention and better relief in transportation accidents, the establishment of command posts, dedicated lines of communication, reassessing the situation continually and modifying responses accordingly are essential activities, which should be mentioned clearly in the highway DM plan.

iv) In view of the issue of illiteracy of drivers, it is recommended to develop MSDS graphically/pictorially.

v) Preparation and circulation of emergency response guides for each cluster of chemical plants and MAH units should be done for the public and all the responders and role players in case of Off-Site accidents during the transportation of dangerous goods. Such a booklet containing information on the classification of HAZCHEM, UN numbers, CAS numbers, important telephone numbers, potential hazards, and emergency response for each type of accident case like for explosion etc., would be of immediate assistance in combating transport emergencies.

vi) Instituting regular safety inspections and the number of inspections that should be mandatory.

vii) A highway DM plan should also contain the precautions and actions to be taken by the first responders reaching the incident site.

viii) The role of different emergency function units should also be clearly mentioned and should be updated regularly after mock drills, if required.

ix) The levels of transport disasters will also be categorised in the same way i.e., Level 0 to Level 3 mentioned in chapter 5.

x) The potential environmental emergency that may occur during a transport emergency should also be taken into account and the role of the Pollution Control Board will be important in such cases and must be clearly mentioned.

xi) Complete mop-op operations after a spill or a chemical accident shall be ensured.

xii) The highway DM plan shall include a dedicated communication network to integrate the highways all across the nation. To achieve this goal, the initiatives taken up by the Department of Road, Transport and Highways i.e., telephone no. 1073 already reserved for this purpose; provision of cranes for road clearance and ambulances at 50 km stretches, will be implemented. For its proper implementation, states shall ensure the development of a CCR, station ambulances on roads in connection with the nearest trauma care centre and dovetail with the DM plan of national highways.

xiii) The National Highway Authority has a provision to provide one ambulance for each completed stretch of 50 km of national highways and such provisions will be implemented in a time-bound manner. Health being the state subject, state governments shall ensure provision of immediate medical care to the disaster victims.

The highway DM plans for a particular stretch should be categorically defined in the actions/ response protocols in accordance to the various identified focal points where population is in the nearby vicinity. Response books with specific fire-

related precautionary measures with reference to the type of HAZCHEMs being transported should be available with the driver and in police/fire control rooms in the stretch under reference.

6.4.6 Avoidable HAZCHEM Traffic

It was noticed during a survey that some of the MAH units prefer to procure certain chemicals (sulphuric acid in particular) from neighbouring states. It is recommended that a detailed study should be undertaken where such unnecessary movement of HAZCHEM is taking place to estimate the incremental hazard potential. Further, if possible, the tax structure also needs to be reviewed, to prevent such cross boundary movement of HAZCHEM.

6.4.7 Training Police Personnel

District authorities, especially police personnel, need to be trained for hazardous goods transportation. Police academies in the various states may be suitably directed to bring about training in the field of hazardous goods transportation to various police personnel.

6.4.8 HAZMAT Vans

In addition to the availability of an ambulance and crane at the toll booths on the highway (by the National Highway Authority of India), procurement of HAZMAT vans may also be considered. These vans will not only be useful in prompt handling of chemical transport emergencies but will also be useful in case of industrial accidents.

6.4.9 List of Technical Experts

District-wise lists of technical experts need to be prepared and distributed to all the MAH units, transporters, police and fire stations which can be used to obtain technical guidance during an accident involving hazardous goods carriers.

6.4.10 Emergency Response Guidebook

The *Emergency Response Guidebook*, published jointly by the transport departments of the USA, Canada and Mexico, is a very useful document providing clear and concise information on the HAZCHEM management of a transport emergency involving HAZCHEM. It is a searchable database of all major HAZCHEMs. It is suggested that a copy should be provided to all technical experts, fire stations, major hospitals and police stations along the highway stretches for prompt and correct response.

6.4.11 Modification/Harmonisation of Rules

i) Responsibility for Loading Leaky/Defective Tankers : Clarity is required on the issue of responsibilities associated with respect to loading of cargo into defective/non conforming vehicles at the consignor end (presently, the Central Motor Vehicles Rules, 1989 are not clear on this issue).

ii) Fire Extinguishers and PPEs : It may be noted that Rule 41 of the Static and Mobile Pressure Vessel (Unfired) Rules, 1981, Rule 72 of the Petroleum Rules, 2002 and Rule 86 of the Explosives Rules, 1983, specify that two fire extinguishers need to be carried in the vehicle, of which one should be accessible from outside the cab. However, Rule 129 (1) (iv) of the CMV Rules, 1989 does not specify the type or numbers of fire extinguishers to be carried on the vehicle. Specifications of the fire extinguishers and PPE need to be brought out in the rules. The rules need to be harmonised for better implementation.

iii) Driver's Educational Qualifications: Rule 9 of the CMV Rules, 1989, addresses the educational qualification aspects of the drivers of hazardous goods carriers. Present criteria stipulates only reading and

writing skills, with knowledge of the English language. However as per a survey, less than 5 per cent of the drivers interviewed possess such knowledge skills. The implementation of a draft notified by the Department of Road, Transport and Highways vide GSR No. 583 (E) dated 21 September 2006, specifying the minimum educational qualification for the drivers i.e., Class VIII pass to be eligible for hazardous goods transport for better implementation of the rules, shall therefore be implemented in a time-bound manner.

iv) Harmonisation of the List of HAZCHEMs: the MSIHC Rules, 1989, (amended in 1994 and 2000) lists 684 HAZCHEM in addition to qualifying criteria for toxic and flammable substances, whereas the CMV Rules, 1989, lists around 300 HAZCHEM. This disparity needs to be eliminated for better clarity and implementation of rules.

v) Accident Database : Accident reporting requirements are defined under various rules, however, no comprehensive database is available for accidents involving HAZCHEM transportation. Results obtained from the analysis of historical data is very useful in planning, policy and implementation aspects. It is recommended to harmonise the relevant rules governing HAZCHEM transportation, appointing a single agency/authority for collection of accident information, database generation and clear-cut reporting requirements.

vi) Community Awareness about Facilities on Highways

a. Sensitising the public and community by dissemination of proper information to the community at large by the district administration through press and electronic media about facilities for handling highway transport emergencies involving HAZCHEM.

b. At selected locations based on proximity to the population on highways, display boards in the interior areas besides the highways should be installed with dos and don'ts in case of transport accidents involving HAZCHEM.

vii) Identify and Develop Local Community Leaders for an effective emergency response. Community leaders to accept the responsibility as trainers to train the public and should play a special role in building support and enthusiasm for awareness programmes.

viii) Parking Lots of overnight parking of HAZCHEM vehicles should be away from inhabitation.

ix) Trauma/Poison Centres should be spread out uniformly in India so that they are easily accessible during the transportation of casualties to prevent the loss of lives.

x) Round-the-clock emergency crews/ professional technical teams provided with MAH and cluster of MAH should have an extended coverage of 200 km to reach transport accident spots for help. The arrangement would not be limited to dangerous goods transported by an installation only.

xi) For urgent and immediate relief to victims in transportation accidents, all states should have dedicated helicopter services for medical relief and transfer of casualties to bigger hospitals. The crew should be fully conversant/trained on MSDS including antidotes and first-aid operations for relief operations.

xii) As dangerous goods regulations are not as complicated as perceived, guidelines on simple common sense precautions by

involvement of all concerned with dangerous goods would lead to safety for all.

6.5 Transportation by Pipelines

Pipelines are assuming importance as a means of transport of hazardous substances. Crude oil, its derivatives and natural gas are among the main substances transported by pipelines. The advantages of pipeline transport are that they can move large volumes of substances quickly, over long distances at relatively low cost, high reliability and have few transport-associated environmental impact (i.e., exhaust, noise or congestion). However, like fixed installations handling hazardous substances, they also pose a threat to human health and safety and to the soil, water and environment.

The effects of accidents involving pipelines are often very serious, as felt in the Komi (Russian Federation) oil leakage in 1994 and the Ghiselenghein (Belgium) gas explosion in 2004. External interference, corrosion and poor maintenance are among the most common causes of pipeline accidents. The guidelines, therefore, comprise:

i) Creation and maintaining an administrative framework to facilitate the development of a safe and environmentally sound transportation infrastructure, including pipelines for hazardous substances.

ii) The pipeline operator has the primary responsibility for the safety of the systems and for taking measures to prevent accidents and to limit their consequences for human health and the environment.

iii) Pipelines for the transport of hazardous substances will be designed and operated so as to prevent any uncontrolled release into the environment.

iv) Risk assessment methods should be used in evaluating pipeline integrity and impact on human health and the environment.

v) Land-use planning considerations will be taken into account both in the routing of new pipelines (e.g., to limit proximity to populated areas and water catchment areas to the extent possible), and in decisions concerning proposals for new developments/building in the vicinity of existing pipelines.

vi) Pipeline operators and the authorities responsible for pipelines shall review and, if necessary, develop and implement systems to reduce third-party interference, which is a cause of accidents, including their effects.

vii) National legislation shall be clear, enforceable and consistent to facilitate safe transport and international cooperation.

viii) Competent authorities should ensure that pipeline operators:

   a. Draw up emergency plans.

   b. Provide the authorities designated for that purpose with the necessary information to enable them to draw up Off-Site emergency plans.

   c. Emergency plans shall be coordinated between pipeline operators and competent authorities, as well as with fire brigades and other disaster control units.

ix) Pipelines shall be designed, constructed and operated in accordance with recognised national and international codes, standards and guidelines.

x) Consideration will be given to the impact on the safety of a pipeline such as design and stress factors, quality of material, wall thickness, depth of burial, external impact protection, markings, route selection and monitoring.

xi) The safety of the pipelines shall be demonstrated through a suitable risk

assessment procedure including the worst case scenario and including breakdowns and external additional loads.

xii) The pipeline operator shall draw up a Pipeline Management System (PMS) to ensure that it is properly implemented. The PMS shall be designed to guarantee a high level of protection of human health and the environment. The following issues shall be addressed by the safety management system.

a. The pipeline will be inspected and maintained regularly. Only reliable trained staff or qualified contractors may carry out maintenance work on a pipeline. A certified expert should inspect the pipeline at regular intervals as far as required by the notification/ permit. These inspections are to cover in particular the proper condition of the pipeline and the functioning of the equipment ensuring pipeline safety.

b. Organisation ability, roles and responsibilities, identification and evaluation of hazards, operational control, management of change, planning for emergencies, monitoring performance, audit and review shall be duly addressed in the PMS.

7 Approach to Implementation of the Guidelines

The National Guidelines have been formulated as a part of an integrated national all-hazard approach for the management of disasters. The prime aim is to ensure that the occurrence of chemical accidents and risks posed to human health, life and the environment are reduced/ minimised. The chemical emergency management approach aims to institutionalise the implementation of initiatives and activities covering all components of the DM cycle including prevention, mitigation, preparedness, relief, rehabilitation and recovery etc., with a view to develop a national community that is informed, resilient and prepared to face chemical emergencies, if any, with minimal loss of life and property. Therefore, it shall be the endeavour of the central and state governments and local authorities to ensure its implementation.

While the primary responsibility of initial accident response shall remain at the local level; the state, centre and the private sector shall reinforce the system. For an efficient and coordinated management of chemical disasters, evolving a single National Plan, identification of the various stake holders/agencies who are actively involved along with their responsibilities, institutionalisation of the programmes and activities at the ministerial/ department levels, increased inter-ministerial and inter-agencies communications and networking, rationalisation and augmentation of the existing regulatory framework and infrastructure, are considered vital for ensuring a seamless and harmonious functioning by all stakeholders. The preparation and planning for the response to a chemical emergency is to be structured into a coherent and interlocking system. In order to optimise the use of resources and the response effectiveness, response plan will be highly coordinated and consolidated responsibilities will be assigned jointly with the participation of all the concerned stakeholders. Implementation of the Guidelines shall begin with formulation of a DM plan and an enabling phase to build necessary capacity, taking into consideration the existing elements such as legislation, emergency plans, stakeholder initiatives, gaps, priorities, needs and circumstances. To start with, the existing disaster management plans at various levels shall be further revamped/strengthened to address the chemical hazards.

The nodal ministry will evolve programmes and activities in the detailed Action Plan for the holistic and coordinated management of chemical disasters. To sustain an integrated approach to CDM, the central government needs to establish arrangements for implementing the National Plan on an inter-ministerial or inter-institutional basis so that all ministries concerned and stakeholders interests are represented and all relevant substantive areas are addressed (see Annexure K).

The agenda of these Guidelines shall also be implemented by the governments of the various states and UTs. The experience gained in the initial phase of the implementation is of immense value, to be utilised not only to make mid-term corrections but also to make long- term policy and guidelines after comprehensive review of the effectiveness of DM plans undertaken in the short term. All states and UTs shall develop their DM plans through an extensive consultative approach covering all

stakeholders and in consultation with their district-level plans. Three sets of agencies viz. the NDMA, SDMAs and DDMAs, shall forge a mutually reciprocal relationship for the effective implementation of the national Guidelines in a focused way. The relationship between the NDMA and state authority/SDMAs need to be interactive and complimentary.

The guideline document provides for strengthening the chemical safety in the country on a sustainable basis. These guidelines have set modest goals and objectives to be achieved by mobilising all stakeholders through an inclusive and participative approach. Appropriate allocation of financial and other resources including dedicated manpower and targeted capacity building would be the key to the success of the implementation of the guidelines. Periodic training, tabletop exercises, simulations, mock drills, etc., would further enhance and ensure their effective implementation.

7.1 Implementation of Guidelines

7.1.1 Preparation of the Action Plan

Implementation of the guidelines at the national level could begin with the preparation of an Action Plan, that shall promote coherence among chemicals management mechanisms and strengthen chemicals management capacities at various levels.

The National Plan needs to include:

i) Measures to be taken for prevention of chemical disasters (leading to zero tolerance), or mitigation of their effects (leading to avoidable morbidity and mortality).

ii) Measures to be taken for the integration of mitigation procedures in the development plans.

iii) Measures to be taken for preparedness and capacity building to respond to any threatening chemical disaster situations or disasters.

iv) Roles and responsibilities of different ministries or departments of the Government of India, nodal ministry, industry, community and NGOs in respect of measures specified in clauses (a), (b) and (c) above.

The plan shall spell out detailed work areas, activities and agencies responsible, and indicate targets and time-frames. The plan prepared shall also specify indicators of progress to enable their monitoring and review. The plan would be sent to the NDMA through the NEC for approval.

The ministries/agencies concerned, in turn, shall:

a. issue guidance on implementation of the plans to all stakeholders;

b. obtain periodic reports from the stakeholders on the progress of implementation of the DM Plans;

c. evaluate the progress of implementation of the plans against the time-frames and take corrective action, wherever needed;

d. disseminate the status of progress and issue further guidance on implementation of the plans to stakeholders; and

e. report the progress of implementation of the National Plan to the nodal ministry.

The MoEF shall keep the NEC apprised of the progress on a regular basis. Similarly, SECs/departments shall develop state-level DM plans and dovetail these with the national DM plan and keep the state authority/SDMA informed. The state departments/authorities concerned will implement and review the execution of the DM plans at the district and local levels along the above lines.

7.1.2 Implementation and Coordination at the National Level

Planning, executing, monitoring and evaluating are four facets of the comprehensive implementation of the Guidelines. It is envisaged that the NDMA will work with the core group in identifying appropriate agencies, institutions and specialists with expertise in relevant fields and involve them in various activities to help implement the CDM plans as per the spirit of the national Guidelines. Separate stakeholder group of individuals or agencies is required to undertake each of the above four sets of activities. Some individuals may be common to the first three groups. However, the fourth stakeholders group involved in evaluating the outcome of the planning, executing and monitoring needs to consist of specialists who are not directly involved in any of first three groups; this will help in getting an objective feedback on the effectiveness of activities based upon the Guidelines. The professionals, particularly scientists, chemists, chemical engineers, pharmacologists and toxicologists etc., are therefore, to be closely involved in the disaster risk management initiatives at all levels and for all tasks relevant to their expertise. The availability of professional expertise is a crucial factor for the dissemination, monitoring and successful and sustainable implementation of the CDM plan. Professional expertise is required to be built up at all levels and for all tasks. The CDM framework also imposes additional responsibility on professionals to improve their skills and expertise corresponding to the best practises world over for a safer chemical industry, to contribute to capacity building and to cooperate with and form partnerships with other stakeholders. Synergy among their activities can be achieved by developing detailed documents on how to implement each of the activities envisaged in the guidelines. This consultative approach of developing detailed guidelines for plan implementation helps in two ways, namely *(a)* it increases the ownership of stakeholders in the solution process; and *(b)* it brings clarity to the governments on their roles and responsibilities. Procedures need to be developed to elaborate the monitoring mechanisms to be employed for undertaking transparent, objective and independent review of activities outlined in these Guidelines. In particular, implementing these activities can be smooth and successful if a single-window system is adopted for conduct and documentation of each of the above four phases, i.e., having one person accountable for each of the above four phases of activities outlined in the guidelines in each of the stakeholder ministries, departments, state governments, agencies and organisations.

7.1.3 Institutional Mechanisms and Coordination at State and District Levels

The DM Act, 2005 envisages the constitution of SDMAs at the state level. The SCG constituted as required under the CA(EPPR) Rules, 1996 notified under the Environment (Protection) Act, 1986, shall act as the advisory committee/subcommittee of the SDMA in the field of CDM.

Similarly, the DCGs and the LCGs shall function as the advisory committee/subcommittee of the district administration/DDMAs and local authorities respectively for the management of chemical disasters. The measures indicated at the national level may be adopted to ensure effective implementation by regular monitoring at the state level by the authorities concerned. The state shall also allocate and provide the necessary finances for efficient implementation of the plans. Similarly, district and local level plans shall be developed and need to follow a professional approach. Since most activities under these guidelines are community centric, requiring the association of professional experts for planning, implementation and monitoring, the SDMAs shall formulate suitable mechanisms for their active involvement with the various stakeholders. These activities are to be taken up in a project mode with a specifically earmarked budget (both plan and non-plan) for each activity. The approach followed shall emphasise chemical

safety and risk reduction measures including technical and non-technical preparedness measures, be environment and technology friendly, sensitive to the special requirements of the vulnerable groups and communities, and address all stakeholders involved in CDM. This is to be achieved through strict compliance with existing and new policies. Further, the SDMAs need to designate officers in-charge of CDM safety matters. Recognising the enormity and criticality of CDM, the SDMAs are required to preferably identify and enlist officers with sole charge of matters related to chemical disaster risk management as a first step towards ensuring effective implementation of the CDM guidelines. It is essential that officers handling risk management aspects in the SDMAs need to have a reasonable term of office which is required in getting the best out of their experience and do justice to the office and responsibilities they are holding.

7.1.4 District Level to Community Level Preparedness Plan and Appropriate Linkages with State Support Systems

In the preparedness plan and state thereof, a number of weaknesses have been identified with regard to awareness generation, response time and other timely actions for evacuation and medical assistance. This constitutes significant portion of the Off-Site emergency plans and it has been found to be a weak link in emergency management which is required to be addressed in detail. The central and state governments need to evolve mechanisms through mock drills, awareness programmes, training programmes etc., with a view to sensitise and prepare officers concerned for initiating prompt and effective response.

7.2 Financial Resources for Implementation

Chemical disasters in the past have revealed that expenditure on relief, rescue and rehabilitation far exceeds the expenditure on prevention and management. This should therefore, be the underlying principle for allocation of adequate funds at industry and government level for prevention, mitigation and preparedness rather than concentrating on their management at the time of a disaster. The basic principle of return on investment may not be applicable in the immediate context but the long-term impact would be highly beneficial. Thus, financial strategies will be worked out such that necessary finances are in place and flow of funds is organised on a priority basis by the identification of necessary functions, both in the phases of preparedness and response, relief and rehabilitation respectively.

Central ministries and departments and the state governments will mainstream DM efforts in their development plans. In the annual plans, specific allocations will be made for carrying out disaster preparedness efforts as well as disaster mitigation measures.

Each chemical industry will arrange sufficient funds for the purpose of prevention, mitigation and preparedness measures. Wherever necessary and feasible, the central ministries and departments and urban local bodies in the states may initiate discussions with the corporate sector undertakings to support the retrofitting measures of vulnerable storage sites and chemical industry buildings as a part of PPP and corporate social responsibility efforts.

After a chemical disaster, central and state governments provide funds for immediate relief and rehabilitation. These funds address the immediate needs of the victims. This process does not adequately cover the requirements for reconstruction of damaged structures, especially those privately owned. Expenditure incurred by the Government of India in the provision of funds for relief, rehabilitation and reconstruction is increasing manifold due to the rapidly increasing risk profile of the country and the emergence of new toxicants. In most countries, risk transfer through insurance has been adopted

as a step towards providing adequate compensation. Such a mechanism reduces the financial burden of the governments. Risk transfer mechanisms have been found to be fairly successful. The insurance sector will be encouraged to promote such mechanisms in the future.

The MoEF will develop a national strategy for risk transfer, using the experiences of micro-level initiatives in some states and global best practises and will also facilitate the development and design of appropriate risk-avoidance, risk-sharing and risk-transfer mechanisms in consultation with financial institutions, insurance companies and reinsurance agencies. The MoEF and other ministries will project their financial provisions in their annual budget for new mitigation projects requisite for risk management practises.

The MoEF will ensure that newly established industries will be made to comply with earthquake-resistant design and construction practises, adequate preparedness within the plant perimeter and adoption of best engineering practises as a preventive measure. The approval and disbursement of funds from banks and other financial institutions to industrial units will also be linked to the compliance with these norms by industrial units. The nodal ministry will coordinate with the central ministries/departments concerned and state governments compliance to this aspect by financial institutions. It will also coordinate, with the relevant bodies, the development of suitable techno-financial measures to improve the safety aspects of the industrial units.

7.3 Implementation Model

The phasing of the implementation model will include the short term covering 0–2 years; the medium term covering 2–5 years; and the long term covering 5–8 years. The Action Plan shall indicate detailed work areas and activities/targets with suggested time-frames, suitable indicators of progress along with authorities/actors for the implementation of guidelines including monitoring mechanisms.

A) Some of the important issues for the formulation of the CDM Action Plan are as follows:

i) Putting in place a national mechanism covering all major disasters and reporting mechanisms at the district level.

ii) Dovetailing regulations governing HAZCHEM safety with the DM Act, 2005.

iii) Establishing of a national risk management framework criterion for chemical assessment.

iv) Strengthening of institutional framework for CDM and its integration with the activities of the NDMA, state authority/SDMA, district administration/DDMA and other stakeholders.

v) Renewed focus on model safety codes/ standards for prevention of accidents at industry level by matching processes, technologies for safety installations compared with the best in the world.

vi) Identifying infrastructure needs for formulating the mitigation plans.

vii) Implementing a financial strategy for allocation of funds for different national and state/district-level mitigation projects.

viii) Establishing an information networking system with appropriate linkages with state transport departments, state police departments and other emergency services. The states will ensure proper education and training of the personnel using information networking system.

ix Identification/recognition of training institutions.

x) Strengthening of NDRF, fire services, MFRs, paramedics and other emergency responders.

xi) Revamping of home guards and civil defence for CDM.

xii) Develop a national medical emergency plan binding all government, private and public hospitals under an enactment with unified, well-established triage and other emergency procedures.

xiii) Develop highway DM plans for all the identified stretches, nodal points, and micro SOPs integrated in the driver's kit.

xiv) Establish a register of relevant national and international institutes and information exchange programme.

xv) Establish post-disaster documentation procedures, epidemiological surveys and minimum criteria for relief and rehabilitation.

xvi) Sensitise the community regarding common chemical risks, and their expected cooperation and role during emergencies.

xvii) Sensitise corporate houses for more pro-active roles in the prevention of chemical accidents by instituting regular internal audits of plant safety measures, actuation of On-Site emergency plans and institutionalisation of mutual aid arrangements.

B) Stop-gap arrangement till formulation and approval of Action Plan: The following recommendations can be taken up as a stop-gap measure for immediate action pending formulation of the Action Plan by the nodal ministry and other stakeholders followed by its approval by the NDMA through the NEC:

i) Preparation of a report to establish a summary baseline of information on hazard identification and risk assessment in chemical installations.

ii) Risk analysis and assessment of pipelines to identify areas that are likely to be affected and have high exposure of natural hazards.

iii) Incorporation of GIS technology which allows to collect, display, manage and analyse large volumes of specially referenced and associated data for emergency planning, preparedness and response.

iv) Identify and incorporate legislative and institutional framework for preparedness with specific and measurable indicators.

v) Analyse, summarise and disseminate past statistical information on disaster occurrence, impact and losses.

vi) Develop, update and disseminate risk maps and related information to decision makers in an appropriate format.

vii) Support the development and improvement of relevant data bases.

viii) Research, analyse and report on long-term changes and emerging issues that might increase vulnerabilities and risks or the capacity of authorities and people to respond to disasters.

ix) Prepare a national response plan indicating authorities and responsibilities with a view to enhance the ability of the country to prepare for and manage chemical disasters.

x) The transport routes of HAZCHEM, the likely emergencies and resources available at defined locations are to be immediately documented.

xi) CAS should be augmented (including the infrastructure facilities).

xii) Isolated storages and warehouses in the country to be identified and documented.

xiii) Continuation of CDM training and workshops.

Annexures

Annexure-A

Some Major Chemical Accidents in India (2002–06)

S. No.	Name of Unit	Date of Accident	Source	Death/Injury/Missing; Losses
1.	GACL, Vadodara, Gujarat	05.09.2002	Chlorine gas —explosion	4/20/nil
2.	IPCL, Gandhar, Gujarat	20.12.2002	Chlorine gas —release	Nil/18 workers & 300 villagers in Jageshwar affected/nil
3.	IOC Refineries, Digboi, Assam	07.03.2003	Fire in motor spirit tank	Nil;Product loss Rs11.55crore
4.	Ranbaxy Laboratories Ltd., Mohali, Punjab	11.06.2003	Toluene	2/19/nil
5.	BPCL Bottling Plant, Dhar, Madhya Pradesh	05.10.2003	LPG leak from tank lorry	Nil
6.	Orient Paper Mills, Amla, Shahdol, Madhya Pradesh	13.10.2003	Liquid chlorine	Nil/88/nil; 5 m pipe affected
7.	IDL Gulf Oil, Kukkatpally, Hyderabad, Andhra Pradesh	25.11.2003	Explosion	8/5/1
8.	Anil Enterprises, Zakhira, Rohtak, Haryana	28.04.2004	Fire in LPG fired oven	6/2/nil
9.	HIL Udyogmandal, Kerala	06.07.2004	Toluene fire	Nil
10.	Shyamlal Industries, GIDC, Vatva, Ahmedabad,Gujarat	12.04.2004	Benzene fire	Nil
11.	Chemical Factory, Dombivilli, Maharashtra	31.05.2004	Hexane release —fire	1/8/Nil
12.	Chemplast, Mettur, Tamil Nadu	18.07.2004	Chlorine leak	Nil/27/nil

13.	Gujarat Refinery, Vadodara, Gujarat	29.10.2004	Explosion in slurry settler	2/13/nil
14.	Ranbaxy Laboratories Ltd., Mohali, Punjab	30.10.2004	Fire in dryer room	1/2/nil
15.	Matrix Laboratory Ltd. Unit 1, Kazipally, Medak District, Andhra Pradesh	05.03.2005	Sodium hydride	8/nil/nil
16.	Gujarat Refinery, Gujarat	15.06.2005	Fire	Nil
17.	Coromondal Fertilizer Ltd., Ennore, Tamil Nadu	22.07.2005	Ammonia	Nil/5/nil
18.	Gulf Oil Corporation Ltd., Sanathnagarn, Hyderabad, Andhra Pradesh	04.10.2005	Explosion/fire	2/2/nil
19.	Orchid Chemicals and Pharmaceuticals Ltd., Alathur, Kancheepuram District, Tamil Nadu	03.11.2005	Explosion with fire	2/4/nil
20.	Aurobindo Pharma Ltd., Unit-V, IDA Pashamylaram Medak Dist., Andhra Pradesh	28.11.2005	Explosion while drying cloxaciline sodium	1/4/nil
21.	Indian Oil Corporation Ltd., Mathura Refinery, Mathura, Uttar Pradesh	29.12.2005	Fire	1/nil/nIl
22.	Kanoria Chemicals and Industries Ltd. Renukoot, Sonebhadra, Uttar Pradesh	29.03.2006	Chlorine release	6/23/nil
23.	Anjana Explosives Ltd., Peddakaparthi Nalgonda District, Andhra Pradesh	18.07.2006	Spillage of hazchem	5/nil/nil
24.	Ravi Organics Ltd., Muzzaffarnagar, Uttar Pradesh	19.09.2006	Gas release	1/nil/nil
25.	Reliance Industries Refinery, Jamnagar, Gujarat	25.10.2006	Leaked hot vaccum gas oil catches fire in air	2/nil/nil

Annexure-B

List of Relevant Statutes on Management of Hazardous Substances

- The Environment (Protection) Act, 1986 (amended 1991) and following Rules thereunder:
  - The Environment (Protection) Rules, 1986 (amended 2004).
  - The Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 (amended, 1994 and 2000).
  - The Hazardous Wastes (Management and Handling) Rules, 1989 (amended 2000 and 2003).
  - The Environment Impact Assessment Notification, 2006.
  - The Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996.
  - Bio-medical Wastes (Management and Handling) Rules, 1989.

- The Factories Act, 1948 (amended 1987).
  - State Factory Rules.

- The Inflammable Substances Act, 1952.

- The Motor Vehicles Act, 1988 (amended 2001).
  - The Central Motor Vehicles Rules, 1989 (amended 2005).

- The Public Liability Insurance Act, 1991 (amended 1992).
  - The Public Liability Insurance Rules, 1991 (amended 1993).

- The Petroleum Act, 1934.
  - The Petroleum Rules, 2002.

- The Insecticide Act, 1968 (amended 2000).
  - The Insecticide Rules, 1971 (amended 1999).

- The National Environment Tribunal Act, 1995.

- The Explosives Act, 1884 (amended till 1983).
  - The Gas Cylinder Rules, 2004.
  - The Static and Mobile Pressure Vessels (Unfired) Rules, 1981 (amended 2002).
  - The Explosives Rules, 1983 (amended 2002).

Annexure-C

List of Selected BIS Standards on HAZCHEM

Standard	Title
IS 646: 1986	Liquid Chlorine, Technical (Second Revision).
IS 662: 1980	Anhydrous Ammonia (First Revision).
IS 1446: 2002	Classification of Dangerous Goods (Second Revision).
IS 4155: 1966	Glossary of Terms Relating to Chemical and Radiation Hazards and Hazchem.
IS 4209: 1987	Code of Safety in Chemical Laboratories (First Revision).
IS 4263: 1967	Code of Safety for Chlorine.
IS 4262: 2002	Sulphuric Acid—Code of Safety (First Revision).
IS 4544: 2000	Ammonia—Code of Safety (First Revision).
IS 4607: 1968	Code of Safety for Hazchem.
IS 4644: 1968	Code of Safety for Benzene, Toluene and Xylene.
IS 5184: 1969	Code of Safety for Hydrofluoric Acid.
IS 5513: 1984	Ethylene Oxide.
IS 5571: 1979	Guide for Selection of Electrical Equipment for Hazardous Areas.
IS 5572: 1994	Classification of Hazardous Areas (Other than Mines having Flammable Gases, Vapours for Electrical Installation).
IS 5685: 1970	Code of Safety for Carbon Disulphide.
IS 5931: 1970	Code of Safety for Handling Cryogenic Liquids (First Revision).
IS 6044 (Part I): 1971	COP for LPG Cylinder Installations.
IS 6044 (Part Ii): 2001	COP for LPG Storage Installations.
IS 6156: 1971	Code of Safety for Chlorosulphonic Acid.
IS 6164: 1971	Code of Safety for Hydrochloric Acid.
IS 6269: 1971	Code of Safety for Ethylene Oxide.
IS 6270: 1971	Code of Safety for Phenol.
IS 6818: 1973	Code of Safety for Phosphoric Acid.
IS 6819: 1973	Code of Safety for Calcium Carbide.
IS 6953: 1973	Code of Safety for Bromine.
IS 6954: 1973	Code of Safety for Caustic Potash.
IS 7415: 1974	Code of Safety for Aniline.
IS 7444: 1974	Code of Safety for Methanol.
IS 7445: 1974	Code of Safety for Acetone.
IS 8185: 1976	Code of Safety for Phosgene.
IS 8388: 1977	Code of Safety for Nitrobenzene.
IS 9277: 1979	Code of Safety for Monochlorobenzene.
IS 9279: 1979	Code of Safety for Aluminum Phosphide.

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Contd

IS 9786: 1981	Code of Safety for Vinyl Chloride Monomer (VCM).
IS 10553: 1983 (P-I, II, IV)	COP Chlorine Cylinders and Drums.
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IS 14165: 1995	Handling of Carcinogenic Substances—Code of Safety.
IS 14200: 1994	Code of Safety for Hydrogen Peroxide.
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IS 14814: 2000	Acetylene—Code of Safety.
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IS 14984: 2001	1,3-Butadiene—Code of Safety.
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OISD

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Standard\Std-113.doc	Classification of Area for Electrical Installation at Hydrocarbon and Handling Facilities.
Standard\GDN-115.doc	Guidelines on Fire Fighting, Equipment and Appliances in Petroleum Industry.
Standard\Std-116.doc	Fire Protection Facilities for Petroleum Refineries and Oil/Gas Processing Plants.
Standard\Std-117.doc	Fire Protection Facilities for Petroleum Depots and Terminals (Amended Edition).
Standard\Std-129.doc	Inspection of Storage Tanks Rev. I.
Standard\Std-138.doc	Inspection of Cross Country Pipelines—Onshore.
Standard\Std-142.doc	Inspection of Fire Fighting Equipments and Systems.

Standard\Std-144.doc	Liquefied Petroleum Gas (LPG) Bottling Plant Operations Rev. I. Vol - I Design Philosophies. Vol - II Operating Practices. Vol - III Inspection and Maintenance Practices. Vol-IV Safety and Fire Protection.
Standard\Std-150.doc	Design and Safety Requirements For Liquefied Petroleum Gas Mounded Storage Facility.
Standard\Std-157.doc	Recommended Practice for Transportation of Bulk Petroleum Products.
Standard\Std-158.doc	Recommended Practices on Storage and Handling of Bulk Liquefied Petroleum Gas.
Standard\Std-159.doc	LPG Tank Trucks—Requirements of Safety on Design/Fabrication and Fittings.
Standard\Std-160.doc	Protection to Fittings Mounted on Existing LPG Tank Trucks.
Standard\Std-163.doc	Process Control Room Safety.
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4. A Guide to CA(EPPR) Rules and On-Site and Off-Site Emergency Plan, 2001.
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3. Guidelines for Safe Warehousing of Substances with Hazardous Characteristics (Indian Chemical Manufacturers Association, 1987).
4. Major Hazard Control, A Practical Manual (ILO, 1988).
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Annexure –D

Strategy for Community Awareness on Hazardous Materials

Key Importance of Proper Community Awareness

- Due to the statutory provisions, the industry is obliged to provide appropriate information to the community living in the vicinity of a hazardous plant/installation.

- It is important to realise that a well-informed community is an asset to both the industry and local authorities as it would offer willing cooperation not only during an emergency but also in other development programmes.

- Communication with the public is a joint responsibility of government, industry and the community. Rapport between them creates tremendous goodwill for industry.

- Communication channels need to be a two-way initiative. Further, members of the community should participate in the development and implementation of such communication programmes.

Suggested Strategy

To be effective, community awareness activities should be undertaken as per the strategy developed after due deliberations among the stakeholders in the LCG. The essential features of such a strategy are:

- **Credibility—**It is absolutely necessary to ensure that the information provided to the community and the activities undertaken for its propagation are absolutely credible. Since the LCGs represent all the stakeholders and community awareness is one of their functions, the information and activities should be approved by the LCG and released/undertaken on its behalf.

- **Need-based—**The information provided should be need-based relating to HAZCHEM handled and the type of accidents/emergencies encountered in the industrial area to which the community belongs. Too much detail should be avoided.

- **Regularity**
  - An on-off approach must be avoided
  - A regular system should be in place so that the community can seek information on its own as and when required. Further, a visible difference can only be ensured if awareness/education activities are undertaken regularly.

- **Community Information Representative (CIR**)

  A suitable nodal person may be designated by the LCG to function as a CIR and made known in the industrial area. Such a person could be from a reputed NGO represented on the LCG. The CIR should use the facilities (lecture hall, audio visual aids, etc.) already available in the industrial area.

- **Effective Communication**

  The information released should be simple, supported by pictorial representations as far as possible and issued in the local languages, Hindi and English. Further, for effective communication, it is not enough to issue only written information through leaflets. It should be supplemented by regular awareness sessions (about 2 hours duration). The use of video along with the lecture would contribute to the proper understanding of CDM. A required number of community educators can be trained in making the communication effort more effective. Besides general information, specific information on chemicals used in the industrial area should be given to individuals who ask for such information.

- **Target Groups**

  These should be carefully selected by discussion in the LCGs. Opinion makers who interact with the community and are respected by it, such as college/school teachers, students, office bearers of Mahila Mandals and residential cooperative societies, hospital representatives, etc., can play an important role in developing community awareness and should be selected. The number of people to be exposed to such training and awareness programmes should be estimated carefully.

- **Supplementary Activities**

  To supplement the above activities, community awareness information could be displayed in places frequently visited by the public, such as the municipal ward office, rationing office, hospitals/ dispensaries, school/colleges, bus stops, railway stations, etc. Various other innovative/creative means such as shopping bags, inserts in the telephone directory etc., as decided by the LCG could also be used effectively. Community festivals could also be used.

Annexure –E

Important Roles and Responsibilities of Various Stakeholders

The important roles of different stakeholders related to CDM shall be spelled out more clearly to further increase their effectiveness:

a) **The chemical industry** should fulfil its total obligations as described earlier. Complete coordination should be ensured between the industry and district authority. The chemical industry shall also specifically address the following:

   i) Selection of safe technology by industry shall be the prerogative of the industry based on their need, size and availability of inputs as an important preventive measure for CDM.

   ii) On-Site emergency plan and periodic mock drills.

   iii) Supporting district authorities in mitigation, rescue and rehabilitation, with resources identified and agreed with the authorities in advance. Such areas shall be included in Off-Site plans.

b) **The district authority** is responsible for the Off-Site emergency plan and it shall be equipped with up-to-date MAH units, website, control room etc., with provisions for monitoring the level of preparedness at all times. Regular meetings of various stakeholders of CDM will be conducted by district administration/DDMA to review the preparedness for CDM.

c) **The police** will be an important component of all disaster management plans as they will be associated with investigation of accidents/disasters. Police take overall charge of the Off-Site situation until the arrival of the district collector or its representative at the scene.

   i) Special training should be imparted to the police personnel for the investigation of a transport emergency involving HAZCHEM. The police personnel should use the information available with the driver of the HAZMAT vehicle involved in the incident/accident for handling the emergency.

   ii) Any disciplinary action, if warranted, against the driver or cleaner should not get precedence over the investigative procedure.

d) The **fire services** are one of the first responders and shall be adequately trained and equipped to handle chemical emergencies. The fire services need to be updated in terms of equipment and trained manpower. Necessary regulations will also have to be evolved to empower them to handle chemical emergencies. The general perception of their functioning is that they are involved in fire fighting only. At times they have inhibitions to handle chemical emergencies. The fire services shall be strengthened to handle not only emergencies arising out of fire but also those arising out of HAZCHEMs. Fire services are to acquire a thorough knowledge of likely hazards at the incident site and the emergency control measures required to contain it. The infrastructure and capacity building of the NFSC and the fire brigades shall be augmented on a priority basis. A national-level programme shall be introduced to strengthen and train the entire fire-service sector, along with its capacity building.

e) In a chemical emergency, the **revenue department** shall coordinate with other agencies for evacuation, establishment of shelters and provision of food, etc.

f) When required for evacuation purposes in a chemical emergency, the **department of transport** should make transport promptly available.

g) The role of **civil society and private sector** in the Off-Site plan shall be defined.

h) **The health department** needs to assure that all victims get immediate medical attention on the site as well as at the hospitals/health-care facility where they are shifted. In addition, the department needs to network all the health-care facilities available in the vicinity for effective management and also take effective measures to prevent the occurrence of any epidemic.

i) **Pollution control boards** need to ascertain the developing severity of the emergency in accordance with responsive measures by constant monitoring of the environment. If and when an area is fit for entry will depend upon the results of the monitoring. A decontamination operation would be required to be carried out with the help of other agencies and industries.

j) **The NDRF and SDRF** are the specialised forces to manage these disasters in a longer run according to the severity and nature of the disaster. Their specialised training is an effective measure that needs to be built up and maintained with time for achieving a higher standard of preparedness. They need to coordinate with other local agencies such as the Central Industrial Security Force that may be responsible for security at the industrial site.

Annexure-F

Suggested Elements of an On-Site Emergency Plan

- **Plant Emergency Organisation**
  - Designated person in charge/alternates.
  - Functions of each key individual and group.
  - Telephone numbers (office and home) for key people/alternates.

- **Plant Risk Evaluation/Information on Preliminary Hazard Analysis**
  - Quantity of HAZMATs.
  - Location of HAZMATs.
  - Properties of each (MSDS sheets).
  - Location of isolation valves.
  - Special fire-fighting procedures (if any).
  - Special handling requirements.
  - Type of accidents.
  - System elements or events that can lead to a MAH.
  - Safety relevant components.

- **Details about the site**
  - Location of dangerous substances.
  - Seat of key personnel.
  - Emergency control room.

- **Description of HAZCHEM at the plant site**
  - Chemicals (quantities and toxicological data).
  - Transformation if any, which could occur.
  - Purity of HAZCHEM.

- **Likely dangers to the plant**

- **Enumerate effects of**
  - Stress and strain caused during normal operation.
  - Fire and explosion inside the plant and effect if any, of fire and explosion outside.

- **Details regarding**
  - Warning alarm and safety and security.
  - Alarm and hazard control plans in line with disaster control planning, ensuring the necessary technical and organisational precautions.

- Reliable measuring instruments, control units and servicing of such equipment.
- Precautions in designing of the foundation and load bearing parts of the building.
- Continuous surveillance of operations.
- Maintenance and repair work according to the generally recognised rules of good engineering practises.
- Details of communication facilities available during emergency and those required for an Off-Site emergency.
- Details of fire fighting and other facilities available and those required for an Off-Site emergency.
- Details of first aid and hospital services available and its adequacy.

- **External organisation if involved in assisting during an On-Site emergency**
  - Type of accidents.
  - Responsibility assigned.

- **Area Risk Evaluation**
  - Properties of HAZMAT at nearby plants.
  - Population clusters nearby.
  - Contacts (names, telephone numbers) at other sites.
  - Established procedures for notification of chemical release at other sites in area.

- **Notification Procedures and Communication Systems**
  - Alarm systems.
  - Communication equipment (radios, hot lines, etc.) plant management, local officials and response agencies, neighbouring industries, nearby residents.
  - Names and telephone numbers (with alternates) list.
  - Designated person for media contacts.
  - Procedure for notifying families of injured employees.
  - Central reporting office.

- **Emergency Equipment and Facilities**
  - Fire-fighting equipment.
  - Emergency medical supplies.
  - Toxic gas detectors (where needed).
  - Wind direction/speed indicators.
  - Self-contained breathing apparatus.
  - Protective clothing.
  - Other On-Site equipment to be specified according to local conditions.
  - Containment capabilities.

- **Training and Drills**
  - Knowledge of chemicals (properties, toxicity, etc.).

Contd

Contd

- Procedures for reporting emergencies.
- Knowledge of alarm systems.
- Location of fire-fighting equipment.
- Use of fire-fighting equipment.
- Use of protective equipment (respirators, breathing air, clothing, etc.).
- Decontamination procedures for protective clothing and equipment.
- Evacuation procedures.
- Frequent, documented simulated emergencies.

- **Regular Tests of Emergency Organisation/Procedures**
  - Simulated emergencies.
  - Documented, frequent alarm system.
  - Frequent tests of fire-fighting equipment.
  - Evacuation practise.
  - On-going emergency preparedness committee.

- **Plan Updates**
  - Annual or more frequent if needed.
  - Reflect results of drills and tests.

- **Emergency Response Procedures**
  - Communications.
  - Evacuation or safe haven.
  - Medical (include handling of multiple injuries).
  - Special procedures for toxic gas releases (chlorine, etc.).
  - Hurricane procedures (coastal area only).
  - Utility failure procedures.
  - Individual unit emergency procedures.
  - Bomb threat procedures.

- **Detailed Operating Manuals (for each process unit and utility system)**
  - Start-up/shutdown emergency procedures.
  - Analysis of potential incidents.
  - Emergency response and action to be taken for each incident.

- **Established Emergency Response Durations**
  - Sounding of alert level III (for Off-Site emergency).
  - Communication to control room—wind speed and direction and for recorded message transmission to nearby community through public address system.

- Actuation of stand-by systems.
- Hotline/communication to first responders—the police and fire brigade.
- Mobilisation of internal resources.
    - Affected plant/system stoppage.
    - Replacement of operation staff with other plant/unit personnel.
    - Fire tender/ambulance.
    - Employees and visitors shifting to assembly points.
    - Energising fire hydrant/foam or other specified protection system.
    - Isolating the leaky area.
    - Emergency crew repairing/isolating leakages.

- **Procedure for Returning to Normal Operations**
    - Interface and lines of communications with Off-Site officials.

All clear siren or in case of aggravation of emergency—initiation of full scale Off-Site measures including broadcast, evacuation, diversion of all types of traffic etc. and full scale operation of medical emergency system.

Annexure-G

Information for use in the Off-site Emergency Plan

This is a section in the On-Site emergency plan for use in the Off-Site emergency plan.

- Summary of risk analysis, vulnerability zone for those scenarios which can escalate into off-site emergencies.

- List of resources required to handle the off-site emergencies foreseen in the On-Site plan, their assessment of the adequacy and prompt full scale availability (establishment of response time), route/alternate route clearance, diversion/stoppage of traffic on mobilisation routes.

- If own resources (such as equipment, trained man-power, medical help etc.) are not adequate to meet such off-site emergencies, to clarify the arrangement (formal or informal) made to obtain the additional resources (e.g., mutual aid or arrangement with the public response agencies) mentioning the salient terms of such arrangements.

  Organisations involved (including key personnel) and responsibilities and liaison arrangements between them.

  - Information about the site including likely locations of dangerous substances, personnel and emergency control rooms.
  - Technical information such as chemical and physical characteristics and dangers of the substances and plant.
  - Identify the facilities and transport routes.
  - Contact for further advice e.g., meteorological information, transport, temporary food and accommodation, first aid and hospital services, water and agricultural authorities.
  - Communication links including telephones, radios and standby methods.
  - Special equipment including fire-fighting materials, damage control and repair items.
  - Details of emergency response procedures.
  - Notify the public.
  - Evacuation arrangements.
  - Arrangements for dealing with the press and other media interests.
  - Longer term clean up.

- What resources can be spared by the industrial unit for use in the Off-Site emergency arising out of On-Site emergencies of other units and what is the arrangement for releasing such resources?

- How has the community awareness programme been planned? How has the community been identified (from which zone/part or full vulnerability zone based on well established wind-roses)? Have the key opinion makers who can play an active role been identified? (Give list along with their contact details). Has the selection of the community or that of key persons in the community been done in consultation with the district authority, etc.?

- Has insurance under the Public Liability Insurance Act been obtained? Give summary.

- Designate a contact person who would be authorised to coordinate for the Off-Site plan and his contact details.

Technical team (chemical-wise) in case of an Off-Site emergency that has taken place due to escalation of an On-Site incident, contact details of its members.

Annexure-H

Major Chemical Installations: Chemical Safety Procedures

- Accident/incident reporting system.
- Audit: external/internal.
- Confined space entry.
- Contractor safety/training.
- Loss prevention from hazards:
  - Building and structure design.
  - Capital project review during design and construction phases.
  - Combustible dusts.
  - Electrical.
  - Emergency planning.
  - Documentation for safe practises, equipment and piping.
  - Fire protection system.
  - Fire-fighting capability.
  - Regular inspection/testing of equipment.
  - Protective measures for flammable liquids and gases.
  - Flexible joints in hazardous services.
  - Minimisation of fragile devices in hazardous services.
  - Instrumentation to monitor and control critical parameters.
  - Leak and spill control/containment.
  - Means for egress of occupants.
  - Pressure vessel design, installation, inspection, documentation to prevent damage/rupture to equipment or other hazardous operations.
  - Process computer and data handling protection.
  - Process safety comprising:
    - Risk assessment to evaluate hazard potential, both qualitative and quantitative.
    - Procedures to evaluate impact upon safety and loss prevention.
    - Reactive chemicals review process.

- Reactive hazards for existing/new processes and whenever key personnel/processes changed.
- Storage facilities for toxic, flammable, combustible or corrosive material equipped with appropriate protective features as located to minimise exposure to other operations.
- Interlocking.
- Jobs and process operating procedures.
- Line and equipment operating rules and guidelines.
- Block-out and red-tag procedures.
- Testing of emergency.
- Emergency alarms and protective devices.

- Security:
  - Access control for authorisation, identification and control of all people and vehicles accessing installation facilities.
  - Control of data and process control computers.
  - Data information and transmission system.
  - Location emergency control (designated person responsible for overall security and planning).
  - Programming and vision to control emergencies.
  - Material control.
  - Social unrest procedures and tests.

Annexure-I

Some Specific Safety Provisions for the Safe Transportation of Petroleum Products

Petroleum products are the major bulk HAZCHEM material transported by various means of transportation. The products mainly include gasoline (petrol), diesel, compressed gases and others. The Petroleum Rules, 2002, covers a majority of the safety aspects related to its handling, transportation, etc.

A) The following recommendations are in accordance with the above Rules specifically for liquid products:

a) No leaky tank or container shall be used for transportation of HAZCHEM.

b) Filled barrels and drums should be loaded with their bung upwards.

c) No ship, vessel and vehicle shall carry petroleum if passengers or any combustible cargo is present on board.

d) Smoking, matchsticks, lighters or other fire inducing appliances should be strictly prohibited during loading/unloading and while transportation.

e) Loading/unloading of petroleum after sunset shall be prohibited unless adequate lighting and fire-fighting facilities with trained personnel are kept in place.

f) Petroleum in bulk shall be necessarily carried in a ship or other vessel which is licensed for the stated purpose and stored in the standardised mandated manner approved by the licensing authority in water transportation.

   i) It should not be transported in a barge or flat-bottomed boat unless it is self propelled or is in tow of, or attended by a steamer or tug and carries fire extinguishers. After complete discharge of petroleum from the vessel, its holds, tanks and bilges shall be rendered free from inflammable vapour.

   ii) Gas Free Certificates for dock entry, man entry and hot work by the appointed officers are obligatory.

   iii) Petroleum in bulk is to be loaded/unloaded into or from any ship only at locations notified/ permitted by the central government in case of import.

   iv) Handling facilities in all cases shall be approved by the chief controller after evaluating the various safety reports.

   v) The use of naked lights, fire or smoking on board a vessel is prohibited.

   vi) Fire-extinguishing appliances should always be kept ready.

g) Transportation of petroleum by land requires strict provisions for safety of the tank vehicle. The tank vehicle shall be built, tested and maintained as per the third schedule of The Petroleum Rules, 2002. The tanker shall be fabricated and mounted on the chassis by an approved manufacturer conforming to the approved fabrication/mounting drawings. The schedule also gives details about correct structural relationship between various components of the tank vehicle.

h) Pipelines are one of the major modes of transportation for petroleum products. The design and route of pipelines shall be approved before laying them. Pipelines shall be constructed of suitable steel and designed as per the recognised code. Pipelines are to be patrolled effectively by the company owning it and they should have efficient communication facilities.

B) Compressed gases are highly inflammable and also prone to accidents while transportation. They are transported mainly by cylinders and tankers:

a) Filled cylinders should not be transported by a bicycle/two-wheeled mechanically propelled vehicle; no portion of the cylinder should project from the vehicle and there should be no other flammable or corrosive articles in it. These cylinders need to be prevented from falling, rough handling, excessive shocks or local stresses.

b) No lifting magnet shall be used in loading or unloading of filled cylinders.

c) No person shall transport any leaky cylinder. In case of a leak during transport the same shall be removed to an isolated open place away from any source of ignition.

d) Cylinders containing flammable gases should not be transported along with cylinders containing other type of compressed gas.

e) Toxic or corrosive gas cylinders shall not be transported along with food-stuffs.

f) Each LPG tanker should be provided with an emergency kit for handling leakage of gas in transit.

g) Cryogenic pressure vessels intended for storage or transportation of cryogenic liquids are also covered and the provisions for safety during fabrication, installation and transportation should be strictly implemented.

Annexure-J

UN Recommendations on the Transport of Dangerous Goods

RULES FOR MOVEMENT			
AIR	**SHIP**	**ROAD`**	**RAIL**
International Civil Aviation Organization (ICAO), Montreal www.icao.int	International Maritime Organization (IMO), London www.imo.org	United Nations Economic Commission for Europe (UNECE), Geneva www.unece.org	Office for International Rail Transport (OCTI), Berne www.otif.org
Technical Instructions for the Safe Transport of Dangerous Goods by Air (T1)	International Maritime Dangerous Goods Code (IMDG)	European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)	Regulations concerning the International Carriage of Dangerous Goods by Rail (RID)

Annexure-K

Important Websites

Ministry/ Institute/ Agency	Website
Council of Scientific and Industrial Research	http://www.csir.res.in/
Defence Research Development Organisation	http://www.drdo.org/
Department of Atomic Energy	http://www.dae.gov.in/
Department of Economic Affairs	http://finmin.nic.in/the_ministry/dept_eco_affairs/
Department of Road Transport and Highways	http://morth.nic.in/
Directorate General Factory Advice Service and Labour Institutes	www.dgfasli.nic.in
Disaster Management Institute, Bhopal	www.dmibpl.org
Indian Institute of Chemical Technology	www.iictindia.org
Indian Institute of Management, Ahmedabad	http://www.iimahd.ernet.in/
Indian Institute of Technology, Delhi	http://www.iitd.ac.in/
Industrial Toxicology Research Centre, Lucknow	www.itrcindia.org
Ministry of Agriculture	http://agricoop.nic.in/
Ministry of Chemicals and Fertilizers	http://chemicals.nic.in/
Ministry of Commerce and Industry	http://commerce.nic.in/
Ministry of Defence	http://mod.nic.in/
Ministry of Environment and Forests	www.envfor.nic.in
Ministry of Finance	http://finmin.nic.in/
Ministry of Health and Family Welfare	http://mohfw.nic.in/
Ministry of Home Affairs	http://mha.nic.in/
Ministry of Labour and Employment	http://labour.nic.in/
Ministry of Petroleum and Natural Gas	http://petroleum.nic.in/
National Chemical Laboratory, Pune	www.ncl.res.in/
National Civil Defence College	http://ncdcnagpur.nic.in
National Disaster Management Authority	www.ndma.gov.in
National Environmental Engineering Research Institute, Nagpur	http://neeri.res.in/
National Institute of Occupational Health, Ahmedabad	www.nioh.org
National Safety Council, Mumbai	www.nsc.org.in
UNEP/DTIE	www.uneptie.org
United Nations Development Program	www.undp.org.in
World Environment Centre	http://www.wec.org

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