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NATIONAL DISASTER MANAGEMENT GUIDELINES

MANAGEMENT OF CHEMICAL (TERRORISM) DISASTERS

June 2009

NATIONAL DISASTER MANAGEMENT AUTHORITY
GOVERNMENT OF INDIA

National Disaster Management Guidelines

Management of Chemical (Terrorism) Disasters

National Disaster Management Guidelines—Management of Chemical (Terrorism) Disasters

A publication of:

National Disaster Management Authority
Government of India
NDMA Bhawan
A-1, Safdarjung Enclave
New Delhi – 110 029

ISBN: 978-81-906483-9-4

June 2009

When citing this report the following citation should be used:
National Disaster Management Guidelines—Management of Chemical (Terrorism) Disasters, 2009.
A publication of the National Disaster Management Authority, Government of India.
ISBN 978-81-906483-9-4, June 2009, New Delhi.

The National Guidelines are formulated under the Chairmanship of Lt. Gen. (Dr.) J.R. Bhardwaj, PVSM, AVSM, VSM, PHS, (Retd.), Hon'ble Member, NDMA, in consultation with various stakeholders, regulators, service providers, and specialists in the subject field concerned from all across the country.

National Disaster Management Guidelines

Management of Chemical (Terrorism) Disasters

National Disaster Management Authority
Government of India

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Vice Chairman
National Disaster Management Authority
Government of India

FOREWORD

Formulating guidelines for mitigation and response to various types of disasters forms an important part of the mandate given to the National Disaster Management Authority (NDMA). Disasters which can be caused by acts of chemical terrorism are one such high priority area, as a terrorist attack involving chemical agents can be a highly traumatic event. It is also likely to result in irreparable damage to the environment—both biotic and abiotic, and also cause a large number of fatalities. With this in mind, work on the preparation of *National Disaster Management Guidelines—Chemical (Terrorism) Disasters* was undertaken on a priority basis over two years ago.

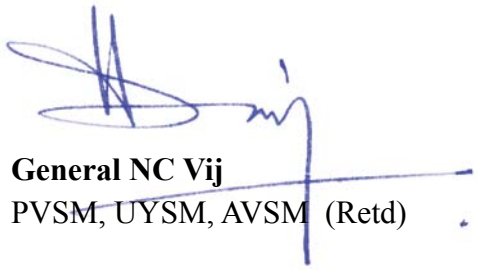
The formulation of these Guidelines has involved the active participation and contribution of nearly 200 experts, including representatives of various stakeholders such as central ministries and departments, regulatory agencies, intelligence agencies, research and development organisations, scientific and technical institutes/academies, National Authority of Chemical Weapons Convention, Defence Research and Development Establishment, and disaster management institutes. There was also extensive interaction at the functional level to identify and incorporate pertinent practical aspects to ensure the smooth functioning of the entire management mechanism.

A Core Group of 11 Members was constituted thereafter, which prepared the draft guidelines taking into account the operational, administrative, financial and legal aspects. These draft papers were extensively reviewed several times by the Members of the Core Group/Steering Group and various experts from this field before finalisation.

Based on these Guidelines, suitable plans will be made by all the concerned central ministries/ departments and states. The underlying philosophy of these Guidelines is to build on existing structures and mechanisms. *National Disaster Management Guidelines—Chemical (Terrorism) Disasters* call 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 to handle any eventualities resulting from chemical terrorism. These Guidelines contain all the details that are required by planners and implementers in the central ministries/departments and states.

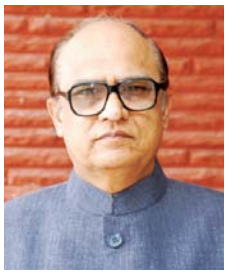
I take this opportunity to express my deep appreciation of the commitment shown by various stakeholder groups who extended their willing support and cooperation to our efforts in preparing these Guidelines. I am grateful to the members of the Core Group for their commitment and endless hours of

work. I also wish to convey my deep appreciation to the Members of the NDMA for their noteworthy contribution to these Guidelines. I would also like to commend the significant contributions made by the Ministry of Defence, Ministry of Home, Ministry of Health and Family Welfare, National Authority of Chemical Weapons Convention, intelligence agencies, and Defence Research and Development Establishment, Gwalior, in preparation of these Guidelines. 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
1 May 2009

General NC Vij
PVSM, UYSM, AVSM (Retd)



Member
National Disaster Management Authority
Government of India

ACKNOWLEDGEMENTS

National Disaster Management Guidelines—Management of Chemical (Terrorism) Disasters has been formulated with the combined and untiring efforts of the Core Group and experts from this field. I would like to express my special thanks to all the individuals who have participated proactively in this consultative process. The keen interest and participation of the Ministry of Health and Family Welfare, Ministry of Home Affairs, Ministry of Defence, Armed Forces Medical Services, Ministry of Environment and Forests, various states and union territories, non-governmental organisations, and the private sector has enriched the content of this document. I would like to place on record the significant contribution made by Dr. R. Vijayraghavan, Director, DRDE; Dr. Muzaffar Ahmad, Director, Health Services, J&K; Shri A.B. Mathur, Additional Secretary, Intelligence Bureau; Shri Raju Sharma, Joint Secretary, National Authority on CWC; Dr. R.K. Sharma, Joint Director INMAS; Dr. R.N. Salhan, Additional DG, Directorate General Health Services; Mr. Satyavam Khanchi, DC, MHA and other core group experts. I am also thankful to Brig. S.B.S. Lidder, Commander, Faculty of NBC Protection, College of Military Engineering, Pune, and chemical scientists from various laboratories for providing inputs related to research in chemical disasters.

I would like to express my sincere thanks to the representatives of the other central ministries and departments concerned, regulatory agencies, Defence Research and Development Organisation, professionals from scientific and technical institutes, eminent professionals from leading national institutions like the College of Military Engineering, All India Institute of Medical Sciences, and National Institute of Disaster Management for their valuable inputs which have helped us in enhancing the content and presentation of the Guidelines.

The efforts of Maj. Gen. J.K. Bansal, VSM, Dr. Pankaj Kumar Singh, and Dr. Raman Chawla in providing knowledge-based technical inputs to the core group and knowledge management studies of global best practices in Chemical (Terrorism) Disaster Management are highly appreciated.

I would like to acknowledge the active cooperation provide by Mr. H.S. Brahma, Special Secretary and the administrative staff of the NDMA. I express my appreciation for the dedicated work of my secretarial staff including Mr. Deepak Sharma and his team for providing secretarial assistance and organising the various workshops and meetings held during the course of preparing the Guidelines.

Finally, I would like to express my gratitude to General N.C. Vij, PVSM, UYSM, AVSM (Retd), Hon'ble Vice Chairman, NDMA, and Hon'ble Members of the NDMA for their constructive criticism, guidance and suggestions while formulating these Guidelines.

New Delhi
1 May 2009

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PVSM, AVSM, VSM, PHS (Retd)
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Abbreviations

2,4,5-T	2,4,5- trichlorophenoxyacetic acid
2,4-D	2,4-dichloro-phenoxyacetic acid
AC	Hydrogen Cyanide
ACh	Acetylcholine
AChE	Acetylcholinesterase
AFMS	Armed Forces Medical Services
AIIMS	All India Institute of Medical Sciences
ARF	ASEAN Regional Forum
ARME	Accident Relief Medical Equipment
ASCI	Administrative Staff College of India
ATI	Administrative Training Institute
BAL	British Anti Lewisite
BARC	Bhabha Atomic Research Centre
BLS	Basic Life-Support
BZ	3-quinuclinidinyl benzilate
C8-DADS	Code-8 Direct Application Decontamination System
CBP	US Bureau of Customs and Border Protection
CBRN	Chemical, Biological, Radiological and Nuclear
CDM	Chemical Disaster Management
CIDS	Chief of Integrated Defence Staff
CISF	Central Industrial Security Force
CLW	Community Level Worker
CMG	Crisis Management Group
CMO	Chief Medical Officer
CN	ω-chloroacetophenone/2-chloro-1-phenylethanone
CNBr	Cynogen Bromide
CNCl	Cynogen Chloride
CPCB	Central Pollution Control Board
CR	Dibenz(b,f)(1,4)-oxazepine
CRRT	Chemical Rapid Response Team
CS	2-chlorobenzylidene malononitrile
CSI	Container Security Initiative
CSIR	Council for Scientific and Industrial Research
CSR	Corporate Social Responsibility
CTD	Chemical (Terrorism) Disaster

CW	Chemical Warfare
CWA	Chemical Warfare Agent
CWC	Chemical Weapons Convention
DA	Diphenylchloroarsine
DAH&D	Department of Animal Husbandry and Dairying
DAP	Portable Decontamination Apparatus
DC	Diphenylcyanoarsine
DDMA	District Disaster Management Authority
DDMP	District Disaster Management Plan
DG AFMS	Director General Armed Forces Medical Services
DGHS	Directorate General Health Services
DM	Disaster Management
DM Act	Disaster Management Act, 2005
DMAP	4-dimethylaminophenol
DMI	Disaster Management Institute
DMP	Disaster Management Plan
DOC/PSF	Discrete Organic Chemicals containing the elements Phosphorous, Sulfur or Fluorine
DRDE	Defence Research and Development Establishment
DRDO	Defence Research and Development Organisation
DRI	Directorate of Revenue Intelligence
DST	Department of Science and Technology
EOC	Emergency Operations Centre
ERC	Emergency Response Centre
ERDMP	Emergency Response and Disaster Management Plan
ERP	Emergency Response Plan
ESIC	Employees' State Insurance Corporation
EWS	Early Warning System
GIS	Geographic Information System
GoI	Government of India
GPS	Global Positioning System
HAZCHEM	Hazardous Chemical
HAZMAT	Hazardous Material
HD	Distilled Sulfur Mustard
HEPA Filter	High Efficiency Particulate Aerosol Filter
HW(MH&TM)Rules	Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008
i.v.	Intravenously
IC	Incident Command

ICA	Indian Chemical Association
ICMR	Indian Council of Medical Research
ICS	Incident Command System
IDRN	India Disaster Resource Network
IED	Improvised Explosive Device
IICT	Indian Institute of Chemical Technology
IIT	Indian Institute of Technology
IPG	Individual Protective Gear
ITRC	Industrial Toxicology Research Centre
LSD	Lysergic Acid Diethylamide
MAH	Major Accident Hazard
MEA	Ministry of External Affairs
MFR	Medical First Responder
MHA	Ministry of Home Affairs
MoA	Ministry of Agriculture
MoD	Ministry of Defence
MoEF	Ministry of Environment and Forests
MoH&FW	Ministry of Health and Family Welfare
MPI	Mass Poisoning Incident
MSDS	Material Safety Data Sheet
NA(CWC)	National Authority of Chemical Weapons Convention
NATO	North Atlantic Treaty Organisation
NBC	Nuclear, Biological, and Chemical
NCDC	National Civil Defence College
NCL	National Chemical Laboratory
NCMC	National Crisis Management Committee
NDMA	National Disaster Management Authority
NDMG-CD	*National Disaster Management Guidelines: Chemical (Industrial) Disasters*
NDMG-CTD	*National Disaster Management Guidelines: Management of Chemical (Terrorism) Disasters*
NDRF	National Disaster Response Force
NEC	National Executive Committee
NEERI	National Environmental Engineering Research Institute
NFSC	National Fire Service College
NGO	Non-Governmental Organisation
NIDM	National Institute of Disaster Management
NIOSH	National Institute of Occupational Safety and Health
NPIC	National Poisons Information Centre
NSC	National Safety Council

NSG	National Security Guard
OAE	Operation Active Endeavour
OCPF	Other Chemical Production Facilities
OISD	Oil Industry Safety Directorate
OP	Organophosphorus Compounds
OPCW	Organisation for Prohibition of Chemical Weapons
PAM	Pralidoxime Chloride
PCC	Pollution Control Committee
PESO	Petroleum and Explosive Safety Organisation
PGE1	Prostaglandin E1
PIC	Poison Information Centres
PNGRB	Petroleum and Natural Gas Regulatory Board
PPE	Personal Protective Equipment
PPP	Public-Private Partnership
PTSD	Post Traumatic Stress Disorder
QRMT	Quick Reaction Medical Team
QRT	Quick Reaction Team
R&D	Research and Development
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RoI	Return on Investment
SCADA	Supervisory Control and Data Acquisition
SCBA	Self-Contained Breathing Apparatus
SDMA	State Disaster Management Authority
SDRF	State Disaster Response Force
SEC	State Executive Committee
SHE	Safety Health and Environment
SMS	Stress Management System
SOP	Standard Operating Procedure
SPCB	State Pollution Control Board
THC	Tetrahydrocannabinol
TIC	Toxic Industrial Chemical
TIM	Toxic Industrial Material
TSDF	Treatment, Storage, and Disposal Facilities
ULB	Urban Local Body
UN	United Nations
UNSC	UN Security Council
UT	Union Territory
VAT	Value Added Tax
WMD	Weapons of Mass Destruction

Glossary of Common Terms

Adsorption: Adsorption is a process that occurs when a gas or liquid solute accumulates on the surface of a solid or liquid (adsorbent), forming a film of molecules or atoms (the adsorbate). It is different from absorption, in which a substance diffuses into a liquid or solid to form a solution.

Agent Orange: Agent Orange is the code name for a powerful herbicide and defoliant which releases dioxins. It is widely used in herbicidal warfare programmes.

All Hazards Hospital Plan: It is a hospital plan that takes care of all the requirements for the management of all types of mass casualties caused by man-made or natural disasters involving the right players so that response can be more effective and appropriately targeted.

Antidote: The term antidote is derived from the Greek antididonai, 'given against'. It is a substance that counteracts the effects of a poison.

Blister Agents: Blister agents (also known as vesicants) are chemical compounds that cause severe skin, eye, and mucosal pain and irritation. Blister agents cause severe chemical burns, resulting in large, painful water blisters.

Blood Agents: Blood agents or cyanogen agents are chemical compounds, which are carried by blood and circulated in the body. Blood agents may contain the cyanide group, which can inactivate the energy-producing cytochrome oxidase enzymes of cells in the body.

Carcinogen: This refers to any chemical substance, radionuclide or radiation that is an agent directly involved in the promotion of cancer or in the increase of its propagation. This may be due to its ability to damage the genome or to disrupt the cellular metabolic processes.

Decontamination: Decontamination is the process of cleansing to remove contamination, or the possibility of contamination.

Fungicides: Fungicides are chemical compounds or biological organisms used to kill or inhibit fungi or fungal spores.

HAZCHEM: HAZCHEM are chemical compounds that can be used for mass destruction, causing serious damage to the health and property of society.

HAZMATs: HAZMATs are any solids, liquids, or gases that can harm people, other living organisms, property, or the environment. HAZMAT may be radioactive, flammable, explosive, toxic, corrosive, biohazardous, an oxidiser, an asphyxiant, a pathogen, an allergen, or may have other characteristics that render it hazardous in specific circumstances.

Herbicides: Herbicides are chemicals which are used to kill unwanted plants. Selective herbicides kill specific targets while leaving other plants relatively unharmed.

Incendiary Devices: Incendiary devices or incendiary bombs are designed to start fires or destroy sensitive equipment using materials such as napalm, thermite, chlorine trifluoride, or white phosphorus.

Intoxication: Intoxication is the state of being affected by one or more psychoactive drugs. It can also refer to the effects caused by the ingestion of poison or by the over-consumption of normally harmless substances.

Lung Injurants: Lung injurants are substances that damage the respiratory tract, causing extensive fluid build-up in the lungs.

Nerve Agents: Nerve agents (also referred to as nerve gases) are a class of phosphorus containing organic chemicals (organophosphates) that disrupt the mechanism by which nerves transfer messages to organs. The disruption is caused by blocking acetylcholinesterase, an enzyme that normally relaxes the activity of acetylcholine, a neurotransmitter.

Personal Protective Equipment: Personal Protective Equipment (PPE) refers to protective clothing, helmets, goggles, or other garments designed to protect the wearer's body or clothing from injury by electrical hazards, heat, chemicals, and infection—for job-related occupational safety and health purposes, in sports, martial arts, combat, etc. PPE is also used to protect the working environment from pesticide application, pollution or infection from the worker.

Pesticides: Pesticides are chemicals which are used to kill harmful animals or plants. They are used especially in agriculture and around areas where humans live. Some pesticides are harmful to humans, either from direct contact or as residue on food, or are harmful to the environment because of their high toxicity, such as DDT (which is now banned in many countries). Pesticides include fungicides, herbicides, insecticides, and rodenticides.

Projectile: A projectile is any object propelled through space by the exertion of a force, which ceases after launch.

Psychic Incapacitants: Psychic incapacitants are also called psycho-mimetic agents or hallucinogens. This class of compounds are represented by 3-quinuclinidinyl benzilate (BZ), tetrahydrocannabinol (THC), fentanyl and lysergic acid diethylamide (LSD). These chemicals are basically central nervous system depressants or stimulants, causing various physiological or mental incapacitations leading to temporary disability.

Riot Control Agents: Riot control agents are sensory irritants of low military value and are usually used as mob dispersing agents. They comprise of tear gases and coughing agents that rapidly produce temporary disabling effects.

Sarin Gas: Sarin gas is an extremely toxic substance whose sole application is as a nerve agent used in chemical weapons. Production and stockpiling of Sarin was outlawed by the Chemical Weapons Convention of 1993.

Stockpile: A place or storehouse where material, medicines and other supplies needed for emergency relief are kept.

Surveillance: Continuous observation, measurement, and evaluation of the progress of a process or phenomenon with the view to taking corrective measures.

Survivor Guilt Syndrome: Survivor Guilt Syndrome is a type of Post-Traumatic Stress Disorder which, has been used to describe the reactions and behavior of people who have survived massive and adverse events.

Toxic Industrial Chemicals: Toxic Industrial Chemicals (TICs) include chemicals manufactured for industrial, commercial, and medical processes. TICs can be in gas, liquid, or solid form (including particles), which can be used as chemical weapons. Exposure to TICs occurs from vapours that affect the eyes, nose, throat, and lungs.

Toxic Industrial Material: This refers to TICs or non-chemical commercial/industrial materials that may be used as weapons, for example, radioactive material which could be used in a dirty bomb.

Toxicity: Toxicity is the degree to which a substance is able to damage an exposed organism.

Triage: Triage comes from the French verb trier which means literally to sort. In the current sense it is from the military system used from the 1930s, of assessing the wounded on the battlefield. The meaning in our context is—one is able to do the most good for the highest number of people in the light of limited resources, especially during a mass casualty event. This concept prioritises those patients who have an urgent medical condition but are most likely to survive if given medical attention as soon as possible.

Executive Summary

Background

The Indian Subcontinent is one of the most disaster prone regions in the world. The periodicity and intensity of disasters have increased manifold in the last few decades, resulting in a large number of human casualties and huge economic losses. In many disasters, human and economic losses can be minimised by prevention, mitigation and preparedness measures. Anti-national elements find terrorism easy to adopt and cost-effective. They are not only adopting newer modalities but also getting more aggressive. The main aim of terrorists is to intimidate the population, seek attention, or force a legitimately constituted government or organisation, to act or abstain from doing an act. A terrorist attack involving chemical agents differs from a normal terrorist attack as it results in specific effects on health and can cause fatal injuries, create panic, affect the morale of the community, and lower its faith in the government. The targets of terrorists include market places, densely populated areas, public functions, important dignitaries, water and electricity supplies, restaurants/food plazas, malls, places of entertainment, and critical and sensitive military, civil and economic institutions.

Genesis of *National Disaster Management Guidelines—Chemical (Terrorism) Disasters*

There has been a paradigm shift in the Government of India's strategy for disaster management, from a rescue, relief and rehabilitation/recovery approach to a holistic approach with emphasis on prevention, mitigation and preparedness. The possibility of a chemical terrorism attack can be minimised by spreading general awareness and building the capacity of the community, institutions, and governmental and non-governmental organisations. Under Section 6 of the Disaster Management Act, 2005, the National Disaster Management Authority has been mandated *inter alia* to issue guidelines for preparing action plans for the holistic and coordinated management of all disasters. *National Disaster Management Guidelines: Management of Chemical (Terrorism) Disasters* (hereafter referred to as the Guidelines) are intended to focus on all aspects of the disaster management cycle, including prevention measures such as surveillance and intelligence, mitigation of direct and indirect risks, preparedness in terms of capacity development of human resources and infrastructure development, as well as relief, rehabilitation and reconstruction/recovery. These Guidelines will form the basis for the ministries and departments at central, state and district levels to formulate their plans. The approach followed in the Guidelines lays emphasis on:

i) Security and surveillance measures for installations manufacturing/using/storing chemicals.

ii) Strengthening intelligence regarding the movement of chemicals.

iii) Preparedness for counter-terrorism measures:

   a. Issues regarding the safety of chemicals and risk reduction strategies etc.

   b. Strengthening of response through rescue and emergency medical resources.

c. Preparedness of all emergency functionaries in terms of protection, detection, decontamination, decorporation, capacity building and infrastructure development.

d. Community-centric mechanism for the management of Chemical (Terrorism) Disasters.

The approach emphasises preparedness and risk reduction measures by developing a rigorous management framework to reduce the number of deaths due to chemical terrorism activities. The Guidelines are environment and technology friendly, sensitive to the special requirements of vulnerable groups and all stakeholders involved.

The Guidelines are a result of relentless efforts by the Core Group, which was constituted after a national workshop on Biological and Chemical Disasters held between 22–23 February 2007. Representatives from various ministries (Home, Defence, Agriculture), Interpol, Research and Development Organisations (Bhabha Atomic Research Centre, Defence Research and Development Organisation and All India Institute of Medical Sciences), professional institutions and a large number of non-governmental organisations and professionals took part. The workshop identified salient gaps and priority areas. The Core Group subsequently held a number of meetings and formulated the draft document. These deliberations acknowledged the initiatives already taken by the Government and other stakeholders. The draft document was reviewed by experts for evolving a consensus among various stakeholders including the nodal ministry. Detailed inputs from various stakeholders and the recommendations and action points that emerged out of these deliberations have resulted in the development of the *National Disaster Management Guidelines: Management of Chemical (Terrorism) Disasters*.

Structure of the Guidelines

The Guidelines have been prepared to provide directions to the central ministries, departments and state authorities for preparation of detailed plans to prevent/manage chemical terrorism. These Guidelines call for a proactive, participatory, well-structured, fail-safe and multi-sectoral approach at various levels. The Guidelines consist of seven chapters. A brief description of each are given in the succeeding paragraphs.

Chapter 1 gives the background, historical aspects and definitions of important terms related to Chemical (Terrorism) Disasters. Chemical terrorism is an act of violence to achieve professed aims using chemical agents. These chemical agents include poisonous gases, liquids or solids that have a deleterious effect on the biotic and abiotic environment. Due to the relatively easy availability of hazardous chemicals in Major Accident Hazard units, storages and during transportation, terrorists can procure chemicals or even try to sabotage the facilities or transport vehicles as it offers them an easier and often more catastrophic method of terrorist activity. The mode of dispersal used for chemical agents would range from dissemination of aerosolised material to contamination of food and water.

Various types of chemicals like chemical warfare agents, dual use chemicals, toxic industrial chemicals, hazardous chemical wastes, agriculture chemicals and other poisonous substances have been described in detail along with their potential harmful effects like panic reaction, chemical burns, injuries, psycho-social trauma and damage to the environment.

Terrorists may also target petroleum and petroleum product pipelines operated for transmission and the distribution network including CNG cascades and LNG Tankers.

Chapter 2 deals with the present status of the institutional framework, various legislations and regulatory framework, international conventions, global initiatives and recent developments at the national level. At the national level important central government Acts and Rules have been delineated. The initiatives of the states have also been described. The Indian Armed Forces have set up a Nuclear, Biological and Chemical Warfare Directorate. The research efforts of the Defence Research and Development Organisation for developing detection and protection systems and protective equipment and ongoing research efforts have been highlighted. Fire and emergency services for the management of Chemical (Terrorism) Disasters are not yet fully developed with the exception of a few HAZMAT vehicles in some states. One National Poison Information Centre is functioning at the All India Institute of Medical Sciences. There are other poison information centres functioning at (a) National Institute of Occupational Health, Ahmedabad; (b) Department of Toxicology, Amrita Institute of Medical Sciences and Research, Cochin; and (c) Toxiclogy and IMCU Unit, Government General Hospital, Chennai. In addition five Emergency Response Centres have been established which deal with chemical emergencies in a given area and to disseminate technical information relating to the chemicals involved. Three more Emergency Response Centres have been approved recently by the Ministry of Environment and Forests for Andhra Pradesh.

At the global level, international conventions and global initiatives have also been deliberated upon, in the chapter. The Chemical Weapons Convention has been discussed at length and how it has helped to prevent terrorist access to the world's most harmful chemical weapons. There are 182 signatory countries to the Chemical Weapons Convention, which entails certain responsibilities on the members. To oversee the implementation of the Chemical Weapons Convention, the Organisation for the Prohibition of Chemical Weapons has been established at The Hague in The Netherlands, and its role has been delineated. In addition, initiatives by the United Nations Security Council through resolutions have also been listed. Recent national developments like the implementation status of the Chemical Weapons Convention through the enactment of the Chemical Weapons Convention Act, 2000, in India, and establishment of a National Authority for Chemical Weapons Convention with clearly defined functions have also been outlined.

Chapter 3 lists out salient gaps in the management of Chemical (Terrorism) Disasters. Chemical (Terrorism) disasters are preventable and there is a need to develop a mechanism to monitor and perform regulatory checks of stocks and transportation of chemicals that have inherent potential to act as tools for terrorist activities. Though numerous regulations, conventions and rules, both national and international have been enacted, there are a number of gaps in them which have been listed. The requirement of specific regulations covering all aspects of protection, detection and decontamination facilities, relief and compensation to victims of man-made disasters, and chemical security have been highlighted. There are gaps in the risk management framework including risk and vulnerability assessment, surveillance mechanism, intelligence gathering and environmental monitoring, detection, characterisation, early warning systems, and safety and security of chemical agents. Existing gaps in capacity development—especially human resources, knowledge management, infrastructural development, and their functional integration have been identified. Gaps in education and training at various levels of first responders and other emergency functionaries have also been highlighted.

The capacity in terms of adequate medical logistics and infrastructural facilities at various levels for the management and mitigation of Chemical

(Terrorism) Disasters is grossly inadequate. Gaps also exist in the availability of personal protective equipment, decontamination facilities at hospitals, updation of poison information centres, medical first responders, and effective communication and networking. Inadequacies in hospital preparedness for management of Chemical (Terrorism) Disasters and the lack of special group treatment facilities have been described. Adequate provisions for proper response, relief and rehabilitation are lacking.

Chapter 4 elaborates on the measures required to plug the gaps identified in the legislative and regulatory framework. The dovetailing of various relevant Acts, Rules and Regulations with the Disaster Management Act, 2005, has been proposed. The measures proposed under prevention include risk and vulnerability assessment, evolving standard operating procedures, surveillance, and environmental monitoring for risk zonation at the micro level. The role of emergency functionaries with regard to intelligence gathering and specific provisions for addressing the various areas of environmental monitoring at all levels has been detailed.

The development of indicators for possible modes of delivery and the after-effects of chemical agents have been suggested. Such indicators shall then be used to develop an effective early warning system. Modes of tracking widespread purchase of chemical agents and epidemiological surveillance beyond the borders and an atmospheric sampling system shall be developed and integrated into the surveillance system. Various steps regarding security and intelligence measures for the safeguard of chemical agents liable to be used for chemical terrorism activities are listed in the Guidelines and there is a need for overall preparedness at all levels, including contingency planning for management of mass casualty incidents due to terrorist attacks.

The guidelines for capacity development for responding to an attack involving weapons of mass destruction include the development of human resources for search and rescue teams, strengthening of Civil Defence, integration of various aspects of disasters in the curriculum, etc. Imparting education related to chemical terrorism is necessary to develop a resilient community. Educational programmes suggested include both basic and in-service training for first responders and others at national, state and district levels. Proper management of knowledge is essential, which can be promoted by coordinated team effort, adoption of best global practices and developing a mechanism for proper usage and implementation of useful information in an effective manner. The implementing agencies have been directed to develop infrastructural facilities and technical expertise, specialised mobile chemical laboratories for collection, identification, detection of HAZCHEM and strengthening of poison information centres. Equipping first responders with personal protective equipment and advanced detection technologies, and making a provision for antidotes is necessary. Identified institutes will be strengthened and networking between them encouraged. Mechanism for re-evaluation and revision of existing training programmes on a continual basis will be developed. Development of effective information and networking of human and functional organisations have been recommended. A national disaster knowledge network shall be developed to enhance coordination between the various stakeholders and decision makers and to fulfil their information needs.

The promotion of community awareness and methods for its spread have been dealt with in detail. The formation of crisis communication teams for the management of Chemical (Terrorism) Disasters has been suggested. Media management is a key feature of response protocols. Setting up a media management centre has been recommended. Training of personnel to liaise with the media and communicate with the public as per the media management plan has been deliberated upon.

Medical preparedness includes the regular practices of medicine, encompassing recognition of the impact of a Chemical (Terrorism) Disaster. Training of specialised medical first responders, incident site management and evacuation plans have been discussed. Hospital preparedness for the management of chemical casualties has been elaborated.

Chemical disaster victims will be immediately decontaminated to remove/neutralise harmful chemicals on their bodies. The basic hospital disaster management plan which can cater for any mass casualty event has been discussed in *National Disaster Management Guidelines: Medical Preparedness and Mass Casualty Management*. Specific recommendations on various aspects of chemical casualties have been given in these Guidelines. The requirements of a specialised laboratory network to deal with a large number of samples during emergencies has also been enumerated.

Measures for preparedness to cater for public health issues like development of a toxicology database, information on diagnostic facilities, etc., have been elaborated. Steps for high level coordination between various responders and service providers have been listed which include situational assessment and prompt response in the relief and rehabilitation phases in the aftermath of a Chemical (Terrorism) Disaster. The Chemical (Terrorism) Disaster mitigation plans will be anchored to frontline research and development facilities in a holistic manner. Post-disaster documentation has been recommended to be managed by experts.

The guidelines for mitigation of direct and indirect risks have also been given. Major Accident Hazard units throughout the country are a source of easily availabe chemicals and present a special challenge. Specific strategies to mitigate chemical terrorism have been worked out—like developing innovative approaches to detect and disrupt the flow of toxic industrial chemicals, and strengthening the response mechanism, etc. A preventive approach for hazardous waste management has been elaborated. The recommended legislative framework includes the creation of electronic records, monitoring, and enforcement. The advantages of the manifest system shall be explained and impressed upon the generators, transporters, recyclers and re-processors of industrial waste by-products and side-streams to deter terrorist access to hazardous waste. Necessary amendments in the Hazardous Waste (Management and Handling) Rules will be introduced. The development of a mechanism against terrorists acquiring hazardous waste for use as weapons has been suggested. Public-private participation is required to be strengthened to enhance the security of chemicals, provide mandatory insurance cover, proper management of hazardous waste, and mitigation of indirect risks that affect the chemical industry.

Chapter 5 deals with guidelines for response, rehabilitation and recovery. Timely and effective response will be based on an emergency response plan assigning roles and responsibilities to various stakeholders, an alert system and situational assessment, parameters for establishing an incident command post, relief camps, medical units and specialised hospital care. The risk assessment will include field detection technologies, aerial survey and ground-level checking. Onsite assistance by responders trained to tackle chemical terrorism will include cordoning off the incident area, and allowing only persons with personal protective equipment to go through; traffic control; activation of HAZMAT response vehicles with fire and emergency services; communication with poison information centres; defining safe routes for evacuation; and providing psycho-social support to victims. The emergency services at the incident site will also include management of mass panic reaction, protection of responders and conducting decontamination procedures. The guidelines also give the response

functions of various emergency functionaries for the management of chemical terrorism.

Detailed emergency medical response by quick reaction medical teams, triage at incident and support zone, evacuation of casualties as per their severity, and treatment at hospitals has been given in detail. Management of long-term health effects have been elaborated. In the rehabilitation and recovery phases, a proactive, multi-pronged and inter-sectoral approach with active participation of the community has been suggested. Adequate provision of relief to victims, restoration of basic infrastructure, medical rehabilitation and other measures have been indicated. Documentation of the event for the purpose of study and concluding 'lessons learnt' has been recommended. Media management, public-private partnership (by integrating capabilities of the private sector with the government sector) and state/district Chemical (Terrorism) Disaster management planning has also been given in some detail.

Chapter 6 sets out the approach for the implementation of the Guidelines and also highlights the key points for ensuring the implementation of plans prepared by central ministries, departments, states and districts. The revamped plans will be implemented and monitored through an institutional mechanism set up as per the Disaster Management Act, 2005. The nodal ministry (Ministry of Home Affairs) with the help of technical institutions like Defence Research and Development Organisation, Defence Research and Development Establishment and others will evolve programmes and activities in the detailed Action Plan for holistic and coordinated management of Chemical (Terrorism) Disasters.

The milestones for implementation of the Guidelines are—short-term plan for 0–3 years, medium-term plan for 0–5 years, and long-term plan for 0–8 years.

The short-term plan will include:

i) Construction of the legislative and regulatory framework by dovetailing various Acts, Rules and Regulations with the Disaster Management Act, 2005.

ii) Prevention—by integrating the surveillance system based on intelligence inputs, establishing a mechanism for risk and vulnerability assessment and developing indicators for early warning system.

iii) Preparedness—by identifying infrastructure needs for formulating the mitigation plans, implementing a financial strategy for allocation of funds, creating trained medical first responders/quick reaction medical teams and equipping them with all material and medical logistics, establishing physical and collective protection and advance detection technologies, temporary decontamination facilities, communication and networking systems with appropriate intra-hospital and inter-linkages with state ambulance/transport services, state police departments and other emergency services including fire, mobile tele-medicine/tele-health services. The overall capacity development including human and resource development, training, education and knowledge management will be focused as a part of the short-term plan.

The medium-term plan includes:

i) Prevention—by strengthening of integrated surveillance systems and early warning systems at regional levels and incorporating specific disaster risk reduction measures for the management of chemical terrorism by testing the disaster management plans prepared in the previous phases.

ii) Preparedness—by institutionalisation of an advanced emergency medical response

system (networking ambulance services with hospitals), intensification of the processes undertaken in the first period (short-term) and capacity development.

The long-term action plans will focus on the intensification of the activities started in the previous phases and initiation of new activities based upon emerging trends. The activities including community awareness, education and training will be continued in all phases and updated with changing times.

The plans shall address important issues like:

i) Implementation of the national emergency plan.

ii) Inclusion of the management of Chemical (Terrorism) Disasters in the educational curriculum.

iii) Testing of various hospital disaster management plans on the basis of well-established indicators and using mock-drills.

iv) Further strengthening of the National Disaster Response Force, fire services, medical first responders, paramedics and other emergency responders.

v) Build chemical terrorism contingencies into chemical (industrial) response plans.

vi) Creation and expansion of an integrated all-hazard national laboratory network.

vii) Establishment of knowledge management centres and localised networking to enable all the emergency responders to communicate with each other.

viii) Constant upgradation should aim to use the latest available technology. Robots for investigation and action may also be adopted.

Public health emergencies with the potential of mass casualties due to terrorist attacks using chemical agents would also be addressed in the plan by setting up an integrated surveillance system, provision for rapid health assessment and investigation of outbreaks, providing laboratory support and instituting public health measures.

Behavioural studies are required on the behavioural patterns of decision makers, first responders, and the population at large when under stress. Similar studies on the psychology and behaviour of terrorists are also necessary.

A central agency will be identified and made responsible for developing methods for environmental testing to be used during a chemical weapon/terrorist attack.

To conclude, the present systems of preparedness and arrangements for mass casualty management in a Chemical (Terrorism) Disaster need to function in a more coordinated and proactive manner. The Ministries of Home Affairs, Health and Family Welfare, Defence, other line ministries, and state governments/district administrations shall enhance their capacities with the help of the private sector. Their actions and policies should complement each other for institution of a rigorous management framework for the management of Chemical (Terrorism) Disasters.

1 Introduction

In November 2004 a United Nations (UN) panel described terrorism as 'an act intended to cause death or serious bodily harm to civilians or non-combatants with the purpose of intimidating a population, or compelling a government or an international organization to do or abstain from doing any act'. A terrorist attack involving chemical agents differs from other terrorist attacks as it presents specific health effects to a larger population in the shortest possible period, hence creating great panic in the community.

The major targets of terrorists include important persons, densely populated and crowded locations, market places, religious congregations, public functions, convention centres, sports events, food and entertainment facilities, utility services like electricity, gas, or water supplies, important places like government institutions including key economic, military, scientific or other sensitive installations, etc. The likely purpose of terrorist attacks is to create panic, kill, injure, incapacitate or destroy life, and cause damage to critical infrastructure, and the environment.

Terrorists, the world over, are not only getting more and more aggressive in their activities but also adopting newer modalities, techniques, and technologies in their modes of operation. Access to advanced science and technology, cyber technology, state-of-the-art communication systems, sophisticated military grade weaponry, global financial channels, both open and confidential, have given an undue impetus to the capabilities of terrorist groups. Use of terrorism as a state policy by some countries and the emergence of fundamentalism and suicide bombers has further compounded the threat of terrorism. This threat has shown a gradual but steady rise globally over the recent past. In the present global threat scenario posed by Al Qaida and other fundamental groups, India is equally prone to terrorist activities. The management of chemical weapons and other related intelligence issues are in the domain of the Ministry of Home Affairs (MHA), Cabinet Secretariat and intelligence agencies. However, since the preparedness for management of Chemical (Terrorism) Disasters (CTD) is common for all three bodies, the details given here are also pertinent to all of them.

There is a global intellectual consensus that acts of terror shall not be accepted under any circumstances. Preparing the nation to address the threat of chemical terrorism is a formidable challenge because anticipating such attacks and dealing with the devastating consequences of the chemical agents involved are difficult and complex propositions.

1.1 Historical Background

There are a large number of toxic chemicals that have been used either in warfare or for terrorist activities. Although instances of what might be styled as chemical weapons date back to antiquity, much of the lore of chemical weapons as viewed today has its origin in World War I. Development of chemical weapons in World War I was predominantly the adaptation of a chemical 'fill' to standard munitions. The chemicals used were commercial chemicals with well-known properties or their variants or derivatives. Chlorine

gas was used for the first time during World War I in pressurised cylinders (April 1915), the effectiveness of which depended upon the wind direction. Shortly thereafter, a projectile containing phosgene was used to cause more severe damage and this method became the principal means of delivery. Phosgene is more lethal than chlorine gas and its effects are delayed. Cyanide was introduced sometime in the middle of the world war. Mustard shells were employed in July 1917, and simultaneously Diphenyl Chloroarsine was tried as a mask breaker. During the World War, it was estimated that at one stage 30 per cent of all artillery shells from both sides contained some kind of poison gas. After World War I, research on new chemical warfare agents called nerve agents began, which were many times more potent and lethal than chemical agents used in World War I. Significant among them were Di-isopropylphosphoro Fluoridate, Tabun, Sarin, Soman, and VX. 'Agent Orange' and 'Super Orange' were the nicknames given to a defoliant used extensively between 1961 and 1971. Agent Orange, a 50-50 mix of two herbicide chemicals, known conventionally as 2,4-Dichlorophenoxy Acetic Acid (2,4-D) and 2,4,5-Trichlorophenoxy acetic acid (2,4,5-T), was by far, the most frequently employed of the so-called 'rainbow herbicides'. The earliest health concerns regarding Agent Orange arose when it was found contaminated with 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), or Dioxin. Degradation of Agent Orange released dioxins, which caused severe damage to the health of those exposed to it during the Vietnam War. The 1980s witnessed the use of mustard gas as a chemical warfare agent. The end of the Cold War has ushered in political and economic turbulence, along with the rise of fundamentalism and state-sponsored terrorism.

The terrorist organisation—'Aum Shinrikyo' in Japan used a single-front company to purchase 180 tonnes of phosphorous tri-chloride, along with other toxic industrial chemicals. They produced sarin gas from these chemicals and released it in two separate attacks in 1994 and 1995. There were five coordinated attacks in the second incident in which 12 persons were killed and nearly 5,000 persons were affected, causing many of them temporary vision problems. All these amply illustrate the potential of Chemical Warfare Agents (CWA) to wreak long-term destruction upon humans and their environment. However the damage causing capacity of CWA has increased manifold in present times.

The numerous industrial accidents involving Hazardous Chemicals (HAZCHEM), which have occurred in the recent past, provide important learning lessons. The foremost of these are the Flixborough explosion of Cyclohexane (U.K., 1974), the Beek disaster (The Netherlands, 1975) consequent to the release of propylene under pressure, the Seveso disaster (Italy, 1976), involving Dioxin or TCDD, the Mississagua accident (Canada, 1979) due to collision of railway wagons containing chlorine and propane, the Houston accident (USA, 1976) involving an anhydrous ammonia tanker truck, the Sommerville, Massachusetts spill of phosphorous trichloride (USA, 1980), the Mexico explosion in 1983 involving liquefied petroleum gas, and the worst of all—the Bhopal Gas Tragedy (December 1984). Various issues connected with chemical (industrial) disasters involving HAZCHEM have been duly addressed by the National Disaster Management Authority (NDMA) in the *National Disaster Management Guidelines: Chemical (Industrial) Disasters* (NDMG-CD) that has already been released by NDMA and is available on its website—www.ndma.gov.in.

Chlorine gas is still being used in conjunction with conventional vehicle-borne explosive devices. Initially, attacks were poorly executed, probably because much of the chemical agent was rendered non-toxic by the heat of the accompanying explosives. Subsequently, with techniques becoming more refined, attacks

resulted in hundreds of injuries, but did not prove to be viable means of inflicting massive loss of life. Their primary impact was widespread panic, with a large number of civilians suffering non-life threatening, but nonetheless highly traumatic injuries. These attacks demonstrate that human society is quite vulnerable to chemical threats.

1.2 Chemical Terrorism

India's unique geo-climatic conditions make it vulnerable to natural disasters. However, socio-political conditions in the Indian Subcontinent have made this region particularly vulnerable to man-made disasters including chemical terrorism. Chemical terrorism relates to acts of terrorism using chemical agents. Terrorists sponsored by states, and non-state actors with substantial financial resources and technical expertise, may acquire explosives, incendiaries, and chemical agents similar to those used by military services. Toxic industrial chemicals or materials, together with their hazardous waste, as well as Chemical Warfare (CW) agents are included in the quadrate of Chemical, Biological, Radiological and Nuclear (CBRN) agents due to their widespread accessibility, availability of dual technology, lesser complexity of production, ease of use, and potential toxicity.

1.3 Types of Chemical Agents

Toxic chemicals which can be used in terrorism may be generally classified in the following broad categories based on their toxicity and usage.

i) CW agents.
ii) Dual use chemicals.
iii) Toxic Industrial Chemicals/Materials (TIC/TIM).
iv) HAZCHEM and their waste by-products.
v) Agricultural chemicals.
vi) Other poisonous substances.
vii) Natural gas and petroleum products.

1.3.1 Chemical Warfare Agents

CW agents include toxic chemicals, their precursors, ammunition, and equipment for the dispersal of chemical agents. These agents exist in liquid, gas, or solid form. They can be classified based on their chemical nature, like organo-phosphorus, organo-sulphur, organo-fluorine, arsenicals, and others; and persistency or dose-dependent lethal and incapacitating properties. Above all, the most widely used classification is based on their physiological effects. The categories include nerve agents, blistering agents, blood agents, lung injurants, psychic incapacitants, riot control agents, and toxins. The toxicity data, mechanism of action, and toxic effects including signs, symptoms, and treatment of CW agents is given in Annexure I. The effectiveness of CW agents depends on many factors. The important ones include:

i) The efficiency of the delivery system, such as munitions and low-flying aircraft.
ii) Modes of dispersal or dissemination, like spray tanks.
iii) Vulnerability of the potential target.
iv) Meteorological conditions, like wind velocity and direction, humidity, temperature, etc.

1.3.2 Dual Use Chemicals

Dual use chemicals are those that can be used for military warfare though they have important industrial applications as well. These industrial chemicals may act as potential precursors of CW agents and are identified in Schedule 2 and 3 of the Chemical Weapons Convention (CWC) list of chemicals. The important ones are phosgene, cyanogen chloride, hydrogen cyanide, and chloropicrin. A detailed list can be found in Annexure II. Production and use of these chemicals is regulated by industrial verifications.

1.3.3 Important Toxic Industrial Chemicals/ Materials

TIC/TIM are manufactured, stored, transported and used throughout the country and are easily accessible by terrorists, and also vulnerable to them. Facilities handling them in large amounts, like Major Accident Hazard (MAH) units, storages (at ports, within HAZCHEM installations or in isolated areas), and during transportation of HAZCHEM or Hazardous Materials (HAZMAT) through ports, railroads, and highways in large, unprotected quantities, are prone to sabotage by terrorists which can lead to toxic spillages/ releases. Some of the important TICs that can be exploited by terrorists include chlorine gas used in water treatment facilities, phosgene gas used in the urethane foam industry, and anhydrous ammonia used in agriculture, refrigeration, and chemical installations. The important physical effects are generally caused by fire, explosion, and leakage of skin toxicants. Chemically, the agents may affect the lungs, eyes, skin, and blood. Many of them may act as carcinogens. A list of TICs categorised as high, medium, and low threat perceptions are presented in Annexure III.

1.3.4 Hazardous Chemical Wastes

The toxic properties of hazardous waste generated by industries not only critically damages the environment (ground water, surface water, land, soil, ambient air, flora and fauna, etc.) but is also under the constant threat of being exploited by terrorists. Hazardous waste can be explosive, inflammable or prone to spontaneous combustion, corrosive, and susceptible to the unpredictable deadly combinations of non-compatible wastes and off-specification properties, etc. They can cause devastation if used selectively and intelligently after due diligence and study of the specifications. Hazardous wastes are also poisonous and can be utilised to contaminate the drinking water supply of a township or a locality with dire consequences. Thus, terrorists may turn to hazardous waste as a resource for toxicants, or for the synthesis of explosives, e.g., chromium, cyanide etc., are highly poisonous in nature, while lead nickel, iron, and other metals in dissolvable form can result in toxic effects. Waste containing chromium, arsenic, cyanide, acids, alkalis, or unstable compounds can trigger violent reactions.

1.3.5 Agricultural Chemicals

Agrochemicals include chemicals such as pesticides, herbicides, and fungicides used in agriculture to destroy insects, fungi, bacteria, pests, and weeds, and to regulate plant growth (such as fertilisers, plant growth regulators, harvest aids, and soil conditioners). Pesticides are chemicals which are used to kill harmful animals or plants. They are used especially in agriculture and around areas where humans live. Some pesticides are harmful to humans, either from direct contact or as residue on food, or are harmful to the environment because of their high toxicity, such as DDT (which is now banned in many countries). Pesticides include fungicides, herbicides, insecticides, and rodenticides. Herbicides are used for the control of weeds (e.g., nitrophenols, chlorophenoxy, dipyridyls, ureas, uracils, triazines, thiocarbamates, etc.). Insecticides are used for the control of insects (e.g., organo-chlorines, organo-phosphates, carbamates, pyrethroids, etc.). The Bhopal Gas Tragedy underlined the dangers arising out of the storage of pesticides or their intermediates. Similar risks are inherent in the manufacture, formulation, and transport of pesticides and their raw materials, formularies, and intermediates. Fertilisers can be organic (composed of organic matter), or inorganic (made of simple inorganic chemicals or minerals). Following the Oklahoma city bombing using ammonium nitrate in 1995, the threat of fertiliser being used as a weapon has manifested itself in a menacing manner.

1.3.6 Other Poisonous Substances

There are many examples of heavy metal poisoning which have caused heavy casualties.

i) The methyl mercury poisoning catastrophe in Iraq during the early 1970s in which an estimated 10,000 people died and 100,000 were severely and permanently brain damaged.

ii) The Minamata methyl mercury poisoning (Japan) affecting 2,955 people, which was first reported officially in 1956, caused by dumping of toxic waste by two factories, contaminating the fish in the waters around the area, which were consumed by the local population.

iii) Arsenic poisoning of milk consumed by infants in Okayama (Japan, 1955) causing 130 fatalities and affecting over 12,000 people.

iv) The prevalent cases of chronic arsenic poisoning in West Bengal, Taiwan, and Bangladesh underline the inherent potential of heavy metals for terrorist activities.

v) Further, the high incidence of lung cancer reported in 1960 from the factory of Nippon-Denki at Kiryama on the Islands of Hokkaido, in which 30 deaths occurred due to inhalation of dust containing highly oxidised chromium (VI).

Lead is also one of the major environmental poisons and its wide usage in a number of daily use products and medical accessories expose the population to associated risks. Other metals include cadmium which has a disruptive effect on the reproductive and endocrine systems, and cyanide which is well known for its lethal potential. The water solubility and acute toxicity potential of heavy metals like arsenic, mercury, cyanide, or related compounds make them a potential choice to poison food and water.

1.3.7 Natural gas and petroleum products

Natural gas and petroleum products can be used as agents for creating havoc and casualties. LNG being transported by tankers can be used as a cryogenic agent for causing large fires, thereby creating mass panic reaction and fatalities. CNG cascades can have a devastating effect if a detonator is placed inside them. Terrorists may also target petroleum and petroleum product pipelines operated for transmission and the distribution network.

1.4 Acquisition and Delivery of Chemical Agents

Usually ordinary chemical agents are not used for chemical terrorism activities because of the large quantities required to produce significant effects, which complicate logistics. Several other factors that limit the use of chemical agents by terrorists include controlled access to precursor chemicals, difficulty and danger in producing the agents, problems with their dispersion without military munitions, and security issues linked to chemical agents.

Many terrorist groups are well organised, technically sound, have well-connected global networks, and have easy accessibility to methodologies for preparing various 'homemade' agents for chemical terrorism. Among CBRN agents, terrorist organisations prefer to use chemical weapons as an ideal mode of attack as they are cheap, relatively accessible, and easy to transport. A wide range of potentially deadly chemical agents are available, including various insecticides, industrial chemicals, and potent toxins such as ricin, which are relatively easy to produce or acquire. A skilled chemist can readily synthesise most of these chemical agents if the precursors are available. These organisations have purportedly developed manuals that cover *inter*

alia, techniques of assassination including details for the production of poisonous gases, pesticides, fungicides, mustards, arsine, phosgene, and other poisons like ricin, etc. Though somewhat unlikely, it may also be possible to steal deadly agents from civilian research facilities or military stockpiles. A state sponsor of terrorism—most of whom have active programmes for Weapons of Mass Destruction (WMD)—would be willing to provide terrorists with chemical weapons or materials, if it could establish 'plausible deniability' while using a surrogate group to inflict a devastating blow on an enemy.

The lethality of some types of highly toxic chemical agents depends crucially on their delivery system, which predominantly affects the resultant exposure. The common mode of dispersal of chemical agents for terrorism may include:

i) Dissemination of aerosolised or gaseous vapour in confined or open spaces (using motorised vehicle dispensers or an aircraft operating in a crop-duster fashion).

ii) Premeditated mass poisoning of water supply at water reservoirs and bottling plants.

iii) Contamination of personal items and belongings, like handkerchiefs, blankets, etc.

iv) Contamination of packaged food products and pharmaceutical products.

v) The hijacking, sabotage and/or use of any conveyance (including an aircraft, vessel, or vehicle) have effectively been utilised in attacks on the World Trade Center, Mumbai local trains, Glasgow, and recent such attacks in Iraq.

Many factors influence the effectiveness of a delivery system. For instance, open-air release of an agent may be crucially affected by meteorological conditions, while the release of an agent even in a confined space is influenced by the individual dose and air circulation patterns.

1.5 Effects of Chemical Agents

Terrorists use chemicals simultaneously with explosives and other dangerous materials for spreading panic and terror. Poisonous chemical agents have deleterious effects on people, animals, plants, and the environment. The tragic sequel of terrorist attacks involving chemicals also varies in its magnitude and impact.

1.5.1 Health Effects

Chemicals agents cause a variety of harmful effects with different degrees of severity. Most of them are capable of causing serious chemical burns, heat burns, injuries, poisoning, disabilities, and chronic health conditions, causing high morbidity and mortality. Contamination of ambient air is the most significant pathway by which the toxic chemical attacks the target organ i.e., eye, lung, skin, etc., in major chemical disasters. Intake by inhalation or absorption through skin and mucous membranes constitute the main routes of entry. In the case of contaminated water or food, the targets will be the digestive and assimilative systems. When the source of drinking water is contaminated, delayed effects will manifest themselves. The variation in magnitude and impact on human life in terms of severity of injuries depends mainly on the type and amount of the chemical agent used, the potential of the implicated chemical to interact with diverse anatomical structures and physiological functions, the mode of dispersal or delivery, climatic conditions, the route of entry and absorption, the individual's susceptibility, the degree and duration of exposure, and the state of preparedness to counter immediate effects. The long-term effects like carcinogenicity and mutagenicity must also be kept in mind for medical follow up of disaster victims.

1.5.2 Psycho-Social Trauma and Community Behaviour

Although people are often tragically killed and wounded by terrorists in their attacks, terrorism by its nature is designed to have far-reaching psychological effects beyond the immediate victims or objects of their violence. It is meant to instil a sense of fear and thereby intimidate or otherwise affect the behaviour of the terrorists' target. Since fear is deliberately created and exploited during such attacks, it can undeniably be regarded as a form of psychological warfare affecting the behaviour of a much wider target population. Cyber based exchange of information which can be used to cause a CTD presents a tough challenge to democratic societies and liberal values. Terrorism adversely affects normal daily life by threatening personal safety, thereby tearing the social fabric by destroying its business and cultural life and the mutual trust upon which society is based. Common responses to the fear generated by the uncertainty of where and when the next terrorist attack will occur may result in refusal of people to go to religious places, shopping malls, sporting events, theatres, cinema halls, concerts, or to travel. It is often difficult to differentiate psychological harm caused by chemical terrorism from other illnesses. Previous events across the globe demonstrate that a large number of patients with psychological distress will impact emergency response and potentially overwhelm the health care system. Strategies must be developed to diminish fear and hopefully decrease subsequent mass psychological distress that is likely to occur following a mass incidence of chemical exposure.

Research and documentation is lacking in India on these aspects, specifically for CTD. International experience and research has evidence that the affected population and survivors experience panic reactions as an immediate response. Individuals' concern for their own safety and for their near and dear ones, leads to extreme emotional reactions of breaking down, shouting, or running around looking for safety. The individual behavioural response pattern in itself can lead to active physical danger, e.g., jumping out of windows from high rise buildings; but more importantly the behavioural response pattern of groups and crowds becomes critical in terrorism related disasters. A stampede or other such phenomena resulting from the collective behaviour response pattern add to and further compound death and injuries. In the Indian experience of terrorism-related disasters, there have been media reports and indirect evidence, but specific evidence from research is not yet available.

Scientific literature suggests the possibility of Post Traumatic Stress Disorder (PTSD) and 'survivor guilt syndrome' besides other depressive disorders. In India, although there have been a few studies on the psychological fallout of terrorism, which have reported moderate rates of psychiatric symptoms and syndromes like PTSD, there is very little systematic research on the psychological aspects including behavioural response patterns.

1.5.3 Effects on Environment

Chemical terrorism disasters may result in the discharge of toxic chemicals into any one of the compartments of environment, viz., soil, water bodies, and atmosphere. The impact on the environment as a consequence of chemical terrorism activity varies in severity. Re-suspension of chemicals occurs by wind and water mediated erosion and human activities. In the aquatic environment, chemicals present in living and non-living compartments keep recycling at a faster pace and the aquatic biota plays an important role in their phase distribution. Transfer of chemicals from the atmosphere to terrestrial and aquatic ecosystems involve deposition, interception, and retention, however, the particle size and nature of

the chemical, the nature of the vegetation, ground surface aspects, prevailing weather conditions, the state of growth of ground cover, and the physico-chemical nature of the water bodies play an important role.

The pervasion of the environmental compartments by toxic chemicals results in perceptible and insidious effects on human health as a long-range target in the course of bio-magnification through the food chain of living organisms. Plants absorb chemicals from the environment through foliage and roots. Once in the plant, the chemicals are trans-located and stored. Since plants are primary producers, accumulation of chemicals in them have considerable consequences on consumers in the food web.

1.6 Aims and Objectives of the Guidelines

Under Section 6 of the Disaster Management (DM) Act, 2005, the NDMA is inter alia, mandated to issue guidelines for preparing action plans for holistic and coordinated management of all disasters. Broadly, the CTD guidelines are intended to focus on all aspects of the DM cycle including the prevention aspects, like surveillance and intelligence, mitigation of direct and indirect risks, preparedness in terms of capacity development of human resource, infrastructure development for response as well as relief, rehabilitation, and recovery.

The Guidelines shall form the basis for the ministries and departments concerned, at the centre and state level to evolve programmes and measures in their respective DM Plans. The approach followed shall emphasise on:

i) Aspects of chemical security and surveillance measures.

ii) Strengthening of intelligence with regard to chemical movement, to prevent their intentional usage for targeting human beings.

iii) Preparedness for counter-chemical terrorism measures including:

   a. Issues of safety of chemicals and risk reduction strategies including technical (structural and non-structural) preparedness measures.

   b. Strengthening of response by ensuring rescue and emergency medical services at the site and hospitals.

   c. Preparedness of all emergency functionaries in terms of protection, detection, decontamination, decorporation modalities; capacity and infrastructure development including education, training, Research and Development (R&D), institutional support, networking and communication, planning, coordination, and ensuring implementation.

   d. Community-centric mechanism involving all the concerned stakeholders of CTD to build up resilience.

The approach followed emphasises preparedness and risk reduction measures by developing a rigorous management framework to reduce the number of deaths during mass casualty events as a consequence of chemical terrorism activities. The Guidelines are environment and technology friendly, sensitive to the special requirements of vulnerable groups and communities, and address concerns of all stakeholders involved in the management of CTD. Acts of chemical terrorism will be mitigated through strict conformity with existing and new policies by establishing a well-prepared, institutionalised mechanism for the management

of CTD all across the country, as part of the all hazard management plans with the proactive involvement of all stakeholders.

All the stakeholders who are involved directly or indirectly in countering CTD or with its management and mitigation shall make use of these Guidelines. Additionally, the following stakeholders, including responders and service providers, shall specifically make use of these in the following manner:

i) The national/state medical management plans covering macro-issues of capacity development and infrastructure and micro-issues pertaining to establishment and networking with Poison Information Centres (PIC) and other relevant knowledge management institutions, R&D, and response agencies, etc., shall be developed based upon these Guidelines.

ii) District administrators in coordination with fire and emergency services, and the Chief Medical Officer (CMO) shall use these Guidelines for development of specific protection, detection, decontamination, and management aspects in their DM plans. All the hospitals (government, local bodies, NGOs, private, and others) shall incorporate special issues and specific provisions related to chemical terrorism while developing their hospital DM plans.

2 Present Status and Context

The world today is facing different facets of terrorism—disgruntled elements in the community, fundamentalists, and inimical actions of some state and non-state actors. The possibility of chemical WMD, including CW agents being used in wars, low intensity conflicts, and terrorist activities cannot be ignored. In the present context, India is equally vulnerable and concerned about prevention, mitigation, and management of CTD.

The MHA is the designated nodal administrative ministry for the management of CTD supported by line ministries. Globally, the use of WMD is prohibited through initiatives like The Brussels Convention (1874), The First International Peace Conference at The Hague, 1899, The Hague Regulation, 1907, and the international conference called by the League of Nations—The Geneva Protocol, 1925. However, these initiatives were not able to prevent the usage of CW agents during World War I and by terrorist organisations thereafter. While India is firmly opposed to WMD proliferation and has an impeccable record in this respect, it believes that only a consensus of willing nations would ultimately prove to be truly effective in prevention and mitigation of CTD. Various platforms at global, regional, and bilateral levels have been engaged by India in its fight against terrorism. The biggest challenge faced is how to prevent, deter, and defend against the acquisition and use of potentially toxic chemicals, HAZCHEM/ HAZMAT, CW, and WMD by terrorists and terrorist groups. In addition, the ways and means available to prevent widespread destruction, minimise loss of human life and prevent disabilities are the other issues to be kept in mind while putting in place the response mechanism for CTD. In this perspective, an essence of the existing policy, and its techno-legal, institutional, and operational framework is presented in the ensuing paragraphs.

2.1 Institutional Framework

Besides the MHA, which is the designated nodal agency for developing and coordinating the intelligence and surveillance mechanism, the important line ministries mainly involved in coordinating the response and relief in the aftermath of terrorist attacks include MoD, Ministry of Health and Family Welfare (MoH&FW), Ministry of Agriculture (MoA), and Ministry of Environment and Forests (MoEF). MHA also draws technical help from the Chief of Integrated Defence Staff (CIDS), Armed Forces, Defence Research and Development Organisation (DRDO), Armed Forces Medical Services (AFMS), paramilitary forces and state machinery.

Mechanisms are in place to oversee the command and control function at the national level through various Crisis Management Groups (CMGs), which coordinate the response of the government sectors, and monitor the situation in terrorist events. Other agencies at the national level concerned with chemical terrorism include Ministry of External Affairs (MEA), Ministry of Information and Broadcasting, Department of Drinking Water Supply, Department of Animal Husbandry and Dairying (DAH&D); and technical

agencies like Directorate General Health Services (DGHS), AFMS, Indian Council of Medical Research (ICMR), and Drug Controller General of India.

MHA interacts with states and technical institutes at periodic intervals to share intelligence inputs. The other backup technical structure includes the various technical laboratories of AFMS, DRDO, Council for Scientific and Industrial Research (CSIR), Department of Science and Technology (DST), and ICMR, as also certain autonomous and semi-autonomous laboratories.

Similar machinery exists at the state level, backed up by various ministries and departments. The main organisations and functionaries concerned at the state level for effective management of chemical terrorism are the Department(s) of Health Services, Public Health Engineering, Transport Services, Agriculture, Animal Husbandry and Dairying, etc. The states also have regional offices of various central ministries to liaise with the central government.

At the district level, the district collector, with the help of various departments and committees, is responsible for planning, preparing, and management of CTD. As applicable, the collector, deputy commissioner, district magistrate, commissioner of police, and superintendent of police have been designated to be a part of the command and control functions.

2.2 Legislative and Regulatory Framework

At the national level, India has created a comprehensive infrastructure of legislative and executive measures to synergise and coordinate actions against terrorist groups. The repealed Prevention of Terrorism Act, 2002, contained provisions to deal with terrorist activities including WMD. These provisions have largely been retained in the Unlawful Activities (Prevention) Amendment Act, 2004, which covers a wide spectrum of activities including WMD. The provisions incorporated in the Act include the definition of 'unlawful association', punishment for possession of substances capable of producing WMD, etc. Relevant provisions under the Civil Procedure Code and Criminal Procedure Code can be invoked to detain and question persons involved in criminal acts, which include terrorism in their ambit. Other provisions under the existing mechanism can be invoked for establishing law and order, for cordoning off the incident area, and for traffic and crowd management. There are a number of regulations in place for manufacture, storage, transportation, insurance, liability and compensation, and environmental issues related to potentially dangerous chemicals. A list of relevant Acts and Rules is delineated in Annexure IV.

2.2.1 Ministry of Defence

The armed forces have a network of hospitals all over the country, which can support clinical case management. Further, the armed forces have the capacity to evacuate casualties by ambulance, ship, and aircraft. However, it is necessary to develop a fleet of ambulances fitted with Nuclear, Biological, and Chemical (NBC) filters. MoD is the nodal ministry for coordinating war-related matters. The AFMS has mobile field hospitals, which can be moved to the affected areas for administering treatment at the incident site itself. The medical and paramedical staff are well trained to handle patients resulting from any disaster. Training is imparted at the time of induction, and refresher courses are conducted regularly.

Role of the Armed Forces

i) The armed forces by their inherent organisational infrastructure, training, leadership, communication, etc., are ideally

suited to be first responders in any national level calamity or disaster.

ii) Response to a chemical terrorist attack would be different from a response to any other disaster due to the specialised facilities required to be created, including protection, detection, and decontamination facilities.

iii) Since this type of disaster would be more towards the management of providing immediate specialised medical assistance, the nodal agency to coordinate and provide assistance as first responders and would be orchestrated by the Director General, Armed Forces Medical Services (DG AFMS). This would be in the form of earmarking command-wise response, relating to assigned areas of responsibilities. Basically, the following may be included:

a. Upgrade necessary infrastructure and develop capacity by equipping the responders with Personal Protective Equipment (PPE), detection, and decontamination facilities to respond adequately and effectively.

b. Training of earmarked medical personnel in the management of casualties during a chemical attack, as these would be different in nature from war casualties or casualties occuring in any other disaster.

c. Creating specialised ambulances for CBRN casualty evacuation.

d. Decontamination facilities, specialised treatment wards, and adequate specialised laboratory support is necessary for the management of CTD.

e. Earmarking of command-wise first responders from all medical resources of the army, navy, and the air force.

f. Adequate mechanisms and provisions are required to be created for providing specialised support to manage chemical casualties.

g. Creation of adequate stockpiles of necessary antidotes, decontamination agents, and essential drugs along with their turnover policy, under various commands.

h. Conduct periodic exercises to ensure efficacy of CTD response plans.

i. Upgradation of the existing infrastructure and provisions is a continuous process based upon the National Guidelines.

j. Regular interaction with nodal ministries (MHA and MoH&FW) directly or through the National Executive Committee (NEC).

The National Crisis Management Committee (NCMC), under the chairmanship of the cabinet secretary, is mandated to coordinate and monitor response to crisis situations. The NDMA provides advocacy on policy, and shall issue guidelines on the subject for the purpose of prevention, mitigation, and preparedness for strengthening response.

2.3 Initiatives at the State Level

Many states have taken the initiative of making Standard Operating Procedures (SOPs) to handle chemical incidents. National policy provides extended support to the state governments in the management of such incidents. At present, state crisis groups exist along with Emergency Operations Centres (EOCs) and Emergency Response Centres (ERCs) for the management of such disasters. However, there is no particular institutional mechanism in most of the states for tackling CTD. Various states are now in the

process of setting up state/district authorities. Some of these authorities have taken initiatives to prepare 'all hazard' DM plans, which also include man-made disasters, and preparedness measures to manage CTD based on the guidelines issued by NDMA or the State Disaster Management Authority (SDMA).

2.4 Other Technical Initiatives

India has a number of technical institutes under various organisations/departments dealing with the management of different aspects of disasters involving chemicals and toxicants. The various technical capacities available are as follows:

i) MoD established the Inter-Services Coordination Committee to monitor the CW programme, wherein the DRDO is also a participant. Research is carried out by DRDO to design and fabricate protective clothing and equipment for troops in the battlefield in case of a chemical weapons attack. The Defence Research and Development Establishment (DRDE) at Gwalior is the primary establishment for studies in toxicology and biochemical pharmacology. Research on the effects of chemical agents and heavy metal toxins is also carried out here. There are ongoing R&D activities in the areas of upgrading the design and manufacture of protective clothing and equipment, detection equipment, decontamination systems, and medical protection equipment like face masks, canisters, casualty evacuation bags, etc. DRDO is also developing reconnaissance vehicles and mobile laboratories for evaluating the situation during an attack or suspected attack.

ii) 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 Safety and Health (NIOSH), Ahmedabad, are working in the field of occupational hazard, safety, and other aspects related to the management of CTD.

iii) Limited facilities, for the collection of environmental toxicants released during a chemical disaster, also exist in the laboratories of CSIR, DRDO, and ICMR, as well as in the Central Pollution Control Boards (CPCBs), State Pollution Control Boards (SPCBs), Pollution Control Committee (PCC), Petroleum and Explosive Safety Organisation (PESO), and some recognised laboratories in the private sector.

iv) Fire and emergency services for the management of CTD are not yet fully developed. A few HAZMAT vehicles are available with the fire and emergency services in some states.

v) The first National Poisons Information Centre (NPIC) was set up in 1995 in the Department of Pharmacology, All India Institute of Medical Sciences (AIIMS), New Delhi. NPIC works in the areas of:

   a. Detection of heavy metal contamination, occupational exposure, food, water, air, and soil contamination.

   b. Environmental health monitoring.

   c. Toxico-surveillance (active survey of prevailing and potential toxicity risks).

vi) In addition to the National Poisons Information Centre functioning at the AIIMS, there are other poison information centres functioning at (a) NIOSH, Ahmedabad; (b) Department of Toxicology,

Amrita Institute of Medical Sciences and Research, Cochin; and (c) Toxiclogy and IMCU Unit, Government General Hospital, Chennai.

vii) State-level forensic laboratories have limited capabilities for detection of chemical substances.

viii) Five ERCs have been established in Manali (Tamil Nadu), Bhopal (Madhya Pradesh), Mahad (Maharastra), Vishakhapatnam (Andhra Pradesh), and Hyderabad (Andhra Pradesh), which deal with chemical emergencies in a given area and disseminate technical information relating to the chemicals involved. The MoEF has recently approved the proposal to establish three more Emergency Response Centres (ERCs) at Vijaywada, Kurrool and Kakinada in Andhra Pradesh.

ix) The Petroleum and Natural Gas Regulatory Board (PNGRB) has taken the initiative of forming sub-committes which provide necessary guidelines for safety and other standards used by various segments covered under oil and gas mid-stream and down-stream sectors. The PNGRB has also framed the Emergency Response and Disaster Management Plan (ERDMP) which also highlights the means of averting such disasters.

2.5 International Conventions and Global Initiatives

There is an increasing reliance on restrictive regimes and the use of punitive action to confront terrorism which is a threat to international peace and security. A number of global initiatives have been taken for non-proliferation, counter-proliferation, and consequence management of CTD, which have contributed in mitigating the overall risks.

2.5.1 Chemical Weapons Convention

India signed the CWC on 14 January 1993, as a pioneer signatory, and deposited the instrument of ratification on 3 September 1996. Consequently, India enacted the CWC Act, 2000, that gave effect to the convention on the prohibition of the development, production, stockpiling, and use of chemical weapons, and on their destruction, to provide for matters connected thereof. Each country was to enact legislation and constitute an authority for this purpose. Accordingly, the National Authority of Chemical Weapons Convention [NA(CWC)] was constituted under the provision of the Indian CWC Act, 2000, for the implementation of the CWC.

According to the CWC, 'all toxic chemicals and their precursors are chemical weapons, as long as the type and quantities are intended for use prohibited under the convention'. It includes the chemical action on life processes causing death, temporary incapacitation, or permanent harm to human beings or animals. CWC has classified toxic chemicals as Schedule 1: A – toxic chemicals and B – precursors; Schedule 2: A – toxic chemicals and B – precursors, and Schedule 3: A – toxic chemicals and B – precursors. A list of chemicals has been included in Annexure I, which tabulates a large variety of chemical warfare agents as per their physiological effect.

As of now, 182 countries are state parties to the CWC, among which India is one of the original signatories. Six other countries have signed the CWC but not ratified it, and there are seven non-signatory nations. The major ones among the latter are Egypt, Iraq, Lebanon, Syria, and North Korea. The former category includes Congo, Israel, and Myanmar.

The CWC stipulates certain responsibilities and requirements of the signatory countries. Some of the important responsibilities are as follows:

i) Each state party to this convention undertakes, never under any circumstances:

   a. To develop, produce, otherwise acquire, stockpile, or retain chemical weapons, or transfer, directly or indirectly, chemical weapons to anyone.

   b. To use chemical weapons.

   c. To engage in any military preparations to use chemical weapons.

   d. To assist, encourage, or induce, in any way, anyone to engage in any activity prohibited to a state party under this convention.

ii) Each state party undertakes to destroy chemical weapons it owns or possesses, or that are located in any place under its jurisdiction or control, in accordance with the provisions of this convention.

iii) Each state party undertakes to destroy all chemical weapons it abandoned on the territory of another state party, in accordance with the provisions of this convention.

iv) Each state party undertakes to destroy any chemical weapons production facilities it owns or possesses, or that are located in any place under its jurisdiction or control, in accordance with the provisions of this convention.

v) Each state party undertakes not to use riot control agents as a method of warfare.

To fulfil the criterion identified under this convention, the following initiatives for its implementation were taken:

i) For purposes of equitable geographical representation in the decision-making organs of the convention, regional groups are recognised.

ii) Implementation of this convention is expected to facilitate a global trade in chemical products and encourage international cooperation between state parties in the peaceful application of chemistry.

iii) The CWC calls for declarations from signatory parties on their stockpiles, detailing types and quantities and also chemical weapon production facilities, both past and present. This includes inspection of storage and production facilities related to destruction of chemical weapons and production facilities. However, the CWC stipulates that destruction must be ecologically and environmentally friendly, and open-pit burning, deep sea dumping and other non-environmentally friendly methods must be avoided.

iv) CWC makes it clear that any toxic chemical can be produced as long as the type and quantity are useful for non-prohibited purposes. A state party can even produce and stockpile a very toxic agent, like VX, to a maximum extent of one tonne, provided the material is used for protective, medical, or research purposes. While medical and research purposes are clear, protective purposes need adequate explanation. This means these chemicals can be used for testing defensive equipment that is for CW detection, or protection from it, or for training personnel.

v) Consequence management preparedness activities carried out bilaterally or through multilateral entities, like the Euro-Atlantic Disaster Response Coordination Centre, have contributed in mitigating the risk of chemical terrorism. Such an initiative is also required for Asian countries.

vi) There are many precursor chemicals that are required for chemical weapon production. While the negotiations were on, it was realised that these precursors, and even some of the toxic chemicals like hydrogen cyanide or phosgene, have legitimate industrial use, and curtailing their production would impede technological developments. It is therefore, clear that while the verification and inspection of chemical weapons and production facilities is expected to cease in a 10-year period, the non-diversion and non-use of industrial chemicals for chemical weapons will continue forever. It was to address these issues that the Organisation for Prohibition of Chemical Weapons (OPCW) was established at The Hague in The Netherlands, which oversees the implementation of CWC.

2.5.2 OPCW and its Role in Implementation of CWC

OPCW is an international agency that empowers the state parties to understand and manage the real and proven threats of chemical terrorism. It has been well understood that in-spite of speedy implementation of the CWC, there is always the possibility of a state party becoming a victim of chemical weapon attack, or being subjected to their use, or making use of riot control agents as a method of warfare, which is also prohibited. The issue of terrorism involving the use of WMD is a concern for the world community. To compound the issue, a state party can be threatened by the action and activities of another state party related to CW use. In such instances not only can the state party that is subjected to a CW attack get assistance from OPCW, but an investigation can also be ordered, which is called 'Alleged Use Inspection'.

2.5.3 Initiatives Taken by the UN Security Council

Addressing the General Assembly in 2001, the UN Secretary General said, 'While the world was unable to prevent the 11 September attacks, there is much we can do to help prevent future terrorist acts carried out with WMD. The greatest danger arises from a non-state group—or even an individual—acquiring and using a nuclear, biological, or chemical weapon. Such a weapon could be delivered without the need for any missile or other sophisticated delivery system'. The UN has since dealt with the threat posed by terrorism and WMD and has made certain useful recommendations. Further steps need to be taken in the UN framework since this is not a problem specific to a particular country or region. Given the global implications, it will not be sufficient to address the problem behind the closed doors of select clubs. The UN has identified the probability of using chemical agents as terrorist weapons, and to prevent such disasters, has passed the following resolutions:

i) Resolution 1540 (2004) of the UN Security Council (UNSC)

This Resolution (adopted by the UN Security Council at its 4956th meeting, on 28 April 2004) affirms that proliferation of nuclear, chemical, and biological weapons as well as their means of delivery, constitute a threat to international peace and security. It also calls for all states to refrain from providing any form of support to non-state actors that attempt to develop, acquire, manufacture, possess, transport, transfer, or use nuclear, chemical, or biological weapons and their means of delivery.

ii) United Nations Security Council Resolution 1373 (2001)

The 9/11 World Trade Center attack by Al Qaida led to the UNSC Resolution 1373

making it obligatory on the part of all states to undertake legal, administrative, and other measures to deal with WMD. The UNSC at its 4385th meeting, on 28 September 2001, adopted Resolution 1373. Operational paragraph 3 (a) also calls upon all states to find ways of intensifying and accelerating the exchange of operational information, especially regarding actions or movements of terrorist persons or networks, forged or falsified travel documents, trafficking in arms, explosives or sensitive materials, use of communication technologies by terrorist groups, and the threat posed by the possession of WMD by terrorist groups.

2.5.4 Container Security Initiative

Containerised shipping is a critical component of international trade. As terrorist organisations have increasingly turned to destroying economic infrastructure to make an impact on nations, the vulnerability of international shipping has come under scrutiny. The Container Security Initiative (CSI) was launched in 2002 by the US Bureau of Customs and Border Protection (CBP), an agency of the Department of Homeland Security. Its purpose was to increase security for container cargo shipped to the US. As the CBP puts it, the intent is to 'extend [the] zone of security outward so that American borders are the last line of defense, not the first'. Under the CSI programme, teams of CBP officials deployed to work with host nation counterparts target and screen all containers that pose a potential threat with regard to terrorism, WMD, their delivery systems, related technologies, and advanced conventional weapons.

2.5.5 Initiative by Europe and Eurasia

i) Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), is a new European community regulation on chemicals and their safe use (EC 1907/2006). The aim of REACH is to improve the protection of human health and the environment through better and earlier identification of the intrinsic properties of chemical substances. The new law came into force on 1 June 2007. The REACH Regulation gives greater responsibility to industry to manage risks from chemicals and to provide safety information on the substances. The benefits of the REACH system will gradually become evident as more and more substances are brought within the purview of REACH.

ii) Operation Active Endeavour (OAE): The North Atlantic Treaty Organisation (NATO) plays a key role in combating terrorism at the regional level in Europe. The OAE is part of NATO's multifaceted response to the terrorist threat—a naval operation aimed at combating terrorism by monitoring maritime traffic in the Mediterranean Sea. It is designed to prevent the movement of terrorists, or WMD, as well as to enhance the security of shipping in general. It began on 4 October 2001, as one of the eight NATO responses to 11 September 2001 attacks. The operation aims to demonstrate NATO's solidarity and resolve in the fight against terrorism and to help detect and deter terrorist activities in the Mediterranean Sea. So far, over 100,000 merchant ships have been hailed and 148 vessels boarded. Recently the OAE has developed good relations with similar operations in the Arabian and Black Seas.

2.5.6 ASEAN's Concerns about Weapons of Mass Destruction

The Association of Southeast Asian Nations, commonly referred to as ASEAN, is a geopolitical and economic organisation of 10 countries

located in Southeast Asia. The ASEAN Regional Forum (ARF) is the principal forum for security dialogue in Asia. It draws together 23 countries, which have a bearing on the security of the Asia-Pacific region. They have been deliberating on the growing dangers posed by the proliferation of WMD and their means of delivery, and reaffirmed their commitment to make further joint efforts to tackle the problem.

2.5.7 The Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal

India is a party to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. The basic objectives of the Basel Convention are the control and reduction of transboundary movement of hazardous and other wastes, subject to the convention; prevention and minimisation of their generation, environmentally sound management of such wastes, and for active promotion of the transfer and use of cleaner technologies. As a party to the convention, India is obliged to regulate and minimise the import of hazardous waste or other wastes for disposal or recycling, and also to prevent export of waste to parties, which have prohibited the import of such wastes. As a party to this convention, India is also required to minimise generation of hazardous waste in the country, taking into account social, technological, and economic aspects. Further, hazardous waste generated in the country is also required to be managed in an environmentally sound manner. India, as a party, can prevent the import of hazardous waste or other waste if it has reason to believe that the waste in question will not be managed in an environmentally sound manner. The sound management of hazardous waste would also reduce its probable usage in chemical terrorism activities.

2.6 Recent National Initiatives

Three major initiatives taken by GoI in the last decade are given in the following paras.

2.6.1 Implementation Status of CWC–NA(CWC)

The Indian CWC Act, 2000, defines the powers and functions of NA(CWC), offences under the Act and punishment for offences. The salient features of the Act are as follows:

i) The provisions of the Convention are given the force of law in India (Sec. 3).

ii) Provides for the setting up of the National Authority and its powers and functions (Sec. 6,7).

iii) Provides for a committee to oversee the functions of the National Authority (Sec. 11).

iv) Empowers the National Authority to call for declarations and returns from the chemical industry (Sec. 12).

v) Establishes a licensing regime for Schedule 1, chemicals (Sec. 15).

vi) Provides for regulations on imports and exports of scheduled chemicals (Sec. 16, 17).

vii) Establishes the provision of registration of units engaged in scheduled chemicals and Discrete Organic Chemicals containing the elements Phosphorous, Sulfur or Fluorine (DOC/PSF) chemicals (Sec. 18).

viii) Enables inspection of certain facilities/ plants by the OPCW inspection teams (Sec. 19).

ix) Enforcement officers may be notified (Sec. 9).

x) Provides for offences and penalties in relation to violations of the provisions of the Convention.

Inspection and verification are the very backbone of this unique multilateral treaty. Some of the major initiatives taken under the dismantlement of state chemical weapons programmes through non-proliferation treaties and arrangements were the CWC, Non-proliferation and Disarmament Fund, etc. The CWC has helped to deny terrorists' access to the world's most harmful chemical weapons. The global CWC has filled all the gaps in the Geneva Protocol, 1925. It is a universal, non-discriminatory, and multilateral treaty for the purposes of chemical weapons disarmament. Two important objectives of the CWC are to prevent proliferation of CW and to promote progress of the chemical industry by the use of chemistry-related science and technology.

The NA(CWC), thus constituted as per the Act, carry out the following major functions:

i) To fulfil the obligations under the Convention.

ii) To serve as the national focal point for all matters relating to the CWC.

iii) To obtain, organise, and file declarations as required under the CWC.

iv) To interact with the OPCW and other state parties.

v) To coordinate and facilitate inspections carried out by the OPCW under the Convention.

vi) To monitor compliance of various provisions of the Convention.

The officers of the Directorate of Revenue Intelligence (DRI), Department of Chemicals and Petrochemicals and NA(CWC) have been notified as Enforcement Officers under the Act. A Steering Committee has been set up under the chairmanship of the Cabinet Secretary to guide and oversee the functions of the National Authority. The Committee includes the Secretaries of Defence, External Affairs, Chemicals and Petrochemicals, Commerce, Revenue, Defence Research and Development, and the Chairperson of the National Authority as Members.

As per the provisions of the CWC, India has submitted for the year 2006, chemical industry declarations which comprise one Schedule-1 facility, 22 Schedule-2 facilities, 30 Schedule-3 facilities, and 360 Other Chemical Production Facilities (OCPF) facilities. The total number of declarations filed with the OPCW by all state parties during 2006 comprised 27 Schedule-1 facilities, 471 Schedule-2 facilities, 504 Schedule-3 facilities, and 5,147 OCPF facilities. During the year 2006, India received a total of 12 chemical industry inspections. The OPCW carries out systematic inspections of all ongoing CW destruction activities. In addition, it also carries out verification and inspection activities at the chemical industry sites declared by state parties. During the year 2006, the OPCW carried out a total of 200 chemical industry inspections.

2.6.2 The Weapons of Mass Destruction and their Delivery Systems (Prohibition of Unlawful Activities) Act, 2005

The objective of introducing this legislation was to provide an integrated and overarching regulation, which provides for prohibiting a range of unlawful activities in relation to WMD and their delivery systems, and WMD usable goods and technologies. These updated controls over the export of WMD usable goods and technologies and prohibitions related to non-state actors will fulfil our mandatory obligations under the UNSC Resolution 1540, which was adopted on 28 April 2004. The legislation and its passage underlines India's role as a responsible power and reflects the inherent sense of national responsibility that arises from the possession of sensitive-to-use technologies. Naturally, it also underlines India's abiding interest in contributing to global peace and security.

2.6.3 National Enactments and Amendments

Recently, new Acts and Regulations have been introduced along with specific amendments to existing Acts to develop an updated and empowered system to combat terrorism. The enactments/amendments include the following:

i) The National Investigation Agency Bill, 2008 (Bill number 75-C of 2008) has been submitted in view of constituting an investigation agency at the national level, applicable to the whole country. It empowers the agency to investigate offences under the following Acts/ Regulations:

   a. The Atomic Energy Act, 1962 (33 of 1962).

   b. The Unlawful Activities (Prevention) Act, 1967 (37 of 1967).

   c. The Anti-Hijacking Act, 1982.

   d. The Suppression of Unlawful Activities against Safety of Civil Aviation Act, 1982 (66 of 1982).

   e. The SAARC Convention (Suppression of Terrorism) Act, 1993 (36 of 1993).

   f. The Suppression of Unlawful Acts against Safety of Maritime Navigation and Fixed Platforms on Continental Shelf Act, 2002 (69 of 2002).

   g. The Weapons of Mass Destruction and their Delivery Systems (Prohibition of Unlawful Activities) Act, 2005 (21 of 2005).

   h. Offences under:

      - Chapter VI of the Indian Penal Code [section 121 to 130 (both inclusive)];

      - Section 489-A to 489-E (both inclusive) of the Indian Penal Code.

ii) Amendments to The Unlawful Activities (Prevention) Act, 1967

Security Council of the United Nations in its 4385th meeting adopted Resolution 1373 (2001) on 28th September, 2001 under Chapter VII of the charter of the United Nations requiring all states to take measures to combat international terrorism. In view of this The Unlawful Activities (Prevention) Act, 1967 (Principle Act) has been amended and enacted as The Unlawful Activities (Prevention) Amendment Bill, 2008. According to this new amendment, Section 37 and 43 of 1967 has additions to the Preamble. Section 2 clause (d) of the principle Act has been amended by adding, the words 'and includes a Special Court constituted under section 11 or under section 21 of the National Investigation Agency Act, 2008' at the end. Accordingly, clause (e), (g) and (h) of Section 2 also have necessary amendments. In addition, there is substitution of a new section for section 15.

iii) The enactment of the PNGRB Act, 2006 by the parliament and notification of the same by the Government of India in October 2007. Specific provisions contained under Chapter 3 clause II (i) lay down technical standards and specifications including safety standards by the Board.

2.6.4 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, taking into account—prevention, an enhanced level of preparedness, capacity-building, and a prompt and effective response system.

The DM Act, 2005, provides for the requisite institutional mechanism for drawing up and monitoring the implementation of DM plans, including measures by various wings of government for prevention and mitigation of disasters, and for a holistic, coordinated, and prompt response to any disaster. The Act seeks to institutionalise the mechanism at the national, state, and district levels to plan, prepare, and ensure a swift response to both natural calamities and man-made disasters or 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/State Executive Committees (SECs), and also create District Disaster Management Authorities (DDMAs).

iii) Creation of the National Disaster Response Force (NDRF) at the national level.

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 will:

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 disaster management.

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.

The NDMA will be assisted by its executive committee, the 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 and mitigation, and ensuring adequate preparedness at all levels, coordinating response to a disaster when it strikes, and for 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 Chemical Disaster Management (CDM), and based on the guidelines issued by the NDMA, will prepare a detailed action plan for CDM. Similarly, all central ministries and departments, state governments, and union territories 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, subsection 3 of the DM Act, 2005. The NDMA will coordinate and ensure their implementation with the help of all agencies concerned.

2.7 Genesis of the *National Disaster Management Guidelines: Management of Chemical (Terrorism) Disasters* (NDMG-CTD)

An important role of the NDMA is to issue guidelines to ministries, departments, and states to evolve programmes and measures in their DM plan for holistic and coordinated management of disasters as identified in the DM Act, 2005.

A national workshop on biological and chemical disasters was convened by NDMA at its headquarters in New Delhi between 22–23 February 2007, as a part of a nine-step participatory and consultative process to evolve the National Guidelines for the Management of CTD. Stakeholders from various ministries and departments of GoI (Home Affairs, Defence, Agriculture), Interpol, R&D Institutes [Bhabha Atomic Research Centre (BARC), DRDO, AIIMS, etc.], professional institutions, (NIDM) and a large number of professionals, Non-Governmental Organisations (NGOs), regulatory bodies, and experts and stakeholders in the field of CTD management participated in the deliberations. During the workshop, the present status of CTD in the country was discussed and salient gaps were identified. The workshop also identified priority areas for prevention, mitigation, and preparedness of CTD and provided an outline of comprehensive guidelines for the preparation of the Action Plan by the ministries, departments, and states. It was decided to articulate the CTD guidelines through a document called NDMG-CTD, which lays down a comprehensive and holistic approach for the management of CTD.

A Core Group of experts involving major stakeholders as well as state representatives of Assam, and Jammu and Kashmir, was constituted to assist NDMA in preparing National Guidelines for the Management of CTD. Several meetings of the Core Group were held to review the draft versions of the document in consultation with concerned ministries, regulatory bodies, and other stakeholders to evolve a consensus on the various issues regarding the Guidelines.

3 Salient Gaps

The looming threat of CTD urgently requires recognition of the need for various measures in critical focus areas so as to develop appropriate guidelines and consequential action plans. A chemical terrorism event poses special challenges in its management as it is a multifaceted phenomenon and requires the involvement of multiple stakeholders at various levels. Additional amenities for protection, detection, decontamination, and specialised treatment procedures for chemical-exposed disaster victims are needed for CTD management besides following the basic principles of management used for any other mass casualty event.

The present legislative and regulatory status for CTD is contained in various chemical-specific and general regulations. A number of programmes, activities, and initiatives on preparedness, mitigation, and response are underway at various levels. R&D is also being pursued in different institutions and organisations, as already described in chapter two. An analysis of the existing status on the various aspects for management of CTD reveals that while considerable progress has been made in the development and implementation of regulations and programmes for the management of CTD, a number of critical gaps still exist in certain areas of prevention, preparedness, response, relief, and rehabilitation, at various levels.

3.1 Legislative and Regulatory Framework

A number of stringent national Acts and Rules have been enacted to deal with the deadly menace of terrorism. However, with the constantly changing modes of operation of terrorist groups, it is essential to upgrade the legislative and regulatory framework for effective CTD countermeasures. These Acts should serve as definitive deterrents to those who are involved in terrorist activities.

Various gaps in the legislation and regulations are:

i) Rules need to be added for harmonisation and incorporation of international best practices, developed by various nations to address similar problems related to chemical terrorism, wherever indicated.

ii) The existing Regulations should be dovetailed with the DM Act, 2005, for development of a holistic approach towards CTD.

iii) Absence of any specific regulation for ensuring the security of toxic chemicals and the connected concerns thereto.

iv) Lack of regulatory mechanism and standards for protection, detection, assessment, and decontamination facilities.

v) Inadequacies in the counter-terrorism policies at the state level.

vi) Inadequate statutes to mitigate the indirect risks associated with CTD.

vii) If any existing Act, Rule or Regulation is found inadequate, the same may need to be amended and new enactments may also be required in certain areas.

3.2 Prevention

Though chemical attacks may not be totally preventable, their incidence can be minimised by adopting stringent measures for the safekeeping of chemical agents commonly used by terrorists. In CTD management, an efficient mechanism needs to be devised to monitor and inspect the stockpiling and transportation of chemicals that have an inherent potential to become either a weapon, or a target for terrorists. Some of the salient gaps in prevention are elaborated below.

3.2.1 Risk Management Framework

A national and state-level risk management framework to address various aspects of CTD is required to be developed as per the DM Act, 2005. The major components of risk management are:

i) Risk and Vulnerability Assessment.

The major gaps in the areas of risk management that need specific attention include:

a. Absence of standard risk and vulnerability assessment plans.

b. Lack of indicators and field-tested variables for various locations vulnerable to acts of chemical terrorism.

c. Non-availability of risk-zonation maps, especially for computing the trans-frontier spread.

d. Lack of SOPs for assessing the risks associated with CTD.

e. No comprehensive studies have been performed to assess the linkages between various global attacks and enhanced risk potential in the Indian context.

f. Compounding of vulnerabilities due to other associated impacts depending on the mode of attack.

ii) Surveillance Mechanism and Environmental Monitoring

Surveillance mechanisms require an influx of information from multiple agencies. The gathered information is then analysed to develop intelligence that gets verified by the various indications received from time to time, and the linkages between the various pieces of information. Only then is the information more precise and usable to prevent any act of terrorism. India has developed a significant intelligence gathering and secured dissemination machinery, though there are some gaps in the available information on various toxic chemicals, and monitoring of environmental parameters such as:

a. Lack of data on potential targets.

b. In case of chemical terrorism, the information is required to cover two important aspects, firstly, the nature of the chemical agent likely to be used, and secondly, the likely targets.

c. Lack of standard surveillance and environmental monitoring mechanism for technical cooperation and coordination with different emergency functionaries.

d. Detailing the role of the emergency functionaries, vis-à-vis the intelligence gathering agencies is also grossly inadequate.

e. Database of all chemicals with their potential use in chemical terrorism activities is not adequate or comprehensive in any manner.

f. Inadequacies exist in the surveillance mechanism at various levels.

g. Lack of coordination amongst the intelligence and other emergency functionaries.

h. A multi-dimensional information network and flow of information on various chemical agents amongst stakeholders is lacking.

i. The areas of environmental monitoring at all levels and their linkage with other emergency functionaries to assess information needs special attention.

j. Lack of mechanism for identifying suspicious activity that could indicate a terrorist threat to the chemical industry.

k. Lack of community awareness about the threat perception.

l. Adequate tools for surveillance and intelligence gathering beyond the borders do not exist.

3.2.2 Detection, Characterisation, and Early Warning System

Most chemical attacks would be localised and their effects evident within a few minutes. Both persistent and non-persistent chemical agents can be used in terrorist attacks. Persistent chemical agents have more drastic immediate, and long-term effects. Non-persistent chemical agents have a high evaporation rate, are lighter than air, and disperse rapidly, thereby losing their ability to cause casualties after 10 to 15 minutes, although these may persist in small areas which are not ventilated. Presence of liquid, spray, vapour, suspicious devices, unexplained casualties, and death of animals are general indicators for possible use of chemical agents.

The initial detection of a chemical terrorism attack could be by public and private personnel, police, fire, emergency services, or some other local first responder. As the effect spreads in the community and beyond, unusual symptoms, pattern of symptom occurrence reported by medical and paramedical staff will be used to help in the identification of the chemical used. Immediate response is usually based on information which may not be adequate for the proper treatment of casualties. There is an urgent need for means of an early warning system, detection, and characterisation of the chemical agent used. Some major deficiencies are as follows:

i) Lack of general awareness about CTD.

ii) Lack of fully equipped PICs and chemical characterisation laboratories.

iii) Lack of training among various stakeholders including first responders to identify hazardous substances and their health effects.

iv) Lack of advanced tools to detect chemical agents.

v) Non-existence of effective indicators for establishing an effective early warning system.

vi) Mechanism for prior intimation from intelligence agencies of likely terror strikes to the custodians of chemical agents does not exist.

vii) Lack of early warning systems and emergency public information systems at potential target areas, including venues of public gatherings.

viii) Lack of capability for collection of samples and proper dispatch to chemical laboratories.

ix) Inadequate facilities for early detection and characterisation of chemical agents at an incident site.

x) Inadequate environmental sampling system.

xi) Inadequacy, both in quality and quantity, of HAZMAT vehicles and teams.

xii) Inadequate number of PICs and other chemical and forensic laboratories that can detect the chemicals used.

3.2.3 Safety and Security of Chemical Agents in CTD

Besides hazardous and toxic chemicals, there are a large number of chemicals used for manufacture of explosives and ballistic material. Identified areas of concern for their safety and security are given below.

i) Effective modes for tracking sale and purchase of potentially hazardous chemical agents are not available in the country.

ii) Physical safety and security of large installations, isolated storages, and pipelines of TIC/TIM is inadequate.

iii) Lack of proper surveillance on industries using chemicals like ammonia (anhydrous), chlorine, epichlorohydrin, hydrochloric acid, hydrofluoric acid, sulphur dioxide (anhydrous), sulfur trioxide, tri-nitro toluene, potassium chlorate, ammonium nitrate, aluminium powder, mercury fulminate, peroxides, etc.

iv) Surveillance is also inadequate on the movement of HAZCHEM including TICs/TIMs like cyanide, toluene, sulphur and their hazardous wastes, waste oils, and used oils, etc., in transport facilities.

3.3 Preparedness

Adequate preparedness at all levels will strengthen proper management of CTD. Preparedness on various aspects coupled with surveillance and intelligence gathering to reduce the probability of a chemical attack occurring, or mitigating its effects calls for the development of an adequate institutionalised mechanism for the management of CTD. There is also need to develop resilience amongst chemical industries, installations, and communities using all means of awareness, education, and training to face these unprecedented challenges. Presently, there are major deficiencies in the area of preparedness, which are elaborated below.

3.3.1 Capacity Development

Capacities required for the management of CTD are grossly inadequate at various levels. Capacity development includes the building of trained and skilled manpower among all functionaries, community resilience using various modes of awareness, and various means of knowledge management. The major gaps in different areas of capacity development include:

i) Human Resource Development

a. Inadequate number of skilled and trained manpower at various levels including identified institutes, research departments, and training centres.

b. Lack of functional integration between knowledge possessed and knowledge ideally required amongst various stakeholders. Training is also not commensurate with the existing modalities available worldwide for management of CTD.

c. Lack of coordination and communication within and between the institutions, and among the individuals.

d. The role of NGOs and other voluntary organisations, and the community is required to be defined.

e. Sensitisation of functionaries at all levels about the special measures for quick assessment of CTD and proper action for its management is required.

f. Lack of a regularly updated database of skilled manpower and resource inventories in the public domain. Specific mechanisms for updating

information on teaching institutions, R&D, and concerned industries, etc., are absent.

ii) Education

Basic knowledge of DM has been included at the secondary level of education, but there is a need for educating all other technical persons and administrators who are concerned with management of CTD. This can be achieved by including the subject of chemical disasters at various levels in the education system, especially in the branches of engineering, chemistry, toxicology, medicine, nursing, pharmacy, and other relevant technical subjects.

a. Various modules for DM are required to be developed and incorporated appropriately at different levels in the education system at the national and state levels, and for all stakeholders including all administrative services of the centre and states.

b. Need to include disaster-related technical education for professionals and medical officers in their respective institutions.

c. The basic knowledge of toxicology needs to be imparted at all levels. It is necessary to educate all stakeholders about the likely effects of important chemical agents that can be used by terrorists.

d. Adequate knowledge of dos and don'ts in the event of a CTD is not available with the community at present.

iii) Training

Training of all emergency functionaries including district authorities and specialised first responders is an important requirement for the management of CTD. Certain areas which require attention are:

a. National and state level institutes for imparting training on the various aspects of CTD have not been identified and established. The existing training institutes in the country require upgradation and strengthening at the centre and state levels. Institutions that can train first responders i.e., Quick Reaction Medical Teams (QRMTs)/ Quick Reaction Teams (QRTs) need to be identified.

b. Specific training modules need to be prepared for management of CTD, for the use of various stakeholders. These modules need to be developed, tested, and implemented at different levels for management of CTD.

c. The paramedical staff lack knowledge on CTD-related subjects and need to be educated about the effects of chemicals, the treatment profiles for management of their toxicities, and antidotes to specific chemicals. These measures need to be established through the training of trainers.

d. Resident welfare associations and NGOs need to be integrated into the training network to develop volunteerism.

iv) Knowledge Management

Knowledge of chemical agents that may be used for chemical terrorism, their effects on biotic and abiotic environments, their clinical management including prophylactic and therapeutic measures, and the list of various institutions and knowledgeable resource persons is one of the key requirements to prevent as well as mitigate

the effects of CTD. Inadequate knowledge management may lead to a number of deficiencies in availability, usage, and implementation of the right information in the correct context. Specific areas needing immediate attention are:

a. There is lack of coordinated effort in developing a centre of excellence as a national resource in the knowledge management of CTD.

b. New technologies and methodologies for CTD management are being adopted the world over. A regular effort is required for upgrading technologies, and acquisition and adoption of these practices after subjecting them to proper testing in the Indian context.

c. A nationwide electronic inventory of essential and specialist resources including both equipment and manpower resources for CTD response needs to be maintained and regularly updated.

d. All the toxic industrial chemicals and materials that can be used for terrorist activity should form a part of the national database on HAZCHEM/ HAZMAT.

v) Community Awareness

Largely, the community is the first responder in all disasters. Therefore, it is imperative to generate necessary awareness and knowledge about chemical agents and their effects. Salient gaps in the area of community awareness include:

a. Community awareness of CTD is grossly inadequate. The community should be involved and made aware about the chemical agents, their basic hazardous effects and antidotes, remedial measures, and dos and don'ts as a desirable activity for management of CTD.

b. The print and electronic media can play an important role in the management of sensitive issues arising out of CTD. There is a need to develop and adopt strategies for generating awareness regarding CTD among the community and their leaders. This is necessary for a disciplined, structured, and panic-free approach for effective communication of any disastrous event and its immediate consequences to the community.

c. In awareness generation, NGOs can play an effective role, but currently lack capacity and capability to support effective response during a chemical attack. There is an urgent need for identifying NGOs with a good track-record for helping during chemical emergencies that can be further trained and equipped.

3.3.2 Infrastructural Development

Capacity in terms of material logistics and infrastructural facilities are grossly inadequate at various levels for the management and mitigation of chemical terrorism related responses. The adequacies of organisations like NPIC, state level forensic laboratories, and the ERCs, in terms of availability of infrastructure, knowledge zones, skilled and trained manpower, and training arenas and locations for innovative and applied research need to be assessed and given a specific direction for the management of CTD.

Adequate measures are lacking, specifically in basic infrastructure, institutions, networking, communication, and coordination amongst different stakeholders.

i) Basic Infrastructure

The major gaps in this area include:

a. PPE is not available with most of the first responders.

b. The civilian medical community needs novel ways to adapt to the many new and emerging detection and warning technologies in the spectrum of chemical warfare agents and other agents with chemical terrorism potential.

c. First responders, Medical First Responders (MFRs), and dedicated chemical detection teams need improved instrumentation for detecting and identifying chemical agents in both the environment and in clinical samples from patients.

d. Hospitals do not have facilities for decontamination or adequate medical infrastructure. Adequate quantities of antidotes are usually not stocked either.

e. PICs need to be upgraded and additional centres and chemical laboratories need to be created at the regional level.

f. There is a need to assess, individually and collectively, the augmentation of infrastructure and financial resources required in hospitals and institutions associated with management of CTD.

g. Based upon risk assessment studies, the identification and positioning of ERCs and various control rooms needs to be determined. Simultaneously, decontamination and poison information centres, ambulances and other supporting services are required to be set up, particularly in view of the expected surge in the number of patients.

h. The integration of all national infrastructural facilities of existing institutions is required for management of CTD.

ii) Institutions

Institutions required for providing technical support services at various levels is a key requirement for sustaining proper development and implementation of effective DM systems. These have not been fully identified yet. The areas that need immediate attention include:

a. National-level institutions and other academic and research institutions such as the DRDO laboratories, Oil Industry Safety Directorate (OISD), IICT, NCL, ITRC, National Institute of Occupational Safety and Health (NIOSH), National Fire Service College (NFSC), National Civil Defence College (NCDC), National Safety Council (NSC), Disaster Management Institute (DMI), NIDM, PICs, forensic laboratories, and the Indian Institutes of Technology (IITs) are not directly mandated for CTD-related activities. Their capabilities and roles in this context need to be redefined. Indian Chemical Association (ICA), Indian Chemical Council, National Insurance Academy, Administrative Staff College of India (ASCI), state institutions and Administrative Training Institutes (ATIs), professional bodies and societies, industrial and corporate institutions and associations, health care providers and their networks, safety and medical equipment manufacturers, etc., need to synergise their activities in matters related to the management of CTD under the overall direction of the concerned regulatory authority.

b. The present status and strength of the institutes mentioned above need to be assessed, and if required, they should be encouraged to develop additional CTD-related training capacities and generate complimentary but independent training programmes.

c. The existing training programmes need to be evaluated and revised on a continual basis for emerging threats as also to include new models and modules.

iii) Networking and Communication

Effective communication and networking between various stakeholders and sensitive organisations is currently inadequate at all levels for a quick and efficient response to terrorist-related chemical disasters. Human and functional networking is required to be established at the following levels for coordinated planning, preparedness, and response to CTD:

a. Fully manned 24x7 control rooms at all levels (district, state, and centre).

b. Intelligence agencies and their real-time networking with international agencies, like Interpol, and intelligence agencies of friendly and collaborative foreign countries.

c. Security agencies like the police, paramilitary forces like the Central Industrial Security Force (CISF); customs and excise personnel manning sensitive installations, sensitive locations in the railway network, ports, airports, and international border check posts.

d. Industries and other institutions, analytical laboratories and research bodies identified by the nodal ministry; other associated ministries in the concerned subjects (within themselves and with agencies at the district, state, national, and international levels).

e. An effective communication network to quickly analyse and characterise toxicants/chemo-toxins at the incident site by improved sample collection, detection, and characterisation.

Special attention is necessary in the following areas:

- Departmental level horizontal system of communication and vertical communication from the local to district levels, and to state and national levels.
- A dedicated communication system for road, rail, and other transportation systems carrying toxic chemical agents with all stakeholders is not up to the mark and a mechanism [including Geographic Information System (GIS)] for continuous monitoring of the transport vehicles all along their route is needed.

An effective network based on the roles of different stakeholders in a pre-rehearsed manner is required to be established. The roles and responsibilities of different stakeholders including the first responders need to be further adequately defined. This would ensure their ready availability as a part of department specific guidelines for better coordination during a CTD.

3.3.3 Medical Preparedness

i) Emergency Medical Response at Incident Site

a. Need to develop and rehearse the emergency functioning at the medical post of the Incident Command System (ICS).

b. Non-availability of adequate number of MFRs for carrying out triage, resuscitation, and Basic Life-Support (BLS) for the casualties.

c. Adequate number of PPE and protective gear for eyes are not available with mobile teams and various first responders and rescue services, which is an essential requirement for the management of CTD.

d. Lack of knowledge among the first responders about the various chemical agents, their effects, and antidotes.

e. Lack of rapid field detection kits for authentic detection and characterisation of chemical agents and advanced online monitoring technologies.

f. Rapidly deploy-able field decontamination facilities for man, machinery, and environment do not exist.

g. The stocked bricks of emergency medicines, antidotes, and BLS equipment are also not available in adequate quantities.

h. Lack of suitably tested indicators for assessing the progression of CTD.

ii) Evacuation of Chemical Victims

The major gaps in this area include:

a. Advanced life-support ambulances fitted with NBC filters are inadequate in both quality and numbers.

b. The usage of air ambulances, heli-ambulances, rail ambulances, and rescue vehicles fitted with NBC filters and air monitoring devices is currently non-existent.

c. Lack of networking amongst patient evacuation services all across the district, state, and national levels.

iii) Chemical and Clinical Laboratories

Laboratory network is an important support for quick detection and characterisation of toxicants for diagnosis and management. At present, the laboratories at various levels lack capabilities and capacities for managing CTD crisis. The other salient gaps include:

a. Shortage of trained staff.

b. Laboratory staff has inadequate knowledge and training. Such observations are made especially at the district level clinical laboratories.

c. Laboratory personnel lack awareness about various types of chemical terrorism agents and their health effects. Non-availability of micro-level SOPs to prepare and respond make matters worse.

d. Refresher training for the laboratory staff and updating them on new emerging technologies has not been planned adequately.

e. PPE for laboratory and medical/ paramedical staff are not available in adequate numbers.

f. Diagnostic capabilities of laboratories are not backed by alternative procedures.

g. Procedures for collection of environmental specimens and biological samples from disaster victims exposed to toxic chemicals need standardisation.

h. Familiarity with analysis of laboratory test results and correlating them with exposure to chemical warfare agents,

and availability of chemical warfare reference guides in the laboratory are grossly inadequate.

i. Networking for sharing of crucial time-critical information is insufficient.

j. Safety aspects related to chemical storages are also inadequate. Precautions to be adopted in handling chemicals during testing and transportation are not adequately specified.

iv) Hospital Preparedness

Prompt availability of adequate medical facilities at incident sites and the preparedness of hospitals are some of the important prerequisites for overall management of casualties during a chemical attack. The major gaps include:

a. There is no provision for equipping medical posts at incident sites with the necessary facilities and adequately trained manpower for handling CTD victims.

b. MFRs do not possess the necessary PPE and are inadequately protected.

c. MFRs usually lack essential knowledge and training about various chemical agents and their effects.

d. Hospital DM plans are absent, and even if these are available, there are gross inadequacies as far as the chemical response plans are concerned.

e. Non-availability of specialised chemical injury treatment centres. Inadequate number of burn treatment centres and specialists that can provide specific and symptomatic health care depending upon the type of chemical agent to which victims are exposed during an attack.

f. Non-availability of decontamination facilities at all hospitals.

g. Non-availability of antidotes for common chemical toxicants at short notice.

h. Lack of information about the sources of antidotes and deficiencies in stockpiling of the same.

i. Inadequacies in contingency planning for hospitals if they themselves become targets of chemical terrorism.

j. Lack of adequate mechanism including infrastructure for long-term medical follow up of patients affected by chemical agents.

k. Absence of regular drills for hospital disaster plans.

l. Non-availability of standardised treatment protocols for chemical injury cases.

m. Inadequate infrastructure to tackle public health problems in the post-disaster phase.

3.4 Response, Relief, and Rehabilitation

Detailed protocols for crisis management and post-disaster phases of CTD do not exist.

i) Inadequate financial arrangement during the recovery phase.

ii) Stockpiled food, water, and relief materials need to be protected to prevent contamination from a CTD.

iii) Inexperience on the part of responders in terms of providing short- and long-term rehabilitation to different groups of society.

iv) Reports suggest that appropriate psychological care can be helpful in recovery and rehabilitation. More focus

and attention seems to have been paid by the concerned agencies and the society at large to immediate response and recovery, but not to long-term rehabilitation. The non-availability of long-term rehabilitation measures for the survivors of CTD has been reasonably well articulated. The psychological aspects of recovery and rehabilitation of such survivors are conspicuous by their absence.

v) Inadequate mechanism for medical referral of certain categories of chemical disaster victims, especially for mental health care.

vi) Lack of adequately trained manpower in mental health services and psycho-social support.

vii) Absence of mock-drills and organised training programmes for medical awareness and preparedness.

3.5 Research and Development

There is a need for undertaking regular and effective R&D programmes for the development of physical protection equipment and in the fields of toxicology, pharmacology and forensic medicine, to tackle CTD holistically. Some of these are as follows:

i) Development and acquisition of effective antidotes, which are not indigenously available for various chemical agents.

ii) Research studies using simulation models of chemical attacks and their management in the form of mock-exercises.

iii) Field testing to verify the accuracy of the simulation models developed for chemical attacks and mobilisation of resources is also inadequate.

iv) The concept of informatics is not used appropriately for the management of large databases, monitoring technologies, and response mechanisms.

v) Biomarkers, bio-indicators, and therapeutic interventions need to be developed for the effective medical management of chemical victims.

vi) The availability of personal and material decontamination methods are also inadequate and need to be addressed.

vii) Research and documentation of the behaviour response patterns in the Indian context is virtually nonexistent for CTD. The VIP influx and crowds of curious onlookers at the incident site compound the problem of crowd management, thus adding to the existing problem.

viii) The lack of a code of conduct or guidelines for the media during terrorist attacks has also been seen to complicate the public reaction further, not only at the incident site, but also at the sites of perceived risk.

ix) Risk perception issues, which govern community behaviour and response, have not been studied properly in the Indian context.

3.6 Post-Disaster Documentation

The necessity for post-disaster analysis for deriving lessons learnt is irrefutable. However, there is no organised system for post-disaster documentation. The essential steps needing attention are:

i) Standard proforma for CTD reporting mechanism.

ii) A chronological compilation of the CTD incident and its management, followed by its evaluation by standard protocols.

iii) Lessons learnt from analysis of post-disaster documentation from other parts of the world are not being disseminated to all stakeholders and used for improving future preparedness.

iv) The documentation procedure for mitigation of indirect risks associated with chemical attacks is also inadequate. There is also a need to develop and carry out follow-up studies over a longer duration to ascertain the long-term effects of such injuries.

3.7 District Disaster Management Planning for Chemical Attacks

i) Clear-cut roles of different stakeholders including the district collector, various committees formed under the DDMA and ancillary service providers are not yet incorporated in the response plans.

ii) It is important to develop a standard all-hazard district level DM plan, which will also address the special requirements for management of CTD.

iii) There is a need to define specialised first responders, specialised treatment centres, and a dedicated communication network for all stakeholders.

iv) SOPs for worst-case scenarios and planning for different emergent situations using computer models are also not currently available.

3.8 Finance

Provisions to adequately finance disaster planning, prevention, mitigation, preparedness, and medical management at the district, state, and national levels including development of infrastructural facilities and skilled manpower have not been made. The central and state governments need to regularly earmark funds for activities to strengthen the various aspects of management of CTD as a part of their all-hazard plans. 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 institutionalised.

An adequate financial mechanism to deal with the social and economic impact of chemicals on human health, society, and the environment, including liability and compensation, needs to be evolved.

4 Guidelines on Preparedness for Management of Chemical (Terrorism) Disasters

Like many other developed and developing countries of the world, India too, is vulnerable to all kinds of terrorist activities. An analysis of existing institutional mechanisms for CTD revealed various gaps. Guidelines for preparedness have been developed based on the gaps identified in the existing mechanism with incorporation of well-tested global best practices and technological advances in the field. One of the major requirements for the management of CTD is the development of reliable detection technologies coupled with a continuous surveillance system. Such surveillance systems will be integrated with inputs from national and international intelligence agencies. A management framework based upon advanced technologies for the management of CTD by harmonisation of various activities is required to enhance the capacities at district, state, and national levels. Infrastructure must be developed or upgraded to prevent, mitigate and manage illness and injury caused by chemical agents used in terrorist activities. The national approach to chemical terrorism will not be a stand-alone plan but will be incorporated into the 'all hazard' mitigation strategy for combating all types of man-made disasters. The strategy can be made effective by adoption of a three-step approach, namely, identifying the potential risks and assessing their impact, building the necessary capabilities to respond effectively, and continually evaluating and testing our preparedness, which includes identifying lessons from mock-exercises and real-life events.

4.1 Legislative and Regulatory Framework

Support provided by the legislative and regulatory framework will help in the development of a suitable mechanism for management of CTD. The major recommendations include:

i) The legal and regulatory framework, at all levels, will be harmonised by dovetailing various relevant Acts, Rules, and Regulations with the DM Act, 2005.

ii) Inadequacies in the legislative and regulatory framework for chemical counter-terrorism will be addressed on the basis of risk assessment studies.

iii) The existing regulations pertaining to CTD agents will be reassessed and if needed, modified, or new stringent Acts/Rules/ Regulations enacted.

iv) Under the umbrella of international cooperation, the chemical security provisions will be updated periodically.

v) Regulations will be introduced to mandate the registration of 'holding and marketing' of all potentially hazardous chemicals that could be used and targeted by terrorists.

vi) As part of the regulatory measures, procedures laid down under the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008, [HW(MH&TM)Rules] concerned with maintenance of records for hazardous

waste generated and its transportation, storage, and disposal, will be stringently implemented. Computerised records will be created to make information easily accessible for monitoring and enforcement agencies, reduce paperwork, and make tracking easier. The manifest system should be made obligatory even for recycled and reprocessed industrial waste, by-products, and side-streams. Necessary amendments to the HW(MH&TM)Rules will be made to ensure security and safety concerns.

vii) The ERDMP prepared for mid-stream and down-stream petroleum and petroleum products provides necessary reference for the Emergency Response and Disaster Management Plan. Further, PNGRB has notified various regulations under Technical Standards and Specifications including Safety Standards (T4S) for gas pipelines, petroleum, petroleum products pipelines and CGD.

4.2 Prevention

Accidents or attacks involving chemical agents may not be totally preventable but can be mitigated by adopting a sound risk management framework based upon the risk and vulnerability assessment, surveillance, and environmental monitoring.

4.2.1 Counter-Terrorism Strategies

The key aim of the counter-terrorism strategy will be the adoption of appropriate measures, which will mitigate the overall risk of CTD, based on vulnerability and threat assessment. Necessary counter-terrorism strategies will be aimed to minimise the various socio-economic factors that lead to terrorism. This will be followed by reduction of the perceived terrorist threat by using the following measures:

i) Crucial surveillance data and intercepted information gathered by intelligence agencies will be shared with authorised stakeholders on a need-to-know basis.

ii) Surveillance technologies will be updated to keep up with global best practices.

iii) Adequate steps will be taken to enhance and update surveillance capabilities. The help and support of telecommunication companies and internet service providers will also be taken for this purpose.

iv) Regular monitoring and continuous follow up of terrorist activities and changing trends will be done by gathering intelligence inputs.

v) The ability to identify and understand the various factors enhancing possible terrorist threats will be improved.

vi) Various deterring and disrupting measures will be adopted to limit the factors that lead to emergence of terrorism.

vii) International cooperation with overseas partners will strengthen intelligence inputs to help prevention and mitigation of various factors that lead to terrorist activities.

viii) Border security will be strengthened, and identity management improved.

ix) Enhanced protection of installations, storages, and pipelines carrying HAZCHEM by working in conjunction with the corporate sector.

x) Steps will be taken to reduce the risk and impact of attacks during transportation of toxic chemicals and materials by adopting advanced security and technological measures.

xi) Appropriate financial strategies will be adopted to scuttle the flow of funds through illegal means from unauthorised sources to various terrorist and other undesirable organisations. This will be achieved by:

a. Developing secure networks of intelligence and law-enforcement agencies.

b. Seeking cooperation from national and international financial and banking agencies, and other financial regulatory bodies.

4.2.2 Risk and Vulnerability Assessment

Risk and vulnerability assessment must precede emergency management plans for mitigation of CTD. It requires inputs from several agencies and a coordination mechanism which will be supported by documented information and continuing research in the relevant areas of chemical safety and security.

A comprehensive risk management approach will focus on the intent and capabilities of potential terrorists, the vulnerability of various possible targets, and the possible consequences of such attacks.

The criterion of risk and vulnerability assessment includes development of indicators which are as follows:

i) Factors to define vulnerable locations and thereby development of risk-zonation maps for possible chemical attacks based upon intelligence inputs or surveillance reports.

ii) Define priority activities that require strengthening to prevent or mitigate the effects of terrorist activities.

iii) Mechanism to define field variables followed by their testing.

iv) Mechanism for identification of major plausible hazards and indicators that show the progression of the severity of CTD at different time intervals.

v) Modes to promptly identify various vulnerable groups and their prioritisation.

vi) Identify and establish resource inventories and existing counter-terrorism measures to limit the impact of CTD.

vii) Carry out risk assessment studies based on global incidents to determine the risk potential in the Indian context.

Information and inputs derived from the above indicators will help in the proper assessment of risks. Such information will also be integrated with the existing risk management framework.

4.2.3 Surveillance and Environmental Monitoring

The information collected from surveillance and continuous environmental monitoring ultimately helps in risk-zonation at the micro level. The important priority areas are:

i) Preparation of a secure database of all the chemicals which have potential for use in different chemical terrorism activities or as a potential target for terrorist attacks. Such information should be made available to various stakeholders who are involved in the management of CTD.

ii) Assessment of the impact of all plausible worst-case scenarios.

iii) Establishment of a mechanism to synergise technical cooperation and coordination between the intelligence gathering

agencies, technical institutes, and other emergency functionaries.

iv) The zoning of vulnerable sites susceptible to chemical attacks is required urgently. Exit pathways must also be identified. The above shall be done after considering the effects of identified toxic chemicals/ chemical agents. The vulnerability assessment mapping will be based on the following factors:

a. GIS-based modelling—taking into account the topography of the area and the prevailing climatic conditions.

b. The vulnerable population (children, women, elderly people, disabled, patients, etc.), medical care facilities, schools, important government buildings, financial institutions, and public utilities that need extra care during such attacks.

c. The number and quality of shelters available, the access routes for people out of the incident site, as well as awareness in the community about various chemical risks and necessary response measures.

d. Existing negative factors like presence of densely populated and industrial clusters, absence of evacuation routes, inadequate health care facilities, lack of communication facilities, and measures to mitigate them.

e. Reservoirs, water bodies, ecologically important sites, food storages, wildlife sanctuaries, and cattle sheds, etc., that would intensify the vulnerability of the area.

f. The level of resilience and capacity to respond in the local population.

g. Vulnerability of important routes used for HAZCHEM transportation.

h. Variables like proximity of urban areas, and the effect of an attack on important installations.

The surveillance module will also include a model for CTD based chemical mock-exercises and their periodical testing at the ground level. Mock-exercises will be designed specifically for high risk sites and areas based on the vulnerability and surveillance module threat assessment.

4.2.4 Chemical Security and Early Warning System (EWS)

A large number of dual-use chemicals can be targeted for CTD activity. The toxic industrial chemical infrastructure is spread all over India and hence it presents a special challenge. The security of such chemicals at the installation level, during transport, and at isolated storages and pipelines is necessary for effective prevention of their misuse. Specialised areas of concern such as management of TICs/TIMs, hazardous waste, and strategies for mitigation of indirect risks requires effective planning at all levels and needs to be addressed carefully. The effect of attacks can be optimally mitigated with an efficient EWS. Mechanism for chemical security and EWS will be developed based on the following:

i) Development of indicators for the possible mode of delivery and the effects of chemical agents for terrorist activities. Such indicators will be used to develop an effective EWS (Annexure V). Conducting mock-drills to validate the above indicators of EWS using scenarios of intentional chemical attacks is also necessary.

ii) Understanding the terrorist's motivation and capabilities regarding use of TIC/TIMs for chemical attacks or as targets.

iii) Develop innovative approaches to deny terrorist access to TIC facilities, associated

chemicals, or other capabilities they would require to carry out chemical attacks.

iv) Tailor the deterrence strategies at national and state levels to counter terrorists and those who might help or facilitate a chemical attack.

v) There is a need to detect and disrupt the flow of toxic industrial chemicals, funds, and other resources and inputs required by terrorists and likely anti-national elements to carry out a chemical attack.

vi) Institute measures to strengthen response, should an attack be imminent, and in the event of a chemical release, take measures to alleviate the consequences by creation of an infrastructure equipped with the latest forensic and investigative techniques and qualified manpower.

vii) Networking of intelligence services for countering chemical terrorism is recommended at all levels, especially in and around installations, storages, and vulnerable transportation routes of chemicals for close information sharing, and for updating the law enforcement agencies about the various threats and changed emerging trends. The level of intelligence-sharing with other stakeholders will be decided by law-enforcement agencies.

viii) Create awareness, and vigilance about the need for chemical security provisions, amongst all those who produce, hold, and utilise chemical agents, and educate government functionaries, and the community by:

   a. Sharing of data regarding chemicals and adoption of infallible and concise chemical security provisions.

   b. Communication to increase dialogue and consultations.

ix) Periodical review of risk-vulnerability studies, and environmental and surveillance mechanisms, analysis of the security aspects of different emergency plans to continuously upgrade the existing indicators of threat perception, where intelligence agencies and other stakeholders participate.

x) Creation and regular updating of resource inventory of key contacts from industries, regulatory bodies, intelligence agencies, and other stakeholders.

There is no doubt that under initiatives and instructions from MoEF and MHA, the chemical industry has taken initiatives to enhance security and safeguard its infrastructure. The regulatory system, however, needs to be put in place, in line with the Guidelines on Chemical (Industrial) Disasters, already issued by NDMA.

4.2.5 Prevention of Illegal Trafficking of Hazardous Waste

The illegal trafficking of hazardous waste and its potential usage in CTD is an important aspect that requires immediate attention. Adequate attention is required to be given to issues pertaining to hazardous waste generation, storage, and disposal from origin to destination. This category includes a wide variety of chemicals, with hazardous by-products of unknown nature, which are produced during the degradation process, and may serve as an important target or source of chemical terrorism activities. The mechanism for prevention of illegal trafficking of hazardous waste includes the following:

i) A systematic approach will be adapted in chemical terrorism risk mitigation to evolve a fail-safe approach against terrorists seeking to acquire and make improvised chemical devices using hazardous waste.

ii) Security provisions employing public and private partnership will be put in place to optimise collective and individual risk-reduction efforts.

iii) These provisions will be extended to all modes of transportation, i.e., air, water, and land.

iv) Illegal dumping sites will be identified and removed to prevent terrorists access to hazardous waste.

v) National, state and district level planning needs to ensure the implementation of the following recommendations:

a. A monitoring system will be developed to keep surveillance on industries involved in transfer of chemicals and hazardous waste including cyanide, toluene, sulphur waste, and used oil, etc.

b. Identifying and listing industries using chemicals like ammonia (anhydrous), chlorine, epi-chlorohydrin, hydrogen chloride (hydrochloric acid), hydrogen fluoride (hydrofluoric acid), sulphur dioxide (anhydrous), sulphur trioxide, tri-nitro toluene, potassium chlorate, ammonium nitrate and aluminium powder, mercury fulminate and peroxide which could be used in conjunction with Improvised Explosive Devices (IEDs), etc.

c. Drawing up an inventory of all hazardous waste and materials from waste generators and Treatment, Storage, and Disposal Facilities (TSDF) operators will be carried out and included in the secure web-based system for online tracking of its movement and disposal by Central and State Pollution Control Boards, Indian Port and Customs Authority, Directorate General of Foreign Trade, manufacturers, and transporters. All data from the recycler facilities will be maintained and tracking of waste should be an ongoing exercise.

d. The inventory data will be linked with Value Added Tax (VAT) data maintained by all generators, transporters, and TSDF operators.

e. Establishment or adoption of a classification system for hazardous waste. This would help in standardising the definitions regarding name, nature, storage, handling, and disposal of hazardous waste.

f. Strict implementation of import and export of hazardous waste and materials as per existing rules.

g. CPCB will develop mechanisms for identification of states and districts which are more prone to hazardous waste exports, imports, production, and recycling, as also the modes of transportation.

h. Establish citizen watch programmes with the help of local communities to monitor and report any illegal or suspicious transfer or dumping of hazardous waste. SPCBs, based upon the directions issued by CPCB, can then keep a watch on the activities of recyclers in the 'Red List' to prevent illegal sales or dumping.

i. The database should necessarily include the quantity and quality of hazardous waste generators, and lists of those adopting environmentally sound technologies for waste reduction and recycling and those which are neglecting this vital aspect.

j. Invigorate 'Right-to-Information' and enlighten the community in order to promote public awareness and information programmes on hazardous waste.

k. CPCB, in coordination with SPCBs will develop a resource inventory including network of professionals working in the area of hazardous waste.

l. Reinforce national capacities to detect and halt any illegal attempt to introduce hazardous waste into the country, state or district.

m. Promote regional agreements and strengthen international cooperation in the management of trans-boundary movement of hazardous waste based upon the Basel Convention.

n. Spread awareness to prevent the illegal trafficking of crucial electrical components like timer machines, switches, detonators, remote and time-delay switches, and electrical, mechanical, and impact detonators, which may serve as important components for IEDs by terrorists.

o. Upgradation of chemical laboratories and PICs for analysis of hazardous waste samples collected by the customs department.

4.2.6 Planning for Mitigation of Indirect Risks Associated with CTD

CTD pose a number of indirect risks thereby enhancing the overall vulnerability status. It also needs to be dealt in state and district DM plans to develop effective mitigation measures. Indirect risks can be classified as those risks that affect a location or an enterprise whose infrastructure may be exploited during the planning or execution of a chemical terrorist attack. The important measures to mitigate these indirect risks are as follows:

i) Transporters who unwittingly provide chemical transport services may face liability for transporting chemicals to 'actors' whose background they should have checked more thoroughly. Thus, necessary provisions should be laid down for verifying the true identity of the buyers.

ii) Financial intermediaries and banks that provide funds to front companies moving or transporting HAZCHEM, dual-use chemicals, and chemical weapons to terrorist organisations can suffer substantial loss of reputation and face liability for the same. It is imperative to develop SOPs that can maintain a strict vigilance on these issues, and develop newer models to counter these indirect risks by private sector risk managers and security professionals. The contours of enterprise liability related to the facilitation of acts of terrorism need to be defined in the plans.

iii) A mechanism will be developed to integrate the internet service providers in the intelligence and surveillance systems since they can help detect plans in cyberspace that involve nefarious designs to sabotage chemical facilities and pass such information on to law enforcement agencies for appropriate action.

4.2.7 Prevention of Disaster and Terrorist Activities for Petroleum, Petroleum Products, Pipelines, Storages and Process Plants

A pipeline integrity assessment system will be brought out by PNGRB which will help in the prevention of disasters. Other measures like regular patrolling, Supervisory Control and Data Acquisition (SCADA), periodic inspection, etc.,

will be carried out for the prevention of disasters. Similar provisions will be incorporated in the respective regulations if needed.

4.3 Preparedness

Preparedness for CTD involves planning, infrastructure, and knowledge management for both capability and capacity development, and commensurate human resources to cope with chemical emergencies. Preparedness includes a range of time-sensitive special emergency tasks carried out by all emergency response units, responder organisations and their networks, health care providers, network of laboratories, voluntary organisations in the private sector, international organisations and other stakeholders based upon the need and threat assessment of the area. It requires increased chemical terrorism awareness among all stakeholders about chemical agents, and likely injuries they can inflict. EWS based on risk and vulnerability assessment will be developed. Protection, detection, decontamination, quick evacuation, and prompt emergency response are the crucial components of medical preparedness and emergency medical response at the incident site, during evacuation of casualties, and treatment at hospitals. SOPs will be evolved containing definite standards of individual and collective protection, detection, decontamination facilities, and essential medical countermeasures as a part of preparedness plans. The various areas are discussed in detail in the following paragraphs.

4.3.1 Preparedness for Emergency Response at the Incident Site

Rapid and efficient response to a chemical terrorist incident is essential to save lives and prevent further casualties. The initial stages of response in such attacks are also equally dangerous to the first responders themselves. Responders rushing to the scene of the chemical attack who are not well-informed, well-versed, and prepared (protected) or properly equipped will most likely become part of the problem and not the solution. The impulse to hurriedly rush into an event may be fatal for these responders. The emergency response at the incident site requires coordination between numerous agencies. It begins with the initiation of the following activities:

i) Define and create infrastructure and SOPs for emergency responders including, detection of chemical agents, search and rescue teams, fire and emergency services, MFR network, PPE, secure communication network, and early medical response.

ii) Response teams will work at the incident site and at residential locations from where the communities are to be evacuated.

iii) MFRs/QRMTs will provide BLS and resuscitation at the incident site and also support the rescue workers. They will be trained for triage, field decontamination, emergency administration of antidotes, and psycho-social first aid.

iv) Other teams of the different emergency functionaries will play an active role based upon their area of specialisation.

v) All the rescue teams will work with full integration and coordination under the overall supervision of the incident commander.

Some of the specific key issues of preparedness for emergency response to CTD at the incident site are described below.

A) Protection

The availability of appropriate PPE is important for protecting and inculcating confidence amongst

the rescue workers dealing with management of CTD. The major recommendations are as follows:

i) Development of capabilities for individual respiratory and body protection to prevent exposure to chemical agents. The essential characteristics of air tightness and non-permeability to gases will be maintained. Respiratory protection will be achieved by using either Self-Contained Breathing Apparatus (SCBA) or face masks fitted with NBC filters. The NBC respirator, NBC canister, protective clothing, impermeable protective clothing, gloves, over-boots etc., developed by DRDO may be adapted.

ii) Based on risk assessment, collective protection (physical protection for a group of individuals with the aim of reducing the discomfort of wearing gas masks and clothing) may need to be established. Temporary inflatable shelters maintained at positive pressure with separate entry and exit doors located at perpendicular positions will be catered for. The shelters will be fitted with NBC filters for detoxification of contaminated air.

iii) Depending upon the risk and threat perception, adequate number of protective gear will be stocked at the district level and other important locations for all first responders including NDRF, SDRF, police, fire and emergency services, MFRs, and other personnel connected with management of CTD. The protocols for quick wearing, leak testing, and removal of protective gear will also be laid down. They will be checked from time to time for proper functionality.

It is necessary for the responders to understand the limitations of the different protective gear and their probable usage under different circumstances to protect themselves prior to saving the lives of others. The permeability of chemical agents and modes of removing contaminants from the air to provide physical and collective protection are elucidated briefly in Annexure VI.

B) Detection

Early detection of the type and quantity of chemical agent(s) used in CTD is vital for proper management of the victims. The knowledge of the exact nature of the chemical used in the event will facilitate proper antidote administration and effective treatment for early recovery. The characterisation of chemical compounds depends upon the reliability and accuracy of the detection technologies used. The major points for addressal are mentioned below.

i) EWS will have an inbuilt mechanism to monitor different regions and if the concentration of any chemical agent goes above the threshold level which may be harmful, a response will be activated. Any undue alarm or suspicion will be obviated by due verification.

ii) A mechanism will be established for monitoring the progress of the chemical event, to provide real-time data of the changing dynamics of the chemical agent. Indigenous industries will be encouraged to develop such instruments in collaboration with research institutes which are able to operate under extreme climatic differences as observed at various vulnerable locations in the country.

iii) SOPs regarding the usage of different detection techniques will be laid down as per their priority.

iv) Fire and emergency services will be equipped with HAZMAT vans for speedy detection of the nature of chemicals used in an attack. District authorities will have at least one HAZMAT response van depending upon the vulnerability status

of the area. The firefighting teams will also be properly trained to use the various detectors. Rapid field detection kits for detection and characterisation of chemical agents and advanced online monitoring technologies will be developed.

v) Surveillance for detection of illness and injuries resulting from chemical terrorism shall be integrated into the existing surveillance programme, while developing new mechanisms for detecting, evaluating, and reporting suspicious events that might represent terrorist acts. As part of this effort, central, state, and district health authorities will form partnerships with front line medical personnel in hospital emergency departments, hospital care facilities, PICs, laboratory networks, and other institutions to enhance detection and reporting of unexplained injuries and illnesses as part of the routine surveillance mechanism for chemical terrorism.

vi) Detection teams shall not enter the defined 'risk areas' contaminated with toxic chemicals without special protective equipment.

vii) Detection technology shall be upgraded from time to time to ensure accuracy of the identification of chemical agents by minimising false positive signals.

viii) A multi-level chemical laboratory network for chemical terrorism will be created for an early characterisation of chemicals so as to identify short-term and long-term effects.

ix) Detection and surveillance will include the provision of mapping vulnerable areas so that evacuation routes can be defined.

x) A mobile chemical laboratory fitted with a chemical analyser will be made available for highly vulnerable areas.

Detection and characterisation of the chemical agent is the first step in initiating the response activity. Therefore, it is imperative to develop adequate detection technologies with skilled and trained staff in every district.

C) Decontamination

Decontamination is a process that removes or neutralises chemical agents physically and also prevents their absorption through the skin. An ideal decontamination agent will rapidly and completely remove all chemical toxic agents either by cleaning, disinfection, or sterilisation.

The complete decontamination process at the incident site includes:

i) Mobile decontamination facilities established at the incident site but outside the risk area. The models of temporary mobile decontamination facilities will be developed, tested, and made available at the district level.

ii) The first step is the physical removal by brushing off, washing, or adsorption of the chemicals by using adsorbent materials like Fuller's Earth, Dutch Powder, and other substances like ion exchange and resin-based decontamination materials.

iii) The next step is the use of chemical methods like soap and water including detergents, etc., based upon the principles of oxidation, and acid or base hydrolysis. Mustard (HD) and the persistent nerve agent VX contain sulphur molecules that are readily subject to oxidation reactions. VX and the other nerve agents (GA, GB, GD, and GF) contain phosphorus groups that can be hydrolysed. Therefore, most chemical decontaminants are designed to oxidise HD and VX and to hydrolyse nerve agents (VX and the G series). All the necessary equipment, decontamination

agents, and methodologies will be available to the emergency responders. Necessary decontamination procedures including wound and skin decontamination and gas phase decontamination will be laid down. SOPs will include detailed decontamination processes for specific CW agents.

iv) It is imperative to use different chemical agents that are able to destroy these toxic chemicals specifically in case of CW agents. For example, hypochlorite removes VX in 15 minutes at pH 10 while it may take a longer time to remove mustard agents. On the other hand, vesicants may penetrate at a very fast rate prior to the reactive detoxification process. Thus, necessary SOPs will be laid down for usage of different decontamination processes and training will also be imparted through mock-drills.

v) New updated technologies for decontamination will be adopted after testing and validating the procedures.

vi) Necessary mechanisms will be developed under the guidance of a specific level of medical authority, to prevent the spread of contaminated water due to the runoff reaction.

vii) Self-decontamination procedures to be followed by the community exposed to the chemicals include:

a. Self-removal of clothing will be done, and if necessary by cutting or tearing off the clothes to avoid spreading the chemical agent on the body. While rendering help to others, it is recommended that contaminated areas should not be touched to prevent any possible secondary or cross-contamination. In this case also, the clothes should be cut or torn off if necessary.

b. Wash the affected portions with lots of water and soap. Remove contact lenses if any, and irrigate the eyes to contain or prevent any likely irritation.

c. Dispose soiled and contaminated clothes in a plastic bag while wearing rubber gloves if possible to avoid contact with the same. Seal the above bag and put it in another bag for handing over to the authorities for proper disposal. Fresh uncontaminated clothes from a closed suitcase or cupboard should be worn.

The details of the decontamination procedures for different CW agents are given in Annexure VII.

D) Preparedness for Emergency Medical Response

Medical preparedness will be based upon upgradation of the regular practice of medicine to enable it for emergency medical response in the event of a CTD. Emergency medical response commences with prompt establishment of medical posts as a part of ICS within the golden hour. Treatment begins by providing BLS at the incident site itself, which reduces morbidity and mortality. Mechanism for enhancing the coping capacity of health care providers for an effective medical response is necessary. The preparedness for emergency medical response will focus on:

i) SOPs for establishing an ICP post including the provision of emergency medical care and dedicated mobile teams trained to work in the chemical scenario.

ii) Specific provisions will be ensured for providing emergency medical care during evacuation of the victims from the contaminated environment. Mechanism for coordination between the various health care institutions and other agencies like the

police, fire and emergency services, NGOs and other humanitarian agencies shall be established.

iii) Problem solving procedures based on the past experience of similar disasters and lessons learnt during mock-exercises will be incorporated.

iv) Injuries, illness, and public health problems including psycho-social trauma will be addressed by integration of medicine and public health in the overall comprehensive medical management plans.

v) Indicators suitable for assessing the progression of disasters will be developed. Continuous real time and accurate information will be provided to public health authorities and the public through a dedicated PA system or locally available means.

vi) Protection and detection equipment will be available with various mobile teams and various rescue services which are essentially required for the initial assessment and management of CTD.

vii) Risk and resource inventory of protection and detection equipment, decontamination and decorporation agents, and chemical casualty treatment kits will be prepared at all levels of the medical management planning process.

viii) Immediate clean-up actions using various neutralisation techniques will be initiated to reduce the concentration of chemical agents at the incident site in the case of a CTD involving TICs/TIMs and hazardous waste as potential targets.

ix) QRMTs/MFRs will have first aid medical kits containing important antidotes like pyridostigmine tablets, injection obidoxime, atropine sulphate, dimercaprol, sodium thiosulphate, and other essential components including syringes, needles, and Gudel airways etc., which are specific for CW agents. The various medical treatment protocols for the management of patients affected by various chemicals are given in Annexure I.

x) Reserves of medical bricks containing CBRN related emergency medicines, antidotes, and BLS equipment will be developed and maintained by periodic rotation of stocks. Necessary provisions will be developed for pooling in extra requirements and backup medical services.

xi) Medicos and paramedics will be trained in the medical management of the acute health risks associated with CW agents, usage of different antidotes, providing BLS and psycho-social first aid to reduce panic reaction and acute stress, etc.

xii) Training of specialised MFRs for CTD on the aspects of first aid and resuscitation measures, triage, decontamination and decorporation agents, and treatment modalities will be provided.

xiii) Chemical casualty treatment profiles will be standardised.

xiv) SOPs to collect biological samples of casualties and various environmental samples will be laid down.

E) Roles of Other Emergency Support Functionaries at the Incident Site

The emergency response functions to be performed at the incident site or at hospitals require all round preparedness. The coordination between the various emergency functionaries plays a critical role in overall management in the aftermath of a chemical attack. The preparedness of different

emergency functionaries for performing crucial roles at the incident site is as follows:

i) Police

a. The police will undoubtedly be the first responder for any terrorist chemical attack. It is important to equip them with all the protective gear.

b. Special chemical squads from amongst the police forces will be developed for the management of chemical attacks.

c. Necessary equipment for detection will be installed in the police patrol vehicles depending upon the threat assessment of the area.

d. The police force will be trained and equipped to maintain law and order and avert the occurrence of any secondary disaster or the possibility of a second blast, etc.

ii) National Security Guards

The National Security Guard (NSG) was raised under the National Security Guard Act of 1985, and has acquired considerable experience from the intense insurgency operations it has dealt with. Adopting a variety of roles, from counter-terrorism to hostage rescue to VIP protection, the NSG proudly wears the mantle of being one of the finest counter-terrorist units in all of Asia. The goals of NSG include:

a. Neutralisation of specific terrorist threats in vital installations or in any given area.

b. Handling hijacking situations on land and in the air.

c. Bomb disposal (search, detection, and neutralisation of IEDs).

d. Post blast Investigations.

e. Engaging and neutralising terrorists in specific situations.

f. Rescue of hostages.

The strength of the NSG will be increased and located in various vulnerable cities. Their capacities will also be increased to meet enhanced threats.

iii) Civil Defence

In any disaster the community has a major role to play, both as a victim, and necessarily as a first responder. Outside help comes only later. Civil Defence was first established in India on 24 October 1941. It was enacted by Parliament as the Civil Defence Act, 1968. Having realised its significance, the Government of India (GoI) has already decided to revamp the Civil Defence set up in the country. Civil Defence, which had earlier been set up in the specific context of war to cover only 225 important towns, will now also be utilised for DM.

a. Each district of the country will now have a Civil Defence set up. There will be 18 persons employed on a full-time basis in each district, out of which eight will be trainers and their duty will be to train volunteers and wardens for response duties in DM.

b. Though an amendment (which is in process) to the Civil Defence Act is required to include DM in its charter of duties, the GoI has already included this duty through an executive order.

c. All the proposals for revamping Civil Defence will be implemented in a phased manner. In the first phase (2008–09) 40 major towns have been identified to cover the concerned district for Civil Defence activities.

d. Civil Defence will be equipped and trained for a quick response to CTD.

e. States will start using the existing set up for recruiting and training more and more volunteers and spreading awareness on different aspects of DM.

f. A comprehensive curriculum is required for the training of Civil Defence at all levels in DM.

iv) Fire and Emergency Services

The primary function of the Fire Services is firefighting including chemical fires that occur due to chemical attacks.

a. It is important to upgrade their functions to include primary response to chemical incidents, zonation, mobile decontamination facilities, search and rescue, and clean-up actions.

b. They will be equipped with all protective gear, detectors, HAZMAT vans, and neutralisation units for the effective management of CTD.

c. The fire and emergency services in conjunction with the police force will develop Detection and Survey Teams and Chemical Rapid Response Teams (CRRTs).

v) NDRF and SDRF

The National Disaster Response Force is a specialised force developed for all-disaster response and is presently located strategically at eight different locations in the country.

a. Out of the eight battalions of NDRF, four are trained in CBRN management and equipped with the latest protection, detection, and decontamination equipment. They should also be equipped with thermal cameras for spotting live individuals.

b. On the lines of NDRF, SDRFs will be developed at the state level and will be located at different vulnerable locations within the state.

c. Teams identified from these forces will be developed as special responders.

vi) The water supply division will provide water for decontamination, firefighting, and safe, uncontaminated water supply for drinking. They will function in coordination with medical and other emergency services. Adequate number of protective gear will be maintained with this division, and the necessary training provided to key members of their staff.

vii) The public health departments of states maintain the essential supplies of civic amenities and basic needs of the community. They will act as a backup service for manpower and resource inventory. In coordination with the district authorities, they will develop technical backup teams.

viii) Disaster resilient communication services to all service providers at the incident site will be linked up to all decision making authorities (horizontal and vertical).

ix) Community groups will be specifically trained in providing psycho-social care to the victims and their families.

Detailed roles, various dos and don'ts, and detailed response functions will be defined in the district DM plans. These functionaries will be tested at vulnerable locations by conducting mock-drills. Different capacity development measures will be undertaken based upon the lessons learnt during these mock-drills.

4.3.2 Capacity Development

Capacity development includes development of human resource and enhancement of their skills and competence by imparting education, comprehensive and integrated training, and knowledge management at all levels. Enhancement of core competency of first responders, medical and public health workers, and development of the highest levels of scientific and technological expertise are the other goals for capacity development. It will also focus on building the knowledge, attitude, and skills of the community to cope with the different effects of CTD. Capacity development needs to be further supported by the development of critical infrastructure and institutional and information networking at various levels. The guidelines for the development of these aspects are given below.

A) Human Resource Development

The availability of skilled and adequately trained manpower at all levels is crucial in dealing with chemical terrorism. Competence-based training and the imparting of technical education related to the response strategies at the incident site and medical management of such events is essential. It is necessary to integrate the various types of response forces and the relief workers at different levels under a single coordinated system for the management of CTD. The major recommendations include:

i) Rescue and relief teams will be formed at appropriate levels to help in the management of CTD. The functioning of Civil Defence, Home Guards, and other emergency service providers will be revamped and strengthened to tackle any act of chemical terrorism as part of the 'all hazard' DM approach.

ii) Capacity in terms of skilled and trained manpower is required to be built up at the identified institutes, research departments, and training centres commensurate with the hazard potential of the given area.

iii) Basic knowledge of toxic chemicals will be imparted through induction courses to the public and private sector employees of chemical industries, isolated storages, and to those responsible for the transportation of potentially toxic chemicals.

iv) The role of NGOs, other voluntary organisations, and the community is required to be defined. Resident welfare associations and NGOs will be integrated in this training network to develop groups of volunteers.

v) It is essential to sensitise the functionaries in all financial and insurance institutions with regard to the importance of speedy disposal of disaster-related cases by streamlining their procedures.

vi) Database of skilled manpower will be made available in the public domain and will be regularly updated. A specific mechanism for the same will be worked out with the help of teaching institutions and R&D organisations.

B) Education and Training

Education modules regarding various aspects of chemical terrorism will be developed and imparted to various stakeholders, teachers and students in schools and professional colleges, and the community to develop resilience. It will be imparted at each level and the specificity of such aspects will depend upon the threat assessment of the area. Technical training plays an important role in understanding the nature of chemical agents and the correct response to mitigate the effects of the same. Training of all responders and service providers is essential for the prompt and effective management of CTD. The

identification and earmarking of the education and training institutions at all levels is essential. The important recommendations for education and training include:

i) Education on chemical disaster preparedness will be provided by the functional integration of various aspects of disasters in the education curriculum at the school level. Education on CTD will also be included in the syllabi of professional and technical colleges at appropriate levels. The CTD component will be incorporated in professional and specialised courses like medicine, nursing, engineering, environmental sciences, pharmacy, and toxicology, and by professional bodies such as intelligence, customs, police, banking, and insurance. A public health distance learning programme giving CDM training to health care workers and other stakeholders will be instituted at the university level. Advanced knowledge on the subject will be incorporated into the curriculum for professionals and administrators who have significant roles to play.

ii) Education about the realities of CTD situations will be imparted through the media, books, audio/video, lectures, and group discussions. Regular educational programmes in the form of symposia, exhibitions, and demonstrations will be encouraged. Seminars, camps, and technical workshops will also be organised to promote CTD awareness, and CTD-related education material will be made available for all stakeholders at various levels.

iii) Basic knowledge of toxicology will also be imparted at all levels, besides information on chemical sciences technology used in the management of CTD. Practical examples will be used to explain the different aspects of CTD and its management, and related dos and don'ts.

iv) Responders will be educated to assess their vulnerability to the potential consequences of exposure to chemical agents, including chronic and traumatic stresses in the aftermath of chemical attack. Responders will be taught how to prevent injury to themselves due to the domino or cascading effect of the chemical attacks. They shall also be taught methods to obtain public cooperation and assistance. Education will be provided on the nature of mental stress, its possible consequences, and how to handle it during chemical attacks. The Stress Management System (SMS) will be integrated into the existing health care system at all levels.

v) Educational programmes will be conducted in various vernacular languages all over the country.

vi) Education will be provided to the community about chemical terrorism and its impact, preparedness measures, and emergency response at the incident site and at the hospital. Basic health education and knowledge of sanitation practices will also be provided.

vii) Medical professionals will be given adequate education about the various types of chemical agents including TICs/TIMs, CW agents, etc., their properties, possible modes of dispersal, and their treatment. The medical teams will also be trained in the use of PPE, different modalities and methods of decontamination, principles of triage for chemical casualties, and knowledge of treatment protocols for managing chemical casualties.

viii) Chemical terrorism-related training will also be imparted to the planners at regulatory bodies and district/state authorities, rescue service providers, first responders, frontline health care providers, safety personnel, laboratory workers, nurses, pharmacists, paramedics, and other stakeholders involved in emergency planning, preparedness, and response in CTD to develop skills for quick situational assessment and emergency response.

ix) Mapping, identification, and upgradation of appropriate institutions and resource personnel who will provide the training of trainers for management of CTD shall be undertaken. National-level institutions and other academic institutions such as the IITs, OISD, IICT, ITRC, NIOSH, NFSC, NCDC, NSC, DMI, NIDM, ICA, Indian Chemical Council, NCL, National Insurance Academy, and ASCI; state institutions and ATIs, training centres and other professional bodies or societies; industrial and corporate institutions and associations; training facility health care providers; civil aviation institutions and their networks; safety and medical equipment manufacturers; medical examiners, and emergency response units, and other responders, etc., will synergise their training activities under an overall training partnership approach in matters related to management of CTD.

x) The present status and strength of these identified institutes will be assessed, and if required, be encouraged to build additional training capacities and generate complimentary independent training programmes for CTD related activities. A national agency will be identified, upgraded, and developed to create and coordinate training activities related to CTD. Some of the existing leading institutes of central and state governments and local training institutes will be upgraded and strengthened for CTD training based on the vulnerability assessment of the region.

xi) The fire and emergency services will be equipped with modern equipment and supported by advanced training for strategic response to play an effective role in CTD.

xii) Specialised and interdepartmental training regarding chemical terrorism will be conducted for community leaders so that they may play active roles and have designated responsibilities. Their services shall be used to generate awareness of CTD by organising regular group training sessions for sensitisation, and drills for families, organisations, and the community.

xiii) Preparedness will be ensured by conducting mock-drills which will also ensure the continuous improvement in response. Drills based on terrorism incidents involving or targeting HAZCHEM/HAZMAT and/or their hazardous waste, toxic agrochemicals, or other poisons, acquires a different connotation. SOPs for conducting mock-drills with a focus on the threat of a CTD in the area will be developed, tested, and practised regularly. A programme of periodic drills will be introduced in randomly chosen target areas to enable prompt and appropriate response of all responders, service providers, and the community in the event of an attack. Information and ongoing training for swift and effective response to mitigate the effects of a CTD will go a long way in building capacity and resilience to minimise its effects.

xiv) Tools and techniques will be devised for measuring the effectiveness of the training programmes. Mechanism for re-evaluation and revision of existing training programmes on a continual basis will be

developed and implemented. Retraining programmes will be conducted for all stakeholders at regular intervals.

C) Knowledge Management

Knowledge about the various types of chemical agents, their usage in chemical terrorism, and their hazardous effects is lacking with all stakeholders involved in the management of CTD. It is, therefore, important that knowledge management centres be established and streamlined by the nodal ministry through its technical institutes to ensure easy availability of reliable and authentic information on the various chemical agents that could be used by terrorists during chemical attacks.

These centres shall:

i) Act as an important link to effectively mitigate the effects of chemical terrorism activities.

ii) Be networked with academia, technical institutions like PICs, laboratories of DRDO, DST, CSIR, ICMR, forensic laboratories, professional bodies, industries and their federations or associations, and international agencies.

iii) Be linked with state and district authorities.

iv) Develop a mechanism for proper usage and implementation of the right information in the best conceivable way.

DRDO is currently working on various rapid detection systems and kits for field applications. Once developed, such systems will be adopted and deployed at strategic locations throughout the country and integrated to form an effective EWS. Further, regular efforts at improvement shall be made in the detection, protection, and decontamination procedures for their better efficiency and reliability. A number of antidotes have been either developed or are at the experimental stage for prophylaxis as well as treatment for chemical warfare agents. The linkage of new global advancements by continuous monitoring for selection of best available technology, and its adaption in the Indian context, shall help in promoting team efforts in this direction. NDMA will help the Central Government in defining and establishing such centres for various types of disasters.

4.3.3 Infrastructural Development

Adequate and appropriate infrastructure is essential for the management of CTD. Specialised areas that need infrastructural upgradation are communication systems, PPE, detection and decontamination equipment and facilities, development of HAZMAT response vans, development and upgradation of chemical analysis and forensic labs, PICs, and R&D establishments. It also includes the development of facilities for medical countermeasures at the incident site for emergency medical response, during evacuation and treatment at hospitals. These facilities will be developed based on the experiences of earlier incidents and global best practices. Special emphasis will be laid down in the following areas:

A) Basic Infrastructural Development

The first responders will be equipped with PPE, the latest technologies for detection and characterisation of chemical agents from the environment, and clinical samples. The following basic infrastructure will be developed:

i) Standardised and reliable PPE in numbers sufficient to meet the requirements of all first responders. .

ii) Portable, simple to operate, and rugged field detection equipment, which has high sensitivity and specificity in terms of detection.

iii) Specialised mobile chemical laboratories, HAZMAT vehicles, and reconnaissance vans for the collection, detection, and speedy field characterisation of potentially dangerous chemicals.

iv) The existing diagnostic laboratories will be upgraded and equipped to rapidly identify chemical agents using advanced technologies required for confirmatory chemical characterisation. Appropriate bioassays for detection and diagnosis of chemical injuries will be developed.

v) The development of mobile decontamination facilities. At least one dedicated HAZMAT vehicle will be provided at each district for management of CTD.

vi) Provision will be made to ensure regular availability of antidotes.

vii) Mechanism will be developed to regularly update and augment the infrastructure, skilled manpower, and financial resources required in various institutions associated with management of CTD.

Based upon the risk assessment studies, the requirement and location of ERCs and various control rooms, decontamination centres, PICs, ambulances, and other related supporting services will be identified and created.

B) Poison Information Centres

PICs will be developed such that they are able to provide the necessary diagnostic support required during chemical terrorism attacks. The PIC network will be strengthened by increasing their number and capabilities. There is an urgent necessity to upgrade the national poison information centres and develop regional level centres. The states that do not have PICs shall either develop a state PIC or strengthen existing forensic laboratories by developing their capabilities for CTD. Similarly, facilities at the forensic departments of medical colleges and hospitals shall be upgraded so that they possess facilities for detection and characterisation of various chemical agents used for CW. PICs can also be developed in a public-private partnership approach, in a consortium mode with the participation of technical institutes, academia, and industry. PICs will act as a source of prompt essential information on toxicity of lethal chemicals and on their medical management. Thus, the scope and role of the PICs will be extended beyond the traditional goals, viz., information will be collated on management of various kinds of poisoning and poison prevention in chemical industrial DM activities including chemical terrorism.

PICs should develop a mechanism for being up to date with the various forms of hazardous chemicals in the product cycles of different MAH installations, storages, and pipelines including units dealing with industrial waste, as part of emergency preparedness for CTD. PICs can provide various technical inputs and information about local vulnerabilities to the planners and authorities. Based on this information, guidelines on measures for risk assessment, decontamination in situ and within hospitals, first aid measures, general and specific therapy, and availability of antidotes at strategic locations will be developed and integrated into the district DM plan.

Major roles shall include:

i) Generating information on TICs/TIMs, agricultural and household pesticides, CW agents, lethal chemicals and poisons from the various toxicological data banks.

ii) Developing links responsible for collecting environmental and laboratory samples from incident sites. Laboratory staff will be appropriately trained in methods for proper collection of samples, associated documentation, packaging, and their

safe transportation and final testing using updated sophisticated analytical instrumentation in forensic and other laboratory facilities.

iii) Corroborate analysis made by field and static laboratories and disseminate immediately relevant information about the exact identity and nature of chemicals involved in the chemical attacks, including toxicity data, types of antidotes and their availability.

iv) Conducting training and awareness programmes for professionals (pharmacologists, toxicologists, forensic experts, bio-technologists, medical professionals, and paramedics) about chemical agents, their effects, prophylactics, and antidotes.

v) Training of MFRs and Rapid Response Teams that are able to provide first aid measures, antidotes, and BLS to the people affected during a Mass Poisoning Incident (MPI).

vi) Help in developing education and awareness programmes on chemical accidental poisoning and chemical terrorism activities.

C) Communication and Networking

Effective communication and networking act as the key for an effective response to a chemical attack. A single communication network of all the existing assets including those with existing institutions associated in the management of CTD will be established. The nodal ministry for CTD and for chemical accidents will organise necessary activities to develop a common information platform. The information network will include:

i) A sufficiently robust, yet flexible, information networking system including multi-way dissemination of intelligence with all the states and districts as part of their DM plans will be established on a priority basis. It will be regularly updated and manned round the clock.

ii) All the district functionaries from the concerned departments (intra-connected via a horizontal mode of communication) providing different emergency functional support will have a control room as part of the overall communication network. This system will be integrated in a vertical mode with the National Emergency Operation Centre at the central level, and the various EOCs operating at the level of various CMGs of different ministries and at the state level.

iii) The link up facilities will be established by using all feasible modes viz., telephones, mobile phones, fax, e-mail, wireless (the police services are effectively linked by this mode), Local Area Networking, Wide Area Networking, and internet (a dedicated website for a networked health care institution is preferable).

iv) Institutes, analytical laboratories and research departments identified by the nodal ministry, other associated ministries of CTD along with other emergency functionaries will be identified by the states and will be integrated into an effective communication network to quickly analyse and identify toxicants/chemo-toxins at the incident site.

v) All modes of transport that are used for the movement of chemicals or their derivatives which can be used as chemical agents will have an established, dedicated communication system with all stakeholders, and a mechanism (including GIS) for continuous monitoring of the transport vehicle carrying chemical

agents all along its route. This will also be integrated into the comprehensive information network.

vi) A comprehensive database will be created on the land use, demography, and infrastructure developed at the national, state, and local levels along with current information on climate, weather, and man-made structures.

vii) Resource inventories of governmental and non-governmental systems including personnel and equipment will be developed and networked to help in efficient mobilisation and optimisation of response measures.

viii) A detailed list of hazardous chemical agents, the available sources, harmful effects, and related dos and don'ts will be made available in the information network.

ix) At the national level, the 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 required for effective disaster response. The IDRN will be updated and except for some classified data, all valuable information regarding CTD will be made available in the public domain.

x) It is proposed to develop a web-based national network for information exchange to use The Global Health Network and Global Health Unit for Disaster and Relief Coordination (GHUDRC) for the comprehensive management of CTD.

xi) Intelligence agencies and their coordination with international agencies like Interpol and intelligence agencies of friendly and collaborative foreign countries will be strengthened and given an appropriate level of authority.

xii) Security agencies like police, paramilitary forces, customs and excise personnel manning sensitive installations, container depots, ports, airports, international border crossing points, and railway stations will be trained to identify suspicious consignments and to disseminate necessary information about them.

xiii) Networking of functional manpower will include mobile teams and QRTs, specialist medical officers, paramedics, other health care workers, drivers of ambulances, specialised response forces, i.e., NDRF, SDRF, and other emergency service providers operating at all levels.

The development of these networks will be linked to the mechanism for direct communication with the local community during a CTD and developed as a crisis communication plan as a part of the district DM plan.

4.3.4 Preparedness for Emergency Evacuation of Chemical Casualties

Prompt evacuation of casualties is required to be carried out from the incident site, and of people living or working in the vicinity of the site who are likely to get exposed or come under severe threat of contamination, during a chemical attack. The evacuation plans will be prepared and categorised in two broad groups:

A) Evacuation from the Incident Site of Chemical Attack

i) Casualties from the hot zone of the incident site will be transported to the designated earmarked health care facility after providing BLS, necessary triage and decontamination procedures.

ii) The evacuation planning will include information of the defined route, the availability of NBC filter-fitted ambulances

with specialised paramedical staff, and specialised facilities available with earmarked hospitals, keeping in view the prevalent and forecasted meteorological conditions and levels of contamination.

iii) Rail and/or air transport may have to be resorted to for providing medical aid or evacuation of casualties. Special trains with both A/C and non-A/C sleeper coaches manned by Railway doctors and paramedical staff will be deployed for emergenct first aid and evacuation by integrating these services in the evacuation plan. It is preferable for the networked health care institutions to have dedicated or 'on call' air assistance in the form of air ambulance or transport planes.

iv) Some components of the railways, civil aviation authorities, and road transport departments need to be upgraded and equipped with modern facilities for the management of enhanced need of evacuating a large number of chemical casualties.

v) The necessary modes for the evacuation of casualties will be identified and developed as an integrated ambulance network. SOPs will be laid down for evacuation services and its networking all across the local, district, state, and national levels under their respective DM plans.

B) Evacuation of the Community under Possible Threat of Chemical Contamination:

As a part of the District Disaster Management Plan (DDMP), planning for evacuation of the affected community to pre-defined places will be made. Efforts made in the pre-disaster phase for developing chemical resilience among the community and planning for crisis management shall be of great utility during evacuation of the community under possible threat of chemical contamination. Important issues are as follows:

i) Affected area shall be cordoned off to avoid unnecessary ingress such as onlookers, migratory population, media persons, and VIPs visiting the 'contaminated area', and of unnecessary egress of contaminated population.

ii) State/district authorities shall provide PPE to the people who are required to be evacuated.

iii) Affected population shall be prevented from consuming contaminated food and water.

iv) The authorities will develop adequate mass evacuation facilities including buses or large vehicles maintained under positive pressure fitted with NBC filters.

v) The information about the availability of shelters will be disseminated to the community. The community, under severe chemical threat, or probably exposed to chemicals, can use personal vehicles or move under the guidance of the local authority to the designated shelters depending upon the type of attack. It is important that they should follow laid down egress routes and subject themselves to medical examination and decontamination at designated locations.

vi) It is recommended that schools be made into temporary shelters. The community will be made aware that they should not pick up their wards from school, in order to prevent the risk of chemical exposure during transportation.

vii) It is advisable that people carry a first aid kit while leaving their residence.

viii) The community will be made aware about the necessary precautions to be taken and other dos and don'ts.

ix) The exposed community is advised to go through self-decontamination procedures.

x) Mobile medical teams will be mobilised for triage of symptomatic and asymptomatic victims. Trained paramedics and MFRs will provide BLS to all the patients prior to evacuation.

xi) Persons who show signs and symptoms of exposure to chemical agents will be moved to a health care facility for keeping them under observation. First aid and symptomatic treatment shall be initiated during evacuation.

xii) Certain elements of the population that have been affected but are asymptomatic shall be kept under observation at indoor shelters and if necessary, evacuated to the hospital only after decontamination.

4.3.5 Community Based Disaster Preparedness

The community is usually the first responder in disaster situations. A well-informed community is an asset for the management of CTD. Public awareness and education on disasters and their preparedness on various aspects is essential to mitigate the effects of chemical attacks. The community will be trained during the pre-disaster phase to empower it to cope with CTD. Necessary steps shall be undertaken for the development of adequate capabilities in the community so that it can respond appropriately, and recover speedily from a chemical terrorism attack. It needs to be actively integrated into the overall management planning of CTD. This will be done while forming the task-force constituted from different community groups. Training will be focused and related to management of CTD as a part of the 'all hazard' Disaster Management Plan (DMP) of the area. Preparedness to mitigate the public health consequences of chemical terrorism depends on the coordinated activities of well-trained health care and public health personnel and community. The community will form a part of the district or local DM plan, and will participate in mock-drills conducted for the management of CTD. This will ensure their proactive participation during and in the aftermath of a CTD.

The following activities need to be stressed for community preparedness:

i) Constitution of community teams for awareness generation, training, and other support functions including surveillance and mutual support during the disaster. Group leaders and other community level workers will be identified and defined for support services with the help of the DDMAs.

ii) Creation of public awareness and basic education by elected representatives, local media, paramedics, resident welfare associations, vyapaar mandals, NGOs, CBOs, etc., regarding chemical agents, their effects, and potential injuries during chemical attacks.

iii) Programmes for training the 'training team' will be organised by DDMAs.

iv) Interactive meetings shall be organised with the community at regular intervals by local organisations in the highly vulnerable zones, which are more prone to chemical attacks.

v) The community will be made aware with the help of the media and other modes about helpline numbers and evacuation routes and sites for gathering (assembly points) as part of the 'Emergency Action Advice'.

vi) Vulnerable groups will be identified for being provided special assistance in terms of evacuation, relief, special aid, and medical attention during disaster situations.

vii) Encouraging women and youth groups to actively participate in decision making committees and action groups for psycho-social care, health care, and training to the community.

viii) The community-based approach followed by most NGOs and community based organisations shall be incorporated in the management of CTD as an effective vehicle of community participation.

ix) All community awareness programmes will be conducted in coordination and partnership with authorities of the district administration, NDRF, SDRFs, and local forces. It will include awareness programmes about self-decontamination practices, detection, antidotes, family DM kits, etc.

x) The community plans will be dovetailed into the panchayat, block, and district plans.

xi) Health education and community participation in disease intervention play a key role in prevention of secondary diseases and control of disasters. Education material on management of CTD will be compiled and upgraded from time to time.

xii) CTD related manuals and pamphlets will also be published in vernacular languages to achieve universal dissemination amongst the community.

xiii) Electronic media will be used appropriately to impart knowledge to the community at large. A website will be created to disseminate essential information related to chemical terrorism activities, and to provide training information to public health care workers and the community.

xiv) Programmes will be conducted to educate the public on sanitation and hygiene and use of safe food and water.

xv) Community awareness about stress reactions in CTD situations through education, acceptance, self-assessment, and assessment of one's environment will be encouraged.

xvi) Ensuring community awareness about self-assessment techniques to cope with stress during disaster situations is necessary. It should include:

a. Learning to objectively assess one's stress levels.

b. Identifying one's strengths and weaknesses.

c. Assessing the effectiveness of the coping mechanism.

xvii) Public awareness will be developed and promoted about dos and don'ts, effects of chemical agents, and remedial measures.

xviii) Awareness among children is an important means of creating public awareness, as in many cases parents and other family members also gain information and knowledge through children. Curriculum development with a focus on dissemination of CTD related information on a sustained basis, covering junior, middle, and high schools should thus be worked out by the various boards of education in the country.

xix) In awareness generation, NGOs will play an effective role. To address this critical issue, NGOs experienced in handling chemical emergencies will be identified. The capacities and capabilities of such NGOs will be strengthened to support effective and specialised response in the event of a chemical attack.

xx) Dos and Don'ts for the management of terrorist incidents involving CW agents are given in Annexure VIII.

4.3.6 Hospital Preparedness

The mortality and morbidity of chemical disaster victims is inversely proportional to the

levels of medical preparedness, both at the incident site and in a hospital set up. Special preparedness provisions will be made such that the hospital emergency area can be divided into a special zone for treating chemical casualties without interfering in day-to-day functioning. Hospital preparedness for patients affected by CTD requires special inputs and the development of specialised facilities, and preparedness to cater to uniquely emerging public health issues.

An 'all hazard' hospital DM plan will focus on the specialised requirement of PPE, decontamination facilities at hospitals, creation of specialised medical teams and facilities, adequate laboratory support, training of specialists, nurses, pharmacists, and paramedics including adequate knowledge of various chemical agents, their effects, and treatment protocols including awareness of specific prophylactics and antidotes. Facilities available at hospitals will be shared for the purpose of specialised treatment wherever possible. Preparation of hospital DM plans for management of mass casualty events in general have been discussed in detail in *National Disaster Management Guidelines: Medical Preparedness and Mass Casualty Management*. Specialised issues pertaining to hospital preparedness to cater to chemical casualties are highlighted in the ensuing paragraphs:

i) Protective Equipment

SOPs will be laid out for carrying out protective measures by medical, paramedical, and other identified staff at the casualty reception area and emergency department.

a. An adequate number of PPE will be made available to the emergency department of the hospital for the use of medical teams and other identified staff in the hospital who are involved in the treatment of CTD victims.

b. Hospital staff will also be trained in the use of PPE.

c. Used PPE may be reused strictly as per protocol and safety norms.

d. Used PPE will be segregated and decontaminated before final disposal.

ii) Decontamination Facilities

All the earmarked hospitals will have decontamination facilities available in the vicinity of the emergency department along with necessary logistics including trained personnel to remove or neutralise harmful chemicals that have accumulated due to the chemical incident on the body and attire of both disaster victims and responders.

a. Fixed decontamination facility for man and material will be developed at the entry points with adequate provisions for sealing off this portion from the rest of the hospital.

b. A dedicated and trained decontamination team shall be created from the existing staff of the hospital.

c. Adequate quantities of decontaminating agents (powders and fluids), soap solution, and water will be catered for.

d. Protocols for decontamination procedures for each CW agent will be prepared for contaminated persons, clothes and other accessories, and the dead.

e. SOPs for each CW agent will also be prepared for carrying out decontamination of 'exposed or contaminated chemical incident victims' during mock-exercises.

iii) Specialised Provisions in Acute Treatment Wards and Emergency Departments:

Treatment of patients affected by chemical exposure requires the creation of certain specialised facilities. Some of these are listed below:

a. A few air locked rooms fitted with adsorbent/High Efficiency Particulate Aerosol (HEPA) filters, and positive air pressure for the management of highly contaminated casualties will be created.

b. Resuscitation equipment like oxygen cylinders, suction apparatus, Gudel airways, laryngoscope, ventilator, pulse oxymeter, and defibrillator, etc., will be provisioned.

c. Specialised burn centres which have chemical antidotes, chemical burns facilities, and specialists for treatment of burns due to 'corrosive' substances, which victims are exposed to during an attack.

d. Specialised inventories of life-saving drugs, antidotes, and other medical logistics.

e. Adequate blood bank facilities to provide blood or its components, which may be required for the treatment of severely sick patients.

f. SOPs for the preparation of a uniform casualty profile for chemical casualties.

g. Availability of NIOSH's, Material Safety Data Sheet (MSDS), hazardous substance card, listing of details of commonly used and targeted chemical agents for chemical terrorism, their acute health risks, and treatment protocols.

h. Display of resource inventory defining availability of additional medical teams and surge capacities for additional beds and other medical logistics.

i. Observational facilities for delayed effects of toxicants.

j. Adequate mechanism to address long-term medical follow-up.

k. Special decontamination room will also be prepared for the dead before their safe disposal.

iv) Adequate Specialised Laboratory Support

The necessary components of forensic/chemical/medical/clinical/poison centre laboratories are facilities for chemical and biochemical analysis and abilities for interpretation of the laboratory data retrieved so as to arrive at a conclusive evaluation of the agent as well as its health effects, which in turn aids diagnosis, treatment, and follow-up. These include:

a. Developing a list of the specialised laboratories which will be able to analyse a large number of environmental samples and biological samples like blood and urine from chemical attack victims. The list will take into cognisance upgradation of existing resources, their quality accreditation, and appropriate networking.

b. Educating laboratory personnel about the different types of CW agents.

c. The roles and responsibilities of the laboratory workers and concerns regarding their own safety while working with environmental samples or biological specimens will be formalised and rehearsed from time to time.

d. Providing adequate knowledge to laboratory staff about the procedures of collection and dispatch of specimens to referral laboratories.

e. Laying down necessary SOPs for proper collection and dispatch of the biological specimens. The various formats for collection, labelling, packaging, information acquisition and dissemination, analysis, and generation of necessary reports will be incorporated into the SOPs.

f. The labelling will also include a unique patient identification reference number. Packaging protocols will incorporate information regarding dispatching laboratory, contact number, departure and arrival time, necessary instruction leaflet or manual, and the time by which cases should be verified. Additional information will also be recorded, like method of collection, whether antidote was administered prior to collection of the sample, date and time of potential exposure, etc.

g. Making SOPs to carry out analysis of multiple toxicants.

h. Certain chemical agents are carcinogenic, mutagenic, and teratogenic. Laboratories will also be updated for the follow-up of long-term effects of such agents.

i. Support for diagnostic capabilities of laboratories by online query management and a feedback information system for accurate decision-making.

v) Public Health Issues

Preparedness of public health response in the aftermath of a CTD, wherein food and water are likely to be contaminated, will include the following factors:

a. Information on availability of diagnostic facilities, general and specialist treatment facilities, including specific antidotes and other medications, and specialised sources of expertise.

b. The public health authorities and district authorities will ensure proper provisions for:

- Availability of safe water and uncontaminated food.
- Adequate standards of hygiene and sanitation.
- Psycho-social support to the affected communities.
- Disposal of dead bodies and carcasses.

4.3.7 Preparedness for Prevention of Disaster Activities for Petroleum, Petroleum Products, Pipelines, Storages and Process Plants

PNGRB will incorporate provisions in ERDMP regulations for establishing effective Safety Health and Environment (SHE) teams within organisations. Existing systems to tackle disasters will be shared mutually with the neighbouring industries, civil administrations and DDMAs under the guidance of NDMA.

4.4 Management of a Chemical Attack with Unidentified Chemicals

An unidentified chemical poses unknown risks and a great challenge to the rescuers. Responders will use all protective gear assuming the possibility of a worst-case scenario. The major

recommendations for various phases of the post-disaster phase are as follows:

A) Incident Site Management:

i) Distance of the incident command post should be such that it will not be adversely affected by any change in the dynamics of the meteorological situation.

ii) It is important to point out that gaseous exposure does not cause any secondary contamination to rescuers. While on the other hand, liquid exposure may result in off-gassing, causing further contamination of rescue workers.

iii) Protective gear will include:

a. Respiratory protection with positive pressure and SCBA.

b. Chemical protective clothing, including face mask with canister to protect the rescue workers from any local or systemic effect.

iv) Only specialised, trained forces equipped with state-of-the-art equipment will be allowed to enter the hot zone.

v) Backup teams will always be on standby to replace rescuers before the breakthrough time elapses for their protective gear.

vi) SOPs for giving triage, resuscitation, and BLS shall be made. Procedures for maintaining cervical immobilisation will be laid down in the case of suspected trauma.

vii) Prompt removal of victims from the hot zone shall be ensured.

viii) The exposed victims will be decontaminated in the decontamination facility by the rescue workers wearing protective gear as recommended before. However, cases of mild exposure to gas or vapour with no skin or eye irritation may be transferred directly to a support care facility without any decontamination. Additional decontamination like continuous irrigation of eyes and skin is only recommended to be followed after personal scanning.

ix) Prompt evacuation is necessary for reducing the mortality rate. If the patient has ingested the chemical and is vomiting, it is necessary to provide sufficient plastic bags to isolate vomitus. Standard life-supporting measures will be provided in accordance with the comatose, semi-comatose, or fully conscious status of the patient.

B) Hospital Care for an Unidentified Chemical Attack

i) Protective gear will be given to doctors and associated nursing, paramedical, and other staff to prevent any possibility of secondary contamination.

ii) The patients requiring critical care will be provided with necessary treatment based upon the routes of exposure, symptoms, and specific diagnosis, detection, and characterisation of the chemical entity using laboratory tests, whether the patient is in a comatose, semi-comatose, or fully conscious state.

iii) Necessary antidote will be administered either using universal agents like activated charcoal to remove the ingested toxin, or specific medical care upon identification of the chemical.

iv) Linkages with PICs play a critical role at this stage.

Hospital care will also include the monitoring and management of delayed health effects of chemicals.

4.5 Research and Development

Areas of frontline basic and applied research for the development of specialised facilities for the management of chemical casualties in a holistic mode will be identified. There is a need for upgradation of existing technical institutes and laboratories wherein various research modules will be conceptualised that will help in adoption, upgradation, and evolution of state-of-the-art modalities, technologies, techniques, or facilities for the management of CTD available worldwide and evolution of new ones.

Some of the areas that require special attention are:

i) Upgradation of PPE for the aged, children, and infants.

ii) Development of biomarkers, bio-indicators, and therapeutic interventions for effective medical management of chemical victims.

iii) Development of advanced detection and monitoring technologies and mobile decontamination facilities.

iv) Development of antidotes which are currently not available indigenously for different chemical agents.

v) Development of the concept of 'chemical terrorism simulation modelling' and designing of worst-case scenarios during chemical attacks, for training and validating through mock-exercises.

5 Guidelines for Response, Rehabilitation and Recovery

A prompt and effective response consists of many steps, which require the active involvement of all stakeholders and a high level of coordination between various responders and service providers. Adequate preparedness will ensure rapid and efficient response, which will also be extended to rehabilitation and recovery phases. It will, in turn, mitigate both short- and long-term effects of chemical terrorism activities. It requires an institutionalised framework to be developed at all levels by NDMA, SDMAs, and DDMAs. The major steps of response, rehabilitation, and recovery phases are described in the succeeding paragraphs.

5.1 Response

A timely and effective response will be based upon an emergency response plan which will include roles and responsibilities of various stakeholders, responders, and service providers including the private sector; factors governing the establishment of Incident Command (IC) posts, relief centres, medical units, and specialised hospital care; and various coordination protocols. An effective medical response at the incident site needs to be provided at the earliest. This includes management of casualties at the incident site, adequate care during transportation and evacuation, NBC filter-fitted ambulance services with defined evacuation routes, and their communication linkages and coordination with other identified agencies. Such a mechanism will decrease morbidity and mortality during any chemical emergency situation. The various components of the chemical response plan are as given below.

A) Alert System and Reporting a Chemical Attack or Incident

The Emergency Response Plan (ERP) will have an adequate mechanism for proper planning and coordination with different responders, emergency functionaries, and logisticians. A well-rehearsed and standardised alert system will be evolved as a part of the ERP. Invariably, the first information about a CTD is received from the community, still it is very important to have an inbuilt alert system in the ERP that will activate the definitive specialised response. The following indicators will be used to activate the plans for notification of an event:

i) Explosion with little or no structural damage.

ii) A device that spreads mist or vapour.

iii) Multiple casualties exhibiting similar symptoms.

iv) Mass casualties with no apparent reason or trauma.

v) Unusual odours, liquids, spray devices and cylinders.

vi) A large number of dead animals.

Based upon these indicators, the first responder will activate the emergency functionaries by sending the alert signals to the fire and emergency services, police, emergency medical services, district authorities, and the HAZMAT team. The

necessary updates will be given to the district EOC by the incident commander. The EOC will pass on this information which includes safe routes for evacuation, availability of PPE, weather updates, wind direction, speed, and identified safe zones to the concerned authority and to all the other emergency functionaries. The specialised responders will collect samples of the chemical agents as per the laid down SOPs. Simultaneously, the designated static laboratories will be alerted and asked to remain in readiness to receive field samples so that confirmatory analyses can be carried out without any loss of time.

B) Situational Assessment and Initial Response to CTD

It is vital to assess the situation at the site of incidence before establishing an IC post and initiating the actual response plan. In the aftermath of a chemical attack, initially the survey HAZMAT team will be deployed to identify the 'risk area' and give the situational assessment to the control room. This team will use the field detectors appropriately at the contaminated site. The backup teams will quickly analyse the real time data to give appropriate directions to the decision makers in the control room. The system will explore all modes including field detection technologies, aerial surveys, and direct ground level checking, depending upon the initial survey, etc. Other important components of situational assessment are:

i) Level of response will be based upon various parameters indicated by the HAZMAT teams.

ii) Information will be collected at the incident site in terms of types of targets, number of casualties, meteorological conditions, and level of disaster.

iii) Based on the situational analysis, sites for establishing IC posts will be identified.

iv) As per the laid down standard procedure, various teams like medical, search and rescue, communication, and law and order will be an integral part of the IC structure.

v) The decisions made by the incident commander should not compromise the safety of the responders at any point during the rescue operations. Also, the first responders including MFRs and other emergency functionaries will work in consultation with IC to prevent the occurrence of any secondary chemical disaster due to human error, or because of the overzealous actions of some responders.

vi) The medical authorities shall guide the movement of essential 'bricks' of medical logistics from various district storages, available experts, facilities for protection, detection and characterisation, and emergency medical response systems.

The response will begin by rapid mobilisation of trained CTD responders to provide on-site assistance to local health workers, police, safety and security agencies, and first responders at the site. The rescue teams will enter the accident site, search the area, take over casualties, and eventually channelise them to medical rescue teams or ambulance personnel. Important elements of the initial response are as follows:

i) Cordoning off the incident area.

ii) Guarding the area and allowing entry of only authorised persons with PPE.

iii) Traffic control to avoid any further entry of unexposed people and vehicles in the contaminated area.

iv) Fire and emergency services in collaboration with the HAZMAT response vehicle and PIC shall contain the incident and try to investigate the nature of the chemical agent and its source.

v) Initiate communication with the PIC, and chemical and forensic laboratory.

vi) Establishing an information centre and designating a PRO.

vii) Defining safe routes for entry and exit.

viii) Emergency medical response at the incident site includes 'triage' followed by 'resuscitation' or 'decontamination' depending upon the level of contamination and severity of the injury. Rescue workers, in coordination with QRMTs, will carry out the decontamination. This shall be followed by BLS, administration of antidote, and evacuation to the defined hospitals.

Having analysed all important situational assessment variables including a multitude of health effects, ranging from acute medical effects to the possibility of psycho-social problems such as 'survival guilt syndrome', the probability of multiple secondary disasters, or neuro-behavioral disorders always persists. Thus, the approach of multi-dimensional risk management will be adopted based on the dynamics of changing scenarios.

C) Notification of a Chemical Event and Scale of Disaster

The situational assessment of the disaster situation must be followed by notification of the chemical event and its severity scale. This would lead to the activation of all the emergency functionaries and the establishment of the IC post.

D) Emergency Response at the Incident Site

Emergency response is multi-centric and requires coordination between a multitude of stakeholders and service providers. It can be broadly divided into a number of functional aspects that demand urgency in terms of prompt and effective response. These functional aspects are discussed briefly as follows:

i) Management of Mass Panic Reaction

A chemical terrorism incidence may not necessarily cause significant impact on health, however, it will certainly create mass panic in the community, thereby aggravating the overall situation. The detection and survey teams, equipped with chemical agent monitors, would detect the level of contamination and keep the community informed and reassured, using all available communication systems at the incident site. The first responders, including search and rescue teams and MFRs, will also provide psycho-social support to the affected community. Community leaders, the press and the electronic media like television and radio will also play a significant role in reducing the psychological impact of the situation through appropriate communication.

ii) Self-Protection and Conducting Decontamination Procedures

a. Physical and collective protective measures will be employed at the incident site.

b. Urgent control measures will be instituted to limit the exposure of MFRs and other responders by the use of protective gear and by restricting the exposure time based upon the breakthrough time of the PPE.

c. Protective masks, i.e., the filtration type or a SCBA will be used, depending upon the severity scale and SOPs for use of different types of PPE.

d. Universal protective clothing, plastic wraps to cover the contaminated

material, disposable shoe covering, and paper flooring covers are necessary to prevent any casualty among the responders themselves.

e. The decontamination procedure will be chosen, based upon the nature of the chemical agent, form (solid, liquid, or gas) and possible period of exposure.

f. In case of an MPI, clinical procedures like gastric lavage and others used for prompt removal of poisons will be adopted, depending upon whether the victim, is comatose, semi-comatose, or in a fully conscious state.

g. Temporary decontamination facilities with an adequate water storage facility will be created in the safe zone of the incident site. However, the exact location will be governed by various meteorological and other conditions prevailing locally.

h. Casualties will first be shifted outside the risk area by the rescue service providers equipped with PPE, followed by decontamination at the incident site. Liquid contaminants will be removed by dry decontamination procedures.

i. Ambulances used for the evacuation of casualties will get contaminated in the course of each trip and will need to be decontaminated to maintain their usage for a longer period.

j. Other soiled clothing and material will be decontaminated prior to disposal. The dead will also be decontaminated prior to burial in sealed bags. In addition, all personnel, ambulances, and equipment including protective clothing, gloves, caps, and masks will be decontaminated as part of the clean-up operations.

k. It is important to follow standardised decontamination procedures for CW agents (Annexure VII). Exposure to industrial chemicals generally requires normal decontamination procedures while taking universal safety precautions simultaneously. These procedures will be rehearsed as a part of mock-drills simulating such an incidence.

iii) Response Functions of Different Emergency Functionaries

a. Police

- Maintain law and order, cordon off the affected area, regulate traffic, ensure security and vigilance for possible secondary events, and facilitate movement of various teams.
- Ensure the entry of authorised functionaries with protective gear, personal detectors, and emergency kits with prophylactic antidotes, etc.
- Establish communication with other specialised teams.

b. Detection and Survey Teams

- Skilled technical personnel from mobile technical teams will deploy field detectors and identify the nature of chemical agents and assess the possible dynamics of the situation.
- The mobile team will be backed up by a technical team stationed at a safe distance maintaining linkages with control centres for real-time monitoring of the situation.
- The back up teams will be trained and kept ready with fresh

PPE to provide turnover to the deployed teams for maintaining the breakthrough time standard of PPE being used by deployed teams.

c. Fire and Emergency Services

- Establish safety zones, casualty collection points, and support zones.
- Firefighting chemical fires which includes the containment of the spread of chemicals within the hot zone and deployment of various neutralisation technologies such as mist technology.
- Establish a temporary decontamination facility and carry out decontamination procedures for all the exposed victims.
- Runoff water from decontamination procedures should be monitored and channelised.

d. Chemical Rapid Response Teams

- District authorities will constitute CRRTs who will respond effectively to CW attacks that need necessary antidote administration within a stipulated time frame.
- These teams will comprise of specifically trained personnel who are able to counter the effects of all types of chemical attacks. They will be equipped with the latest state-of-the-art equipment and be able to reach the incident site at the earliest.
- NDRF and SDRFs will develop teams that are ready for deployment at vulnerable locations. They should be trained in all functions of emergency services and specialised response, and be able to take over any desired function as required in a crisis situation.

e. Water Supply Department

- Maintain safe water supply to relief centres for drinking, washing, and other purposes.
- Adequate water supply will also be made available at the incident site for mass decontamination procedures, firefighting, and clean up actions.

f. Electricity Department

- Maintain electricity supply in the identified areas, providing power backup to all other emergency functionaries.
- Cut off electricity in the vulnerable zones as per the directions of the incident commander, if required.

g. Relief and Logistics Department

- Provide safe food, water, essential medicines, and other relief materials.
- The department will provide immediate relief as well as coordinate all long-term relief and rehabilitation measures.

h. Public Health Department

- Examine the food and water supplies being made available by the district authority, ensuring its safety for consumption.
- Establish sanitation and hygiene facilities to prevent spread of contamination.

- Community Level Workers (CLWs) will provide psycho-social care to the survivors and report to the IC post. They shall also communicate with the parent department for necessary further support.

i. Transport Department

- District authorities in consultation with the transport department will ensure an adequate number of NBC filter-fitted evacuation vehicles or ambulances as part of the integrated ambulance network.
- Ensure the institution of a flawless system for requisitioning all available ambulances, and for their smooth movement and recycling so as to attain optimal utilisation.
- Establish decontamination facilities for vehicles deployed for the evacuation of casualties.

j. Communication Department

- Maintain an adequate and robust communication backup system for the smooth flow of information including ham radio, local mobile facilities, landline connections, and satellite-based communication to ensure redundancy.
- Develop the necessary database to provide information about the location of rescue service providers using GPS monitoring.
- Provide adequate communication facilities to all the responders and service providers.

iv) Emergency Medical Response

a. The MFRs of mobile medical teams and hospitals will be activated immediately by triggering the inbuilt alarm. They will be responsible for prompt emergency medical response at the incident site and during evacuation. Hospital staff, however, will be responsible for the same at the hospital.

b. QRMTs/MFRs will be equipped with PPE, detection/decontamination and other requisite medical management equipment, essential drugs, and antidotes.

c. They will carry out triage, BLS and first aid (including emergency psycho-social first aid), and perform essential resuscitative procedures prior to prompt evacuation.

d. The support zone, casualty collection centre, and ambulance parking area will be provided with collective protection and will be the working areas of QRMTs.

e. Depending upon the severity of symptoms that the patients exhibit, they will be sent to the earmarked health care facility. However prior to evacuation, casualties will be placed in casualty evacuation bags fitted with NBC filters/protective gear and suits.

E) Evacuation of Chemical Casualties

Casualties will be evacuated in specialised ambulances fitted with NBC filters. Other concerns include:

i) Medical and paramedical staff including ambulance drivers shall be provided with PPE.

ii) Proper SOPs will be prepared for care of chemical casualties, training paramedics, drivers of ambulances and rescue vehicles, etc.

iii) Adequate supply of filtered air/oxygen and life-support systems will be provided in the specialised ambulances.

iv) Availability of adequate BLS measures, antidotes, and facilities for physical trauma management during evacuation will be ensured.

F) Treatment at the Hospitals

All hazard hospital DMPs shall list out specialised facilities for the management of chemical casualties, which include fixed decontamination facilities, availability of burn beds, and a well-trained team of specialists. The hospital DMP should also cater to a contingency wherein the hospital itself is affected by the terrorist attack. Adequate PPE should be stocked in the hospitals. The specialised staff of these hospitals will be trained to use PPE and other universal safety precautions laid down in the Hospital DMP. Special attention will be paid to the following:

i) Creation of laboratory facilities in the earmarked hospitals for detection and characterisation of the chemical contamination in biological samples.

ii) Creation of facilities at the hospital for mass decontamination.

iii) Availability of adequate numbers of life-saving equipment like ventilators and defibrillators, adequate stocking of oxygen, antidotes, and other life-saving drugs.

iv) Clinical care will be initiated based on the reassessment and reaffirmation of the clinical status of the casualties by specialised medical teams.

v) Critical care will be given to those who are severely injured and require specialised facilities like burn centres, blood transfusion facilities, trauma centres, specialised laboratory networks and other ancillary services.

vi) An inter-hospital and inter-services communication network will be established at all levels to enhance the regional capacity to handle mass casualties, both in terms of optimal bed utilisation and for effective and coordinated treatment, including the resources of private hospitals.

vii) Psycho-social support and mental health care shall form part of the general medical treatment.

viii) Special care will be given for the immediate and delayed effects both during and in the aftermath of chemical attacks.

ix) Long-term effects of chemical agents on the environment will be monitored and an appropriate medical officer nominated by the medical authority to be a part of such survey teams.

x) The consumption of contaminated food and water at all levels will be prevented by developing quality checks under the supervision of the medical officer.

xi) Adequate mortuary facilities will be created at the earmarked hospitals.

G) Management of Long-Term Health Effects of Chemicals

Dissemination of information and imparting knowledge regarding the long-term effects of chemical agents on the exposed population will help in managing the crisis and preventing panic and chaos. Depending upon the type of chemical agent, follow-up treatment of the patient will be regulated, records maintained, and provision for

necessary medical care made. Regular follow-up of such patients is essential to monitor and manage them. Patients with chemical burns will be provided facilities for treatment of contracture and other complications. Follow-up for taking care of the after-effects on eyes, respiratory, and nervous systems will also be monitored and attended to at specialised centres already defined in the DMP. Necessary steps will be taken to monitor the contamination levels of air, water reservoirs, and ground water. Necessary measures will also be initiated for mitigating effects on livestock, flora, and fauna.

5.2 Rehabilitation and Recovery

The rehabilitation and recovery phases require a proactive, multi-pronged and inter-sectoral approach with the active participation of the community at all levels. In the first week after the disaster, the pattern of health needs will change rapidly, from casualty management to more regular primary health care. The emergency services must be re-organised as many permanent facilities may have been severally damaged. Priority will also shift from health care to environmental health measures and temporary shelters. The important activities are as follows:

i) It is essential to develop adequate provision for relief to affected victims of CTD, both in terms of financial help and other support to help cope with and compensate for the loss of life and damage to property. Minimum standards will be developed with the due diligence of all stakeholders and a uniform policy will be formulated at all levels.

ii) The mechanism for reconstruction and restoration of basic infrastructure will be established by the states to bring life back to normalcy using appropriate community-centric strategies.

iii) Medical rehabilitation includes psycho-social care, long-term medical care for vulnerable groups, and vocational rehabilitation, for which an adequate financial strategy will be worked out in the pre-disaster phase itself.

iv) The rehabilitation and recovery process should be based upon the specific indicators and standards for long-term follow-up of the survivors of the attack and their families. The experience available with various responders in terms of providing short- and long-term rehabilitation to different groups of society will be further fine-tuned based on past experience and lessons learnt from mock-exercises, based on different types of simulated scenarios.

v) A mechanism will be developed to re-establish normal health services, and to assess, repair, and reconstruct damaged facilities.

vi) Psycho-social support and mental health care will be given to survivors, their families, and care providers.

vii) Adequate provisions will be made for the continuous availability of safe food, water, and maintenance of appropriate hygiene and sanitation levels as per minimum standards.

viii) Proper bio-waste disposal facilities will be ensured.

ix) A registration and record system will be created at each hospital to store relevant information on the chemical incident, agents, their effects, and details of the treatment and care provided to the victims, including their prognosis.

x) The long-term fallout of the disasters is projected that one per cent of the victims will suffer from severe brain damage, paraplegia, amputations, chronic sepsis, etc. An adequate mechanism will be developed to take care of such patients.

xi) Surveillance of diseases should be continued until the normal reporting system is restored.

xii) Mass casualties resulting from such attacks leave behind a large number of orphaned children who need to be taken care of by governmental and non-governmental initiatives.

xiii) During such events, the resources budgeted for the year are depleted in a short span of time. To re-establish normal health services, extra resources will be required and must be planned for.

xiv) The rehabilitation period also presents an opportunity for making major changes in the normal health care methods, since people during this time are receptive to new ideas that are effective and economically viable.

xv) Setting an appropriate mechanism for the engineering sector is essential for assessment, repair, and reconstruction of damaged facilities and buildings. The assessments made will be developed as projected plans with estimated costs to obtain necessary funding.

xvi) All essential services like water supply, sewage, solid waste disposal, electricity, communication, etc., should be restored on a priority basis.

xvii) Plans must include strengthening environmental surveillance and health services to ensure that the risk of disease does not increase.

xviii) Water quality includes routine testing and chlorination, which should be carried out immediately after the disaster, till the municipal water system is restored.

xix) Areas where food is cooked and supplied from should be monitored to ensure hygienic conditions.

The process is comprehensive and requires efforts at multiple levels, and of many stakeholders, to bring life back to normalcy.

5.3 Post-Disaster Documentation

Documentation is an essential component of post-disaster management for assessing the consequences of disasters, and identifying initiators and factors that affect mortality and morbidity with respect to time variables. In view of this, necessary SOPs for the complete documentation of the chemical incident will be laid down as a part of DDMPs. The complete details about post-disaster documentation will specifically include the following:

i) The concept of post-disaster documentation and derivation of important lessons will be instituted. SOPs for reporting, development of case studies, and critical analysis will be devised.

ii) Details about the incident will be recorded, including causes, effects, capacity, and capability of the management system, adequacy of response, and lessons learnt during mock-exercises.

iii) In the documentation, certain issues pertaining to CTD particularly will include:

   a. Quality of PPE provided to first responders.

   b. Adequacy and efficiency of decontamination.

   c. Timely availability of antidotes.

   d. Evacuation of casualties.

iv) Medical documentation will begin with an identification number assigned to the chemical casualty, to be used as a reference for all medical management procedures. This documentation will

help in the post-disaster analysis by the designated relief management teams of the state/district.

v) Activity-wise documentation and evaluation of data including mortality and morbidity indices, number/types of cases, age, sex, general occupation of the victims, clinical profiles of cohort groups with the same or similar medical problems, and specific medical cases observed during long-term management will help in evolving SOPs for future management.

vi) The lessons learnt from studies of previous incidents indicate essential inputs that dictated the success or failure of DM plans for CTD in a real-time occurrence or attack. Important and relevant extracts of all such documentation shall be shared with stakeholders for improving the management of such incidents in their respective areas.

vii) Based on the lessons learnt, certain study models will be developed, which can be taken in a pilot project mode to improve the overall emergency management planning.

5.4 Media Management

Media management can help in the management of CTD as chemical attacks generate an enormous panic reaction in the community. The designated PRO at the district level will be made responsible for liaison with the print and electronic media so that proper guidelines, ethics, and conduct are practised for handling sensitive issues arising out of CTD. The spokespersons will be given comprehensive training in dealing with the media. Correct reporting of the situation is an important confidence-building measure for the community. The details for setting up a crisis media centre at the IC post will be laid down in the DDMPs. The various aspects of media management planning include:

i) State and district DM plans will have an appropriate mechanism for effective communication with the public through media management.

ii) Media kits on the various aspects of information dissemination related to CTD on the basis of simulated scenarios will be developed and followed as per the directions of the district authority.

iii) The messages to be delivered prior to, during, and after an incident will be meticulously planned, including the listing out of the probable clarifications that one can anticipate in CTD situations.

iv) Identify crucial information and incorporate the same precisely in the initial message so that prompt and appropriate public response is forthcoming during and after the CTD.

v) Press and electronic media will be associated throughout the period of response and the post-disaster phase for early and accurate dissemination of information released by the authorities.

vi) The CMO will determine the modes of dissemination of relevant information. An authorised press release should always be written and handed over to the press so that correct and authentic news is disseminated to the public.

vii) The district authority will issue continuous and regular updates of the situation for media personnel and agencies.

viii) Adequate awareness will be generated in the print and electronic media about the various aspects of CTD.

   a. The media will play a supportive role especially for mobilisation of

resources and dissemination of useful information that can help the community in managing the effects of disasters.

b. Providing information about relief and rehabilitation measures, medical support sites, routes to be followed or avoided, dos and don'ts for the public.

c. Organising relief material and their proper distribution.

d. Disseminating the latest information on the status of casualties, based on authentic information from hospitals.

The entire exercise will be done without impinging upon the independent functioning of the media. The media shall be encouraged to disseminate authentic information only to prevent rumours and panic.

5.5 Public-Private Partnership

The private sector has the potential to play a major role in the preparation for response to chemical terrorism by integrating their capabilities with the government organisations. The private sector has a large infrastructure and is engaged in R&D for development of various products and models, which form a part of the countermeasures required to tackle chemical attacks.

A large part of the chemical infrastructure is owned by the private sector, which has the crucial responsibility of developing their On-Site plans and in addressing many issues related to the management of CTD, including those for preparation, response, and post-disaster phases of rehabilitation and recovery. All industries, which stock and use chemical agents that can be used or targeted by terrorists will form part of the DM system at the district level for better On-Site and Off-Site management.

Industries have already shown considerable initiative in enhancing the security of their infrastructure by developing adequate DM plans. For example, the Indian Chemical Council has developed a code of conduct to guide the actions of their members and has designed the 'Responsible Care Programme' that outlines practices that company security management systems must include. These practices require MAH units to assess vulnerability of their facilities and also develop and implement risk-reduction measures. These programmes shall also be extended to the hazardous waste handled by them. The financial strategy will be worked out in advance during the pre-disaster phase depending upon the vulnerability and threat assessment of the area.

The private sector will also be encouraged to participate in all activities of community awareness and also in rehabilitation and recovery as a part of Corporate Social Responsibility (CSR). The private and corporate sector have adequate capabilities in search and rescue, and have sufficient trained manpower and medical facilities. These resources can be requisitioned by the district authorities, if necessary. Such a mechanism will be developed between the district authorities, and public and private sectors on mutually agreeable terms. Some of the private sector institutions and industries carry out applied research in the field of security technologies. Relevant knowledge generated by the private sector will be shared to develop mitigation measures for effective management of CTD.

5.6 State / District Disaster Management Planning for Chemical Attacks

DM planning for CTD will be carried out by undertaking various mitigation activities identified on the basis of the vulnerability status

of the districts. The important aspects of planning include development of a mechanism for risk and threat assessment in the plans using various knowledge management tools, like:

i) Various authorities such as expert groups at the nodal ministry, line ministries and departments, states, and districts will study and evaluate the threat and possible targets of chemical terrorism all across the country.

ii) A mechanism for continuous intelligence collection within the country and across the borders will be put into effect to safeguard major chemical toxicants from the reach of terrorist groups.

iii) Creation of databanks of retail and wholesale chemical suppliers handling potentially toxic chemicals, and monitoring the sale of excess quantities identified on a case-to-case basis.

iv) The provision for strict implementation of rules for sale, transportation, storage, and waste disposal to prevent theft or access to chemicals, especially those listed in the 'Schedules' of CW agents will be developed. Such rules will be reviewed periodically.

v) Specialised plans will be developed at different levels for predicting the potential targets of chemical terrorist strikes. The clear-cut roles of stakeholders including committees formed under various authorities and ancillary service providers will be laid down in the state and district DM plans.

vi) Identification and training of volunteers in the management of CTD at all levels, the details of which will be laid down in the plans.

vii) Availability of CBRN shelters with air filtration systems at strategic locations with the district authorities, wherever feasible and essential, and based on risk assessment.

viii) Dedicated and specialised transportation for different emergency services and their networking along with their various conjunction points will be identified and laid down.

ix) An effective and simplified communication network of all the important stakeholders will be developed in these plans and tested for its credibility under different scenarios.

x) Information databases, public address, and community participation model will be developed.

xi) GIS-based emergency planning and response system for CTD in major industrial clusters will 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.

xii) The Civil Defence and Home Guards can be effectively utilised in chemical emergency management after some basic training, and both these institutions will be revamped and strengthened. The schedule of their modules will be planned and they will also be involved in various mock-drills conducted at the state and district levels.

xiii) SOPs will be laid down and updated for response agencies like NDRF, SDRF, fire services, police, Civil Defence, and other emergency functionaries.

xiv) Developing the worst-case scenarios for CTD and planning for different emergency functions and situations using various models will be practised at all levels.

xv) Provision for optimal usage of protective gear and other equipment with a standard breakthrough time. Shelf life of such equipment would necessitate their periodic replacement and subsequent utilisation for training programmes.

xvi) A mechanism for emergency financing and human resource allocation will also be developed.

xvii) A mechanism needs to be put in place for different types of detection modalities and training of responders to use them in different scenarios.

xviii) Planning for diversion of resources in the case of multiple chemical attacks or a chemical attack coupled with other non-chemical terrorist activities.

xix) A critical information management system will be developed, which is able to work in the highest scale of severity at all the predefined nodal places, and it will be coupled with continuous surveillance programmes.

xx) On the lines of NDRF, districts will create disaster response teams, and states will build SDRFs that will act as specialised responders during mass casualty emergencies of every origin including CTD.

xxi) Adoption of global best practices, and mechanism for threat perception analysis in terms of hospitals themselves being targeted, will also be put in place.

xxii) A list of chemical industries operating in the district will be maintained and the list will be required to enumerate the plausible industrial products and by-products which can be used or targeted during such attacks. This information is necessary for the development of region-specific SOPs in the medical management of chemical casualties.

xxiii) Planning for the medical management of chemical casualties entails the following issues:

a. All the medical resources available at the district level including those of the private sector will be pooled based upon pre-defined and mutually acceptable financial arrangements.

b. Provision will be made for monitoring the regular availability of all medical equipment, PPE, detectors, decontamination units, hardware, and other facilities placed at strategic locations based on the threat analysis.

c. List of all stockpiles of medical logistics in all government and private hospitals will be prepared. Adequate provisions will be made for timely turnover and rotation of such stocks.

d. Planning for surge capacity of various medical facilities at the regional level.

e. Assessment of likely requirement in terms of manpower, equipment, vaccines, antidotes, ventilators, PPE, water filtration units, and disaster-specific medicine bricks will be done.

f. Planning of integrated ambulance services equipped with NBC filters and other rescue vehicles, an evacuation system, and supply of safe food and water.

g. Training and health education programmes specific to chemical terrorism activity will be developed for all stakeholders in the plans.

h. SOPs will be made for a medical response mechanism using simulation models based upon different worst-case scenarios for handling expected surge capacities.

i. Location of relief camps, earmarked hospitals, nursing homes, and primary health care centres with their responsibilities and the command control centre will also be defined.

j. A medical inventory of neighbouring states and districts will be prepared at the regional level.

k. A directory of all the medical officers, paramedics, nursing staff, ambulance drivers, and medical inventory for chemical-specific incidents will be prepared.

l. The involvement of private players will be clearly outlined; crisis expansion of beds and mechanism for optimal usage of all medical resources will be laid down.

m. Specific tertiary health care facilities which are able to provide specialised care for NBC victims will be identified.

Planning for management of CTD requires a comprehensive risk mitigation approach at all levels. It is important to understand the evolution of the modus operandi of terrorist groups over time. Necessary follow- up, updating, and ongoing analyses ensure the success of a preventive approach. It is pertinent to state that the occurrence of such incidents cannot be totally prevented. It is thus, essential to develop effective response plans to manage such attacks, if and when they occur.

6 Approach to Implementation of the Guidelines

The National Guidelines on Management of CTD have been formulated as a part of an integrated national all-hazard approach for the management of disasters. The prime aim is to reduce the occurrence of CTD affecting humans, livestock, and crops, and the associated risks posed to health, life, and the environment by as much as reasonably achievable. It has been ensured that all aspects of preparedness required are covered for quick and efficient response including measures pertaining to relief, recovery, and rehabilitation. The CTD management approach aims to institutionalise the implementation of initiatives and activities covering the entire continuum of the DM cycle. The objective is to develop a national community that is informed, resilient, and prepared to face disasters with minimal loss of life while ensuring adequate care for the survivors. Therefore, it shall be the endeavour of the central and state governments to ensure its implementation in an efficient, coordinated, and focused manner. This can be achieved by forging mutually reciprocal relationships as envisaged by the institutional mechanism set up through the DM Act, 2005, viz., the NDMA, SDMAs, and DDMAs.

The primary responsibility of initial response shall continue to remain with the state and district authorities. Further capacity enhancement and reinforcement of the system, wherever required, will be provided by the central and state governments. Initiatives like public-private partnerships shall be encouraged for a further revamping of the system. Response to a CTD shall be prompt, holistic, and highly structured so that the use of resources is optimised while ensuring its effectiveness. The following factors are considered vital for ensuring seamless and harmonious functioning of all concerned stakeholders during the management of CTD:

i) Institutionalisation of the programmes and activities at the ministerial/department level.

ii) Development of commensurate preparedness measures, capacity development, and response mechanism.

iii) Identification of various stakeholders/ agencies/institutions with precise roles, responsibilities, a clear chain of command, and defined work relationships.

iv) Rationalisation and augmentation of the existing techno-legal regimes, human resource, and infrastructure.

v) Improved inter-ministerial and inter-agency communication, coordination, and networking at all levels.

MHA as the nodal ministry shall oversee the implementation of the Guidelines at the national level. Other main stakeholders in the management of CTD are the MoD, MoEF, MoR, MoL&E, MoA, Department of Animal Husbandry, MoA; DRDE and other research laboratories of DRDO at the central level; states/Union Territories (UTs), units of concerned central ministries/departments; scientific and technical institutes of various ministries; and departments like DGHS, AFMS, ICMR, CSIR, DST; academic institutions in chemical sciences, life sciences,

medical, biomedical, and the paramedical field; professional bodies; corporate sector; NGOs, and the communities.

Implementation of the Guidelines shall begin with the formulation of a CTD preparedness plan as a part of the 'all hazard' DM plan in all districts and all states and UTs. The enabling phase will be used to develop necessary capacity and infrastructure, taking into consideration existing elements such as legislature, stakeholder initiatives, emergency plans, gaps, and priorities based on vulnerabilities and risk assessment. The existing DM plans at various levels shall be further revamped and strengthened to address CTD preparedness. The central ministries and departments concerned; states, UTs, and districts shall prepare and implement DM plans at all levels that address the strategic, operational, and administrative aspects through an institutional, legal, and operational framework.

These Guidelines have set modest goals and objectives of CTD preparedness to be achieved by mustering all stakeholders through an inclusive and participative approach. All concerned ministries of the GoI, the state governments, UT administrations, and district authorities shall allocate appropriate financial and other resources including dedicated manpower and targeted capacity development for the successful implementation of the guidelines.

6.1 Implementation of the Guidelines

6.1.1 Preparation of the Action Plan

Implementation of the Guidelines at the national level shall begin with the preparation of a detailed action plan (involving programmes and activities) by the nodal ministry (MHA) that shall promote coherence among different CTD management practices and strengthen mass casualty management capacities at various levels. Intelligence inputs, EWS, PPE, efficient detection and decontamination systems, and facilities for health/medical management are common requirements for tackling all forms of terrorism based on the 'all hazards' approach. Other line ministries like MoD, MoEF, MoR, MoL&E [through Employees' State Insurance Corporation (ESIC)], MoA, etc., will also prepare their respective CTD preparedness plan as a part of 'all hazard' DM plans. In view of the expected role of these important line ministries in the management of mass casualties in the event of national calamities, they should also cater for developing additional capacities besides meeting their own requirements in their preparedness plan.

The plan will be simple, realistic, functional, flexible, concise, holistic, and comprehensive, encompassing networking of technical institutes, laboratories, knowledge management centres, R&D set ups, and medical (at the incident site, the hospital, and public health) components. The plan would lay special emphasis on the most vulnerable groups and communities to enable and empower them to respond and recover from the effects of CTD.

The action plan will spell out detailed work areas, activities, and the agencies responsible. It will indicate targets and time frames for implementation, and will be continually reviewed and updated. The identified tasks, to the extent possible, would be standardised to have SOPs and resource inventory, etc. The plan will also specify indicators of progress to enable their monitoring and review within the ministry and by the National Authority. The plan would be sent to the NDMA through the NEC for approval. The action plan shall have an inbuilt mechanism to coordinate with other ministries and the NEC.

The ministries and agencies concerned, in turn, will:

i) Issue guidance on implementation of the plans to all stakeholders.

ii) Obtain periodic reports from the stakeholders on the progress of implementation of the DM plans.

iii) Evaluate the progress of implementation of the plans against the time frame and take corrective action, wherever needed.

iv) Disseminate the status of progress and issue further guidance on implementation of the plans to stakeholders.

v) Report the progress of implementation of the plans to the nodal ministry.

vi) Institute a mechanism to facilitate interstate coordination of efforts.

The nodal ministry will keep the National Authority apprised of the progress on a regular basis. Similarly, concerned state authorities and departments shall develop their state level DM plans based on NDMG-CTD issued by NDMA and dovetail it with the National Plan, keeping the National Authority and SDMA informed. The state departments and authorities concerned will implement and periodically review the execution of the DM plans at the district and local levels along the above lines. Consequently, an 'all hazard' national plan will be developed as per the DM Act, 2005.

The National Plan needs to include:

i) Measures to be taken for minimisation of CTD (ideally 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 development to effectively respond to any prospective mass casualty situation.

iv) Roles and responsibilities of the nodal ministry, different ministries, or departments of the GoI, institutions, community, and NGOs in respect of measures specified in clauses i), ii), and iii) above.

6.1.2 Implementation and Coordination at the National Level

Planning, executing, monitoring, and evaluating are four facets of the comprehensive implementation of the Guidelines. If required, the nodal ministry can co-opt an expert nominated by the National Authority during the planning stage so that the desired results are achieved through the action plan. This consultative approach shall increase the ownership of stakeholders in the solution process by bringing clarity to the roles and responsibilities in respect to various preparedness activities. Detailed documentation will be worked out elaborating the monitoring mechanism for reviewing NDMG-CTD management activities in a transparent, objective, and independent manner. A separate group of experts will be earmarked for evaluation to get an objective third-party feedback on the effectiveness of activities based upon the Guidelines.

The important issues to be kept in mind while preparing the action plan include:

i) Adopting a single-window approach for conducting and documenting activities outlined in the Guidelines in each of the stakeholder ministries, departments, state governments, agencies, and organisations.

ii) Mitigation strategies to be adopted for secure information collection and dissemination, intelligence inputs, and

chemical surveillance at vulnerable locations.

iii) Laying down the roles and responsibilities of all stakeholders at the state and district levels for managing CTD and to assist them with required resources.

iv) Incorporating measures in the development plans for the prevention and mitigation of CTD and its effects.

v) Developing detailed documents on how to ensure implementation of each of the activities envisaged in the Guidelines to attain synergy and coordination among the various activities.

vi) Ascertaining medical preparedness measures to combat the effects of chemical terrorism, including capacity development to effectively respond to incidents of CTD.

vii) Coordinating with line ministries such as railways, civil aviation, defence, and ESIC networks for maintaining their resources to ensure their availability during chemical terrorism emergencies.

viii) Ensuring that professional expertise for the dissemination, monitoring, and successful and sustainable implementation of the various plans is available at all levels and for all tasks.

ix) Making sure that the skills and expertise of professionals are periodically updated corresponding to the best practices used the world over as per the spirit of the emergency medical management framework for CTD.

The plans will lay emphasis on identified critical gaps in managing CTD, strengthen the government hospitals, and ensure assistance to the states in putting up the requisite infrastructure including specialised capabilities for managing mass casualties arising out of CTD. This may include self-contained mobile hospitals that can be airlifted or transported through road, rail, or waterways to the disaster-affected area, especially if the local health facilities are themselves affected. A coordinated and synergistic partnership with the private sector, NGOs, and Red Cross will result in the availability of critical resources during response operations, and assistance in restoring essential services.

6.1.3 Institutional Mechanism and Coordination at State and District Levels

The states, UTs, and district administrations will adopt the measures indicated in chapters four and five in their respective DM plans, as applicable. The respective state/UT/district authorities shall develop CTD preparedness plans based upon NDMG-CTD as a part of 'all hazard' DM plans. The measures indicated at the national level may be adopted to ensure effective implementation by regular monitoring at the state level by the concerned authorities. The states and UTs shall also allocate resources and provide necessary finances for efficient implementation of the plans. Since most activities under NDMG-CTD management are community-centric and require association of professional experts for planning, implementation, and monitoring, the SDMAs will formulate suitable mechanisms for their active involvement at various levels on a continual basis.

The important aspects for effective co-ordination between various stakeholders include:

i) A structured interactive platform in the form of coordination meetings at all levels—block, district, and state will be developed for information sharing. It will be regularly conducted under the aegis of district or state authorities.

ii) Networking with NGOs and ensuring coordination among them will be given attention. They will be encouraged to hold meetings at the block, district, and state levels. Transparency in coordination will be ensured to develop harmony in their action.

iii) Environmental security issues need building of coordination between numerous intelligence agencies. Division of work will be done and clarity in their roles established during the coordination meetings.

iv) DM plans will be prepared from the village level to the state level, as a long-term measure to ensure coordination between all sectors for management of CTD. This is important, since a shift is being observed in terrorism activities towards soft-targets at local levels as opposed to highly secured regions and establishments. Local welfare associations and panchayati raj institutions will also conduct various education and awareness campaigns as part of the emergency preparedness programme.

v) Department-specific protocols will be developed for better coordination during chemical terrorism disasters and rehearsed during mock-drills.

vi) District administration and DDMAs; state authorities and SDMAs; response agencies and the other intelligence enforcement agencies, and financial agencies will be networked for effective management of CTD. These preparedness measures will develop a structured establishment required for CTD management at the incident site, during evacuation, and at hospitals in the short- and long-term.

The IDRN database needs to be strengthened by the states (through continual updating and enhancement) and integrated with their DM plans. The activities are to be taken up in project mode with a specifically earmarked budget (both plan and non-plan) for each activity.

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

A number of weaknesses have been identified with regard to awareness generation, response time, and actions like evacuation, medical assistance, and other timely actions for detection, early warning, prophylaxis, evacuation, medical management activities, and public health issues. This is specially observed in the district DM plans and it has been found to be a weak link in emergency management. The central and state governments need to evolve a mechanism through mock-exercises, awareness programmes, training programmes etc., with a view to sensitise and prepare the officers concerned in initiating prompt and effective response.

The CMO of the district shall be the overall in-charge of medical management of both the government and private set-ups in the pre-, during- and post-disaster phases. Prior arrangements shall be worked out with the private sector to ensure that all these resources can be adopted in disaster situations. Furthermore, the CMO shall be responsible for preparing the district CTD management plan as part of the district DM plan, based on NDMG-CTD.

Disaster resilience is the ability of the community to anticipate disasters and react quickly and effectively when they strike. The process of building resilience shall be strengthened through awareness generation, organising health and sanitation fairs, conducting mock-exercises, public-private partnership, and development of local capacities through education and training programmes.

6.2 Financial Arrangements for Implementation

Consequent to the occurrence of any disaster, central and state governments invariably provide funds for immediate relief and rehabilitation to address the immediate needs of the affected population in terms of food, water, shelter, and medicine. This process does not adequately cover the requirement for reconstruction of damaged structures, especially those that are privately owned. An analysis of different disasters in the past has revealed that expenditure on response, relief, recovery, and rehabilitation far exceeds the expenditure on prevention, mitigation, and preparedness. With the paradigm shift in the government's focus on activities of the pre-disaster phase, adequate funds need to be allocated for prevention, mitigation, preparedness, and capacity development rather than concentrating only on response management. The basic principle of Return on Investment (RoI) may not be applicable or evident 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 the flow of funds is organised on a priority basis by identification of necessary functions, in all phases of preparedness, prevention, mitigation, response, relief, recovery, and rehabilitation. Important activities include:

i) Central ministries, departments, and the state governments will mainstream DM efforts in their development plans.

ii) Specific allocations will be made for carrying out disaster preparedness and mitigation measures in the annual and development plans.

iii) On the basis of the multi-hazard vulnerability status of the particular area, the 'all hazard' DM plan shall have a requisite inbuilt mitigation mechanism including earthquake resistant structures, etc., for hospital buildings and other health care management institutions in the government and private sectors.

iv) Developmental plans will have suitable techno-financial measures for establishing an effective health care system, both for the incident site, and for hospitals, to ensure preparedness and overall management.

v) Concerned ministries and departments will initiate mitigation projects for upgradation of existing infrastructure to meet the enhanced requirement for risk reduction and risk management.

vi) Private stakeholders will allocate sufficient funds for disaster-specific prevention, and mitigation, and medical preparedness measures for CTD management.

vii) Wherever necessary and feasible, the central ministries and departments, and Urban Local Bodies (ULBs) in the states may initiate discussions with the corporate sector undertakings to support disaster-specific risk reduction practices and establishment of medical set-ups to deal with all disasters, as a part of Public-Private Partnership (PPP) and CSR.

Central and state governments will 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 insurance sector will be encouraged to formulate and promote a CTD-related insurance mechanism at the earliest. A national strategy for risk transfer through insurance, using the experiences of micro-level initiatives in some states, and global best practices shall be developed

to reduce the financial burden on the government. A detailed mechanism for insurance is required to be evolved during the response, relief, and rehabilitation phases.

6.3 Implementation Model

The institutional and operational framework, including hospital infrastructure, available with the state and district health authorities in the government sector needs further revamping and strengthening. The private sector health care institutions should also form an important medical resource for the management of mass casualties during CTD. Till date, none of the major hospitals in the government or private sector are fully equipped and geared for managing mass casualties, particularly the victims of NBC. The implementation plan has to be drawn up at each level setting targets for a specified timeline, reviewing each year at every level to evaluate the degree of achievement, reasons for any shortfall, and corrective action for timely implementation. The experience gained in the initial phase of implementation is of immense value, since this would be utilised not only to make mid-term corrections but also to make long-term policies and guidelines after a comprehensive review of the DM plans in the short-term.

6.3.1 Suggested Broad Time Frame for the Implementation of NDMG-CTD

The timelines proposed for the implementation of various activities in the Guidelines are considered both important and desirable, especially in case of those non-structural measures for which no clearances are required from central or other agencies. Precise schedules for structural measures will, however, be evolved in the CTD management plans that will follow at the central ministries or state level duly taking into account the availability of financial, technical, and managerial resources. In case of compelling circumstances warranting a change, consultation with NDMA will be undertaken, well in advance, for adjustment on a case-to-case basis. All identified activities under the action plan for preparedness in CTD management shall be planned for implementation as listed below.

i) Short-Term Plan (0–3 Years)

a. Legislative and Regulatory Framework

- Dovetailing of various relevant Acts, Rules, and Regulations with the DM Act, 2005.
- Strict implementation of the existing Rules and Regulations to ensure safety and security concerns of chemical agents against their potential usage in chemical terrorism activities.

b. Prevention

- Integrated surveillance systems based on intelligence inputs, detection and investigation of chemical releases, and outline of the trends of accidents, for drawing out valuable lessons for CTD management.
- Establishing a mechanism for assessing risk and vulnerability, surveillance-based environmental monitoring system, intelligence gathering, and secure information dissemination system for chemical security.
- Development of indicators for EWS and mechanism for preventing illegal trafficking of hazardous waste.

- DM plans will also focus on the mitigation strategy in dealing with the indirect risks posed by CTD.
- Provisions of laboratory support for chemical identification, characterisation, and diagnosis.
- Institution of public health measures to deal with emergencies as an outcome of CTD.

c. Preparedness

- Identifying infrastructure needs for formulating mitigation plans. Implementing a financial strategy for allocation of funds for various national, state, and district-level mitigation projects.
- Institution of emergency response including medical response at the incident site with all medical logistics and relief support.
- Creation of trained MFRs/QRMTs equipped with all material and medical logistics.
- Establishment of physical and collective protection, advanced detection technologies, mobile chemical laboratories, decontamination agents, and associated trained manpower.
- Provision for temporary decontamination facilities and sensitisation programmes for the community about self-decontamination procedures.
- HAZMAT vehicles will be acquired and linked with emergency services, including the containerised mobile hospitals.
- Communication and networking systems with appropriate intra-hospital and inter-linkages with state ambulance and transport services, state police departments, and other emergency services including the fire services.
- Establishment of provisions for emergency medical response including institution of incident medical post, development of integrated ambulance network for prompt evacuation using road, railways, aerial, and water routes.
- District DM plans will give details about the roles and responsibilities of various stakeholders and service providers, various dos and don'ts, response functions and provisions for conducting periodic drills.
- Mobile tele-medicine/tele-health services.
- Laying down minimum standards for water, food, shelter, sanitation, and hygiene.

d. Capacity Development

Overall capacity development including human and resource development, training, education, and knowledge management will be focused as a part of the short-term plan.

e. Human Resource Development

- Strengthening of NDRF, MFRs, medical professionals, paramedics, and other emergency responders.
- Development of human resources for monitoring and management

of the long-term effects of chemical agents, and mental health and psycho-social care.

f. Education and Training

- Inclusion of various aspects of CTD in the basic curricula of DM.
- Training of MFRs by imparting adequate knowledge on various types of chemical agents including TICs/TIMs, CW agents, etc., their properties, possible modes of dispersal, use of PPE, different modalities and methods of decontamination and sources of their availability, principles of triage for chemical casualties, and knowledge about treatment protocols for managing chemical casualties.

g. Knowledge Management

- Sensitise and define the roles of the public, private, and corporate sectors for their active participation as a part of DDMPs.
- Development of knowledge management centres networked with all technical and educational institutions, linked with national, state, and district authorities to effectively mitigate chemical terrorism activities.

h. Infrastructural Development

- Strengthening and upgradation of NPIC.
- Upgradation of existing laboratories and development of newer laboratories and PICs at strategic locations.
- Establishment of a robust yet flexible communication and information networking system linked up with all service providers and supported by the various inputs of intelligence agencies.
- Development of specialised treatment and decontamination facilities at the earmarked hospitals.
- Specialised facilities for evacuation of victims from the incident site and communities from the close vicinity of the chemical attack.

i. Community Preparedness

- Community awareness programmes for first aid and self-decontamination procedures.
- Dos and don'ts to mitigate the effects of medical emergencies.
- Role of the community in relief and rehabilitation activities in the post-disaster phase.

j. Hospital Preparedness

- Hospital DM plans will be prepared by all hospitals including those in the private sector.
- Developing tools to augment surge capacities to respond to any mass casualty event due to a CTD.
- Identifying, stockpiling, supply chain, and inventory management of drugs, equipment, and consumables including vaccines, antidotes, and other agents for protection, detection,

decontamination, and medical management.

k. Specialised Health Care and Laboratory Facilities

- Development of blood banks, specialised treatment wards, specialised medical stores, laboratory services network, and scientific and technical institutions for applied research and training.
- Institution of procedures for post-disaster medical documentation and epidemiological surveys.

l. Research and Development

Regular updation on certain issues by adopting activities in R&D mode initially by pilot studies.

- Development of biomarkers, bio-indicators, and therapeutic interventions for the effective medical management of chemical victims.
- Development of antidotes that are not indigenously available at present for various chemical agents.

m. Response, Relief, and Rehabilitation

- District DM plans will lay down the SOPs for an alert mechanism, situational assessment, notification of an event, emergency response at the incident site, response functions of different stakeholders or service providers including MFRs/QRMTs, evacuation of chemical casualties, and treatment at the hospital, including management of the long-term effects of chemical agents.
- Adequate provisions for relief and rehabilitation, giving special care to vulnerable groups, psycho-social support, and mental health care to the community.

n. Media Management

- Preparation of media management plans as a part of DDMP by the integration of the press and electronic media at all levels.
- Mechanism to optimally involve the press and electronic media for community awareness.

The short-term plan (0–3 years) will be focused on the integration of various aspects of CTD management planning in the 'all hazard' DM plans at all levels. It includes the identification of the areas that need immediate attention, and inclusion of the various aspects in development and mitigation modes. The strengthening of existing facilities and development of adequate critical infrastructure is required for the management of CTD in the longer run.

ii) Medium-Term Plan (0–5 Years)

The medium-term plan calls for the initiation of the projects that are devised as an outcome of knowledge management, lessons learnt from the simulation and modelling during the first period. It also includes the completion of the plans initiated in the first phase and also speeds up the processes that are undertaken as a long-term approach. Some of the activities that will be identified as a part of medium-term planning are as follows:

a. Prevention

- Strengthening of integrated surveillance systems and EWS at regional levels.
- Incorporation of disaster-specific risk reduction measures for CTD management by testing of the DM plans prepared in the previous phases.

b. Preparedness

- Institutionalisation of the advanced EMR system (networking ambulance services with hospitals).
- Intensification of the processes undertaken in the first period.

c. Capacity Development

- Strengthening of scientific and technical institutions for knowledge management, and for applied research and training in management of chemical terrorism activities. Continuation and updating of HRD activities.
- Developing community resilience.

d. Hospital Preparedness

Testing various elements of the emergency plan through table-top exercises and mock-drills.

e. Specialised health care and laboratory facilities including PICs will be developed all across the country, especially at vulnerable locations with higher levels of threat perception.

iii) Long-Term Plan (0–8 years)

The long-term action plans will focus on the intensification of the activities started in the previous phases and initiation of new activities based on emerging trends. The activities including community awareness, education, and training will continue in all the phases and be updated with changing times. The plans shall address the following important issues:

a. Implementation of the national emergency plan binding all government, private, and public hospitals under a unified system with well-defined emergency functions.

b. Ensuring inclusion of knowledge of CTD management in the curriculum at all levels.

c. Completion of all activities related to emergency medicine for CTD management.

d. Public health emergencies with the potential of mass casualties due to attacks of chemical terrorism agents would also be addressed in the plan through the setting up of integrated surveillance systems, rapid health assessment, investigation of an outbreak, providing laboratory support, and instituting public health measures.

e. Testing of various hospital DM plans on the basis of well-established indicators and using mock-exercises.

f. Complete establishment of information networking system including IDRN, with appropriate linkages with state ambulance and transport services, state police departments, and other emergency services including fire. The states will ensure proper education and training of the personnel using the information networking system.

g. Further strengthening of NDRF, fire services, MFRs, paramedics, and other emergency responders.

h. Sensitise and define the role of public, private, and corporate sector for their active participation.

i. Build chemical terrorism contingencies into response plans.

j. Identify a lead civilian central agency and make it responsible for developing methods of environmental testing to be used following any chemical weapon attack or CTD.

k. Creation of an integrated, 'all hazard' national laboratory network, strengthen partnerships, and expand the national laboratory analytical capability and capacity.

l. Ensuring harmony in the various standardised protocols for institution of preliminary safety measures, routine operations, emergency response including sample collection in the field, and transport to the laboratory to ensure the safety of law-enforcement personnel, and other first responders, and indicators to take decisions about accepting and referring samples.

m. Establishment of knowledge management centres of excellence for CTD throughout the country.

n. Address distinction between the two types of testing—clinical and environmental. Resolve safety, analytical, regulatory, and jurisdictional issues. Improve socio-technological interface with society.

o. Identifying the overriding significance and importance of the weakest link. Secure communication networks for first responders, build redundancy in communication networks by in-built repeaters optimally positioned for incident communication, and a self-healing grid for telecommunication and other utility networks.

p. Localised network to enable all emergency responders to communicate with each other and possibly with victims immediately after an incident. Portable rapid sensors of biochemical and radiological threats.

q. Development of simulation models for testing the efficacy of plans for continuous improvement. Guards should be equipped with modern equipment where feasible or desirable. Robots for investigation and action are important tools of the future.

r. Standard paradigms and programmes for assessing overall vulnerabilities and risks of a city to various terrorist threats, singly, or in combination.

s. Virtual reality simulators to train emergency managers and first responders, and to better visualise the interlocking vulnerabilities of systems that make up the environment.

t. Behavioural studies are required on the behavioural patterns of decision makers, first responders, and the population at large when under stress. Similar studies on the psychology and behaviour of terrorists are also necessary.

To conclude, the present system of preparedness and arrangement for mass casualty management in a CTD is required to function in a more coordinated and proactive manner. MHA, MoH&FW, MoD, and line ministries, state governments, and the district administration shall enhance their capacities with the help of the private sector. Their actions and policies should complement each other for the institution of a rigorous management framework for CTD.

7 Summary of Action Points

The present chapter provides a summary of all the guidelines mentioned in chapter four and five for the management of CTD. The important action points are discussed in the following pages.

1. Legislative and Regulatory Framework

The legislative and regulatory framework includes dovetailing of the DM Act, 2005, with various other Acts, Rules, and Regulations. Based on the risk assessment inadequacies in the legislative and regulatory framework, a reassessment of existing regulations including those related to international cooperation was required. Necessary amendments to the HW(M&H) Rules, 2003, have been made to address the security and safety concerns of hazardous waste and the new HW(MH&TM) Rules 2008 introduced.

Policies and guidelines issued by NDMA will be the basis for developing DM plans by various stakeholders and service providers, both in the government (nodal and line ministries, state government and district administration) and private setup at each level. Prompt and effective response to various chemical terrorism activities will be coordinated by NDMA, NEC, NCMC, SDMAs, and DDMAs.

(para 4.1)

2. Prevention

Important preventive measures can help in the prevention or mitigation of the effects of CTD. Counter-terrorism strategies, risk and vulnerability assessment, chemo-surveillance, and environmental monitoring are required for the mitigation of CTD. Counter-terrorism strategies will include collection of surveillance data; monitoring and continuous follow-up on terrorist activities and the use of deterrent and disruptive measures on them, strengthening border security, and appropriate financial strategies to scuttle their flow of funds. Risk and vulnerability assessment includes development of indicators, defining vulnerable locations and groups, defining priority activities, and field variables, putting in place a mechanism for identification of major plausible hazards, and establishing resource inventories to limit the impact of CTD.

Surveillance and environmental monitoring helps in risk zonation at the micro level by employing database management, and synergising cooperation between various intelligence agencies. It also requires vulnerability assessment mapping taking into account GIS-based modelling, vulnerability of population, quality of shelters available and their access to the community, and evaluating existing negative factors to assess the level of resilience and plans.

Chemical security requires the development of essential indicators (which will also be used to develop an effective EWS) by understanding the terrorists' motivation and capabilities, denying them likely access to toxins, tailoring deterrence strategies, and strengthening response measures. The effective networking of intelligence services, sharing of infallible and concise chemical security provisions, and the continuous assessment and upgradation of existing indicators based on

threat perception, including the possible mode of delivery are the requirements of an EWS.

Prevention of illegal trafficking of hazardous waste and their potential usage in CTD requires a systematic and fail-safe approach, employing public-private partnership to monitor and prevent the creation of illegal hazardous waste dumping sites to prevent terrorists from easy access to HAZCHEM and HAZMAT.

Listing of industries with dual-use hazardous chemical wastes, drawing up an inventory of all hazardous wastes, adopting strict import and export regulations, and establishing citizen-watch programmes to monitor any illegal or suspicious transfer or hazardous waste dumping, are important mitigation measures.

Necessary mechanism is required for determining the true identity of the buyer to prevent any direct or indirect access of TIC/TIM or their waste products to terrorists. Developing SOPs so that funding by financial intermediaries or banks for front companies can be identified and illegal flow of funds cut off. SOPs are also required for transporters so that they can inform the authorities of any suspicious movement of HAZCHEM and dual use chemicals, or any other suspicious material which can be used as a chemical weapon. Mechanism will also be developed for preventing cyber based exchange of information which can be used to cause a CTD.

(paras 4.2.1–4.2.7)

3. Preparedness

Preparedness for an emergency response at the incident site requires protection, detection, and decontamination. SOPs are required for all the emergency responders working under the overall supervision of the incident commander. SOPs will be included for PPE, search and rescue, BLS, triage, detection and characterisation of the chemical agent, and field decontamination. A well-orchestrated medical response to CTD will be possible only by having a command and control function at the district level with the district collector as commander. The CMO will be the main coordinator for the management of CTD.

Capabilities for individual physical protection (respiratory and body protection), and collective protection are required at the district level, as are adequate numbers of protective gear. Protocols for quick donning of protective gear, testing for leaks, and their removal will also be laid down. Early detection of the chemical agents used, parameters to verify whether the agent is above the acceptable threshold level, and monitoring the real-time data of the changing dynamics of the chemical agents as time elapses is required. A mobile chemical laboratory containing chemical analysers will be developed for highly vulnerable areas. The decontamination process requires mobile decontamination facilities as well as essential kits based on chemical or physical methods of removal which are specific to CW agents. SOPs regarding decontamination procedures—both for humans and material will be developed.

Preparedness for emergency medical response includes prompt establishment of medical posts as part of the ICS within the golden hour. Dedicated mobile teams trained to work in the chemical scenario and prior arrangements for the evacuation of victims from the contaminated environment are required. Immediate clean-up actions and various neutralisation techniques will be initiated to reduce the levels of chemical agents at the incident site. Reserves of stocked medical bricks of CBRN emergency medicines, antidotes, and BLS equipment will be made. Emergency support includes police, fire and emergency services, NDRF and SDRF, water supply division, public health division, communication, and community groups, all of which have been identified for

incorporation into emergency planning. NDMA and NEC will coordinate all preparedness activities at the national level while SDMAs and DDMAs will coordinate the various functions at their respective levels.

(para 4.3.1)

4. Capacity Development

Capacity development includes the availability of skilled and adequately trained manpower like rescue and relief teams, Civil Defence, Home Guards, and other emergency service providers who should have basic knowledge of toxic chemicals. Basic relevant knowledge of toxic chemicals will also be imparted through induction courses, to the public and private sector employees of industries, isolated storages, hazardous waste sites, and to those engaged in the transportation of potentially toxic chemicals. The role of NGOs, other voluntary organisations, and the community is required to be defined. For providing basic technical training, the identification and earmarking of education and training institutions at all levels is required. Education on CTD preparedness will be provided through the involvement of the various education boards in the country. Education about the realities of CTD situations will be imparted through the media, books, audio and video, lectures, and group discussions. Medical professionals must have adequate knowledge on the various types of chemical agents, their properties, possible modes of dispersal, and the treatment for people affected and injured by chemical agents. Mapping, identification and upgradation of appropriate institutions, training centres, other professional bodies and societies, and industrial and corporate institutions and associations shall be undertaken. Fire and emergency services will be equipped with modern equipment. Specialised training for community leaders by organising regular group training sessions and mock-drills for sensitisation, drills for organisations concerned, and the community are required. The quality of preparedness will be ensured by conducting mock-drills for the continuous improvement in the status of response. Knowledge management centres will be established, streamlined, and networked with academia and technical institutions, and linked with state and district authorities. Developing a mechanism for proper usage and implementation of the right information is the best conceivable way to act as an important link to effectively mitigate the effects of CTD.

Capacity development will be undertaken at the district, state, and national levels by the ministries and departments concerned as a part of their respective DM plans.

(para 4.3.2)

5. Infrastructural Development

Specialised areas that need infrastructural upgradation and development are, communication; PPE; detection and decontamination equipment/facilities; development of HAZMAT response vans; and the development/upgradation of chemical analysis and forensic laboratories, PICs, and R&D establishments. The first responders will be equipped with specialised mobile chemical laboratories, mobile decontamination facilities, PPE, medical facilities, and the latest technologies for detection and characterisation of chemical agents from the environment and clinical samples. Mechanism will be developed to regularly update and augment infrastructure, skilled manpower and financial resources required in various institutions associated with the management of CTD.

The nodal ministry for CTD and for chemical accidents will organise necessary activities to develop a common information platform for a sufficiently robust networking system, as part of the DM plans. All the district functionaries of the concerned departments will have a control room as part of the overall communication network. A comprehensive database of the land use, resource

inventories, and a detailed list of hazardous chemical agents will be shared with national and international intelligence agencies like Interpol, and the intelligence agencies of friendly and collaborative foreign countries to strengthen the intelligence network.

Nodal and line ministries at the central level and departments of health, SDMAs and DDMAs at the state or district level will identify the various requirements of critical infrastructure to be developed with PPP models to mitigate the impact of CTD.

(para 4.3.3)

6. Preparedness for Emergency Evacuation of Chemical Casualties

Response protocols for evacuation from the CTD incident site, including the casualties from the hot (highly contaminated) zone will be prepared. The evacuation planning will include information on the defined route. Medical resources of the Indian Railway Services, especially the ARME-1 and ARME-2, need to be upgraded and equipped with more modern facilities. SOPs for evacuation services and its networking all across the local, district, state, and national levels under their respective DM plans will be laid down as a part of DDMP.

(para 4.3.4)

7. Community Based Disaster Preparedness

Community preparedness will be strengthened. The community will be empowered with appropriate knowledge in such a manner that it does not panic and reacts appropriately if an incident occurs. The community will be a part of the district or local DM plan and will participate in mock-drills conducted for the management of CTD. Train the trainer programmes will be organised by DDMAs for the 'training teams' of various departments. The community will be made aware about helpline numbers, evacuation routes, and sites for gathering (assembly points) as part of the 'Emergency Action Advice'. The community based approach followed by most NGOs and community based organisations shall be incorporated in CTD management as an effective vehicle of community participation. Self-assessment techniques will be taught to help cope with stress, which will include assessing one's stress levels, identification of one's strengths and weaknesses, and assessment of the effectiveness of the coping mechanism. The capacities and capabilities of NGOs will be strengthened to support effective and specialised response in the event of a chemical attack.

Various provisions will be made according to the SOPs laid down by the ministries and departments concerned.

(para 4.3.5)

8. Hospital Preparedness

Major/earmarked hospitals in the government and private sector will be fully equipped and geared for managing CTD. An 'all hazard' hospital DM plan will focus on the specialised requirements of hospitals handling chemical casualties. These will include PPE, fixed decontamination facilities, creation of specialised medical teams, facilities such as isolation wards and burn wards, adequate laboratory support, training of specialists, nurses, pharmacists and paramedics, knowledge of toxic chemicals and treatment protocols involving specific prophylactics and antidotes. Specialised facilities like air-locked rooms fitted with adsorbent/ HEPA filters, and positive air pressure for the management of highly contaminated casualties will be created in acute treatment wards and emergency departments. SOPs will be prepared for the proper collection of samples for carrying out the analysis of toxicants. The diagnostic capabilities of laboratories will be supported

by online query management, and a feedback information system for accurate decision making. (para 4.3.6)

9. Management of a Chemical Attack with Unidentified Chemicals

An unidentified chemical poses unknown risks and challenges to the rescuers. Provisions for the incident site management include incident command posts and indicators to differentiate between the various kinds of gaseous exposures. Rescue workers will be equipped with protective gear, including respiratory protection and chemical protective clothing. Only a specialised trained force equipped with state-of-the-art equipment and protective gear will be allowed to enter the hot zone. Backup teams will be on standby to replace the first team if the breakthrough time for their PPE is reached before their job is completed. The exposed victims will be decontaminated followed by personal scanning and prompt evacuation. The precautions to be taken by hospitals for unidentified chemical attacks includes providing of protective gear and necessary antidote treatment for doctors, nursing teams, paramedical and other staff to prevent the possibility of secondary contamination. Poison information centres need to be contacted to establish linkages of the poison. Hospital care will also include monitoring and management of delayed health effects of chemicals. (para 4.4)

10. Research and Development

It is essential to develop new research methods and technologies, which will facilitate rapid identification and characterisation of novel threat agents. Research and development will help in adoption, upgradation, and evolution of state-of-the-art modalities, technologies, techniques, or facilities for the management of CTD. Some of the areas that require special attention are, PPE, development of biomarkers and bio-indicators, therapeutic interventions, development of advanced detection and monitoring technologies, development of antidotes, and the concept of 'chemical terrorism simulation modelling' including worst-case scenarios. (para 4.5)

11. Response for Chemical (Terrorism) Disasters

The emergency response plan includes mechanism for an alert system and reporting of chemical attack, or incident protocols for a situational assessment and initial response to CTD, and provisions for notification of the chemical event and the scale of disaster. EMR at the incident site and at the hospital include the management of mass panic reaction, self-protection, and self-decontamination procedures. It also envisages the response functions of different emergency functionaries, like police, detection and survey teams, fire and emergency services, and CRRTs; and the departments of water supply, electricity, relief and logistics, public health, transport, and communication. Response protocols for evacuation of chemical casualties, specialised ambulances, PPE, essential medical equipment and antidotes are required to ensure availability of adequate BLS measures and facilities for physical trauma management during evacuation. Treatment at the hospitals includes availability of decontamination facilities, adequate life-saving equipment like ventilators and defibrillators, stocks of oxygen, antidotes and other life-saving drugs; clinical care protocols; specialised burn centre, blood transfusion and trauma centre facilities; specialised laboratory networks; and other ancillary services. The long-term management of health effects caused by chemicals includes follow-up of the patients, maintenance of records, and provision for necessary medical care. The response plan will be rehearsed to remove the plausible anomalies in actions. (para 5.1)

12. Rehabilitation and Recovery

The rehabilitation and recovery phases require a proactive and inter-sectoral approach, and the reconstruction of severely damaged existing facilities. SOPs will be prepared for medical rehabilitation, including psycho-social care, long-term medical care for vulnerable groups, and vocational rehabilitation. The rehabilitation and recovery process will be based on specific indicators and standards for long-term follow up of survivors and their families. Mechanisms will also be developed to re-establish normal health services, and repair and reconstruction of damaged facilities. Surveillance of diseases will be continued unless the normal reporting system is restored. Mechanism for assessment will be developed as part of the projected plans, which will include strengthening of environmental surveillance and health services, water quality, and adequate food supply. All the above activities will be a part of the response plans for rehabilitation and recovery.

(para 5.2)

13. Post-Disaster Documentation

Documentation is one of the important aspects for the preparedness and management of CTD. SOPs for reporting, recording case studies, and critical analysis will be devised. Provisions for medical documentation, activity-wise documentation, and evaluation of data including mortality and morbidity indices, and incorporation of the lessons learnt from the studies of previous incidents in a pilot project mode to improve the overall emergency management planning is essential.

(para 5.3)

14. Media Management

Media management is a necessary component of CTD management. Mechanism for effective media management includes development of media kits on the various aspects of information dissemination related to CTD, adequate messaging pattern, modes of message dissemination, disciplined use of electronic features for relief information and mobilisation of resources. Adequate awareness will be generated by providing information about relief and rehabilitation measures, medical support sites, routes to be followed or avoided, dos and don'ts for the public, etc.

(para 5.4)

15. Public-Private Partnership

Public-private partnership is required for preparedness, mitigation, rehabilitation, response, and management of CTD. The private infrastructure needs to be integrated with DMP for preparation, mitigation, response, and post-disaster phases of rehabilitation and recovery. Encouragement should be given to the Responsible Care Programme*, risk reduction plans and applied research in the field of chemical security technologies. Important knowledge generated by the private sector will be shared to develop mitigation measures for effective management of CTD.

(para 5.5)

16. State/District Disaster Management Planning for Chemical Attacks

Proper planning and preparedness at the national, state, district, and local level is crucial for the management of CTD. DM planning will include the mechanism for continuous intelligence collection, creation of databanks, strict implementation of rules, plans for predicting potential targets, identification and training of volunteers, availability of CBRN shelters, dedicated and specialised transportation and emergency services, an effective and simplified communication network, information databases,

* http://www.responsiblecare.org

GIS-based emergency planning, and revamping of the Civil Defence and Home Guards.

SOPs will be prepared by response agencies, especially the NDRF, SDRF, fire and emergency service, police, Civil Defence, Home Guards, and MFRs, who are required to manage the worst-case scenarios through optimal usage of protective gear, diverting resources, and adopting global best practices whenever needed. A list of chemical industries operating in the district will be maintained, and medical management will be accordingly planned for chemical casualties. Medical equipment, PPE, detectors, decontamination units, medical logistics, surge capacity of hospitals, integrated ambulance services equipped with NBC filters, and other rescue vehicles need to be catered for. Location of relief camps, definition of evacuation routes, earmarked hospitals, nursing homes, and primary health care centres with their responsibilities and command control will also be defined in the plans.

Necessary follow up, updating and ongoing analysis will ensure the success of a preventive approach. A medical inventory of neighbouring states and districts, directory of all the medical officers and private players involved, and specific tertiary health care facilities will be documented and regularly updated.

(para 5.6)

17. Implementation of Chemical (Terrorism) Guidelines

The strategy outlines the requirements for development of a CTD action plan by the nodal ministry, measures to implement and coordinate various activities at the national level, and the setting up of an institutional framework and coordination at the state and district levels. Adequate strategies will be evolved to develop linkages and state support systems. Necessary financial arrangements will be made for implementation of all the plans developed at the district, state, and national levels. An implementation model with suggested broad time frames as short-, medium-, and long-term plans for 0–3, 0–5 and 0–8 years, respectively have been recommended.

(para 6.1–6.3)

These Guidelines stress on preparedness and management of mass casualties due to chemical incidents. The management of CTD is required to function in a coordinated and proactive manner. MHA, MoH&FW, MoD, line ministries, state governments, and the district administration shall enhance their capacities in active cooperation with the corporate sector. Their actions and policies should complement each other for the institution of a rigorous management framework for CTD.

Annexures

Annexure-I

Chemical Warfare Agents and the Medical Management of Victims

Classification of Chemical Warfare Agents

Chemical warfare agents are classified as per their physiological effects on different body systems as follows:

- Nerve agents
- Blistering agents
- Blood agents
- Lung injurants
- Psychic incapacitants
- Riot control agents
- Toxins

Nerve Agents

Nerve agents continue to be one of the most significant threats—both from terrorists, as well as from the chemical warfare point of view. Nerve agents are Organophosphorus Compounds (OP). All OP compounds do not qualify as nerve agents due to their differential toxicity. Some OP compounds that are less toxic to human beings are used as insecticides. Agents that come in the category of nerve agents are Tabun, Sarin, Soman and VX. These nerve agents are classified under Schedule I of the CWC. The absorption of these agents by the body systems are by inhalation, dermal absorption and the mucous membranes.

Lethal substances that disable enzymes responsible for the transmission of nerve impulses

Name/Symbol	Means of Exposure	Lethal Dosage	Rate of Action	Effects	Antidotes/ Methods of Treatment
Tabun (GA)	Skin contact and/or inhalation	Via inhalation: 400 LCt_{50} Via skin exposure: 1,000 LD_{50}	Very rapid Incapacitating effects occur within 1 to 10 minutes; lethal effects occur within 10 to 15 minutes	Effects seen in eyes (contraction of pupils, pain, dim or blurred vision), nose (runny nose), and airways (chest tightness) Nausea and vomiting also possible Twitching/convulsions result when skeletal muscle reached Fluctuations in heart rate Loss of consciousness and seizure activity can occur within one minute of exposue in cases of exposure to high concentration of agent Eventual paralysis, death	4 steps to management of exposure to nerve agents: • decontamination • ventilation • antidotes • supportive therapy Therapeutic drug options: • Atropine and Pralidoxime Chloride (autoinjectors packaged together in kits provided to military personnel) • Diazepam (anticonvulsant drug) Pretreatment option: Pyridostigmine (can increase the lethal dose threshold significantly if ingested prior to exposure and if paired with traditional therapeutic options
Sarin (GB)	Skin contact and/or inhalation	Via inhalation: 100 LCt_{50} Via skin exposure: 1,700 LD_{50}	Very rapid incapacitating effects occur within 1 to 10 minutes; lethal effects occur within 2 to 15 minutes		
Soman (GD)	Skin contact and/or inhalation	Via inhalation:70 LCt_{50} Via skin exposure: 50 LD_{50}	Very rapid incapacitating effects occur within 1 to 10 minutes; lethal effects occur within 1 to 15 minutes		
VX	Skin contact and/or inhalation	Via inhalation: 50 LCt_{50} Via skin exposure: 10 LD_{50}	Rapid Incapacitating effects occur within 1 to 10 minutes; lethal effects occur within 4 to 42 hours		
Novichok 5 agents		*Novichok 5* estimated to exceed effectiveness of VX by 5 to 8 times *Novichok 7* estimated to exceed effectiveness of soman by 10 times.	Very rapid		Assumed to be similar to treatment methods for other nerve agents listed above

Toxicity data: Nerve agents are one of the most toxic chemical agents, with V agents such as VX being the most toxic. The median lethal dose of nerve agents and some commonly used OP insecticides, for a 70 kg man, are given below:

Agents	LD_{50} (bare skin) mg	LD_{50} (oral) mg	LCt50 (inhalation) mg.min.m^{-3}
Nerve Agents			
Tabun	200 – 1000	25 – 50	100 – 200
Sarin	100 – 500	5 – 20	50 – 100
Soman	50 – 300	5 – 20	25 – 50
VX	5 – 15	3 – 10	5 – 15
Insecticides			
Dichlorvos	> 7000	300 – 6000	500 – 1000
Malathion	> 25000	4000 – 40000	No data

Mechanism of action: Nerve agents exert their biological effects by irreversibly inhibiting the enzyme Acetylcholinesterase (AChE). This enzyme is responsible for hydrolysing Acetylcholine (ACh), a neurotransmitter liberated at the nerve synapse, nerve-muscle (neuromuscular) junction, and nerve-gland junction. In a normal individual, a small quantity of ACh is continuously liberated and being hydrolysed by AChE. Inhibition of AChE causes accumulation of ACh which leads to over-excitation or paralysis.

Signs and symptoms: As soon as the nerve agents enter the system, symptoms of poisoning appear. The effects of nerve agents are the result of action on the muscarinic and nicotinic receptors and on the receptors within the central nervous system. They include constriction of pupil (meiosis), increased production of saliva, a running nose, increased perspiration, urination, defecation, bronchosecretion, bronchoconstriction, decreased heart rate and blood pressure, muscular twitches and cramps, cardiac arrhythmias, tremors and convulsions. The most critical effects are paralysis of the respiratory muscles and inhibition of the respiratory centre. Ultimately, death results due to respiratory paralysis. If the concentration of the nerve agent is high, death is immediate.

Treatment of nerve agent poisoning: The treatment of nerve agent poisoning requires constant attention by the medical personnel. The treatment schedule can be classified as:

i) Termination of further intoxication.

ii) Artificial respiration or oxygen therapy.

iii) Antidote therapy.

Like any other poison, the first and foremost step is removal of the subject from the contaminated environment and removal of the toxicant from the skin. Artificial respiration is very important as it assists the patient in breathing, and should be initiated as early as possible. Artificial respiration must continue until natural breathing of the patient is restored.

Three drugs—atropine, pralidoxime chloride and diazepam are used to treat nerve agent exposure. Atropine is very important to block the excess action of ACh. It is a competitive inhibitor of muscarinic receptors. Atropine should be administered immediately and should be repeated, starting with an initial dose of 2 mg intramuscularly or intravenously. The administration of atropine should be continued till it is adequate, as indicated by dryness of mucosa in the nose and mouth, and an increase in heart rate. The dosage of atropine should not hinder the performance of a non-intoxicated individual. The side effects of 2 mg atropine in a normal individual are increased heart rate, drying of secretions, mydriasis

(dilatation of pupil) and paralysis of accommodation. Most of the effects are reversible.
Pralidoxime (PAM) Chloride is used as a cholinesterase reactivator. The dose of PAM chloride is 15–25 $mg.kg^{-1}$ by slow intravenous injection. Since these oximes are quickly excreted, further doses may be needed. The convulsions induced by nerve agent poisoning may cause brain damage. Diazepam is used as an adjunct to reduce convulsions. The usual dose of diazepam is 5-10 mg, intramuscularly. It is important for the antidotes to be administered very quickly in the field itself in the form of first aid. This is done by the use of auto-injectors. Atropine auto-injector and PAM chloride auto-injectors are available for immediate use. There are no accepted prophylactic antidotes for nerve agent poisoning, i.e., drugs administered before exposure to the agent. Pyridostigmine bromide has been introduced as a prophylactic drug. The dose is 30 mg, three times a day. Though it may give some protection against nerve agent poisoning, it has side effects.

The routine treatment protocol to be followed at the site and at the hospital is as follows:

Prophylaxis

There is no true prophylaxis for nerve agent poisoning that is available for general use.

Pre-Treatment

Pre-treatment can markedly improve the end result of treatment in patients who have been exposed to nerve agents. However it should never be considered as an alternative to the need for risk assessment, or other adequate risk reduction procedures. Pre-treatment should be used routinely, but is particularly recommended in certain high risk or unpredictable situations such as:

i) Potential exposure to soman.

ii) Potential exposure to high doses of other nerve agents.

iii) Circumstances where the exact nature of exposure to a potential nerve agent is unknown (e.g., an investigation of alleged use where there is a suspicion that nerve agents have been used)

iv) A situation where droplet exposure is possible and removal of clothing poses a risk of exposure.

If lower levels of nerve agents other than soman are expected (in the order of 2 x LD50), therapy should be adequate without prior pre-treatment. Reversible cholinesterase inhibitors such as pyridostigmine are widely used for pre-treatment.

Therapy On-Site

<u>General</u>

i) The use of atropine, an oxime, and a diazepam equivalent is accepted as the basis of therapy for nerve agent exposure and can be adminstered by auto-injection.

ii) In all cases of suspected liquid exposure, immediate decontamination is critical.

<u>Self Aid</u>

If symptoms persist or worsen 10 minutes after use of the first auto-injector, a further dose can be administered. Immediate medical attention is required for expert assessment. Meanwhile:

i) Provide ventilatory or other support if needed and urgently move to medical post.

ii) Set up intra-venous line access in anticipation of i.v. treatment requirement.

iii) Acquire the assistance of a doctor.

At the Hospital

i) Ensure that the patient is monitored for possible development of symptoms.

ii) Provide ventilatory support with intubations and ventilation if necessary.

iii) Provide further intra-venous therapy by titration against clinical condition.

- 2 mg atropine or an equivalent dose of a similar cholinolytic can be given every 10 minutes, with a heart rate goal of 80–100/min and drying of secretions.
- Diazepam or equivalent 10 mg should be given by slow injection and repeated if convulsions occur.

iv) Diagnostic procedures to ascertain whether nerve agent poisoning has in fact occurred.

v) Provide supportive treatment as required.

vi) Atropinisation may have to be maintained for prolonged periods depending on the persistence of cholinergic symptoms.

- Intra-venous oxime may be also be required for longer periods, and should be titrated according to RBC acetyl cholinesterase activity.

Blistering Agents

Agents that cause blisters on skin and damage the respiratory tract, mucous membranes, and eyes

Name/Symbol	Means of Exposure	Lethal Dosage	Rate of Action	Effects	Antidotes/ Methods of Treatment
Sulfur Mustard (HD)	Skin contact and/or inhalation	Via inhalation: 1,500 LCt_{50} Via skin exposure: 4,500 LD_{50}	Delayed (tissue damage occurs within minutes of contact, but clinical effects are not immediately evident) Effects manifested 2 to 24 hours after exposure	Pain is not immediate. Topical effects occur on the skin (blisters), in airways (coughing, lesions, in rare cases resulting in respiratory failure) and in the eyes (itchiness, burning sensation, possible cornea damage) Nausea and vomiting can also result	Thorough decontamination using water Prevention of infection using antibiotics Application of lotions/ointments to soothe blisters Mustard has no known antidote British-Anti-Lewisite can mitigate some systemic effects of lewisite, though it can itself cause some toxicity.
Lewisite (L)	Skin contact and/or inhalation	Via inhalation: 1,300 LCt_{50} Via skin exposure: greater than 4,500 LD_{50}	Rapid Pain and irritation occur immediately	Effects are similar to mustard: skin blistering, burning/watery/swollen eyes, upper airway irritation, systemic blood poisoning	
Nitrogen Mustard (HN-3)	Skin contact and/or inhalation	Via inhalation: 1,500 LCt_{50} Via skin exposure: 4,500 LD_{50}	Rapid Rash occurs within one hour; blistering occurs between 6 to12 hours after exposure	Skin blistering, respiratory tract damage	
Mustard-Lewisite	Skin contact and/or inhalation	Via inhalation: 1,500 LCt_{50} Via skin exposure: 10,000 LCt_{50}	Rapid Stinging sensation occurs immediately; blisters follow hours later	Skin blistering, burning in the eyes, inflamation of respiratory tract	
Phosgene-oxime (CX)	Skin contact and/or inhalation	Via inhalation: 3,200 LCt_{50} Via skin exposure: 25 LD_5	Rapid	Extremely irritating to eyes, skin, and upper respiratory system	

Blistering agents are known as the queen of chemical warfare agents, though their threat from terrorists is fairly less due to the difficulty in the delivery. Mustard, lewisite and phosgene oxime are the known blistering agents. Lewisite is an oily liquid which is more volatile than mustard. Phosgene oxime is a solid at room temperature and dissolves slowly in water.

Toxicity data: At a concentration of 100 $mg.min.m^{-3}$ of Sulfur Mustard (HD), incapacitating eye injury will be produced in human beings and significant skin burns will be produced if the concentration is 200 $mg.min.m^{-3}$. The respiratory lethal dose is estimated to be 1,500 $mg.min.m^{-3}$, and death will occur if 3-4 g of HD falls on bare skin. Nitrogen mustard is as toxic, lewisite is fast acting, while phosgene oxime is a powerful irritant.

Mechanism of action: The mustards are radiomimetic and are extremely toxic to dividing cells. After passing through the cellular membrane, HD is converted into highly reactive sulphonium ions. Cellular enzymes, proteins, DNA, and other macro molecules are the targets of HD. The most important target of mustard is DNA. Mustard alkylates the purine bases of DNA and damages them. Lewisite directly binds to sulfhydryl groups and inactivates them.

Toxic effects: Mustard gas in the form of gas or aerosol, affects the skin, eyes and the respiratory tract. The characteristic of mustard gas poisoning is a delayed appearance of toxic effects. The victim knows about the exposure only after a lapse of 4 to 6 hours depending upon the dose. The eyes are more vulnerable to mustard than the respiratory tract or the skin. The effects of mustard gas on the eye can be classified as mild (itching and lachrymation), moderate (eyelids swelling and blurring of vision) and severe (iritis, conjunctivitis and corneal opacity).

The effects of mustard on the skin resemble those of burn injuries. It also depends upon the weather conditions and degree of exposure. In a warm and humid climate, the effect will be more severe. Similarly, the lesions will be more severe in damp and warm parts of the body like the groin, axilla and neck. The first symptom will be itching at the site of contact. Then erythema will appear gradually followed by vesication or blister formation. Mustard burns usually are followed by a persistent brown pigmentation except at the site of actual vesication, where there may be a temporary depigmentation. Although mustard damages the cells within minutes of contact, the clinical effects do not appear until hours later.

The effect of mustard gas on the respiratory tract also depends upon the degree of exposure. If the exposure is mild, swelling and erythema will be present in the nose, larynx and trachea. Laryngeal edema and necrosis may lead to respiratory obstruction. There is a danger of bacterial infection of the lungs which may result in bronchopneumonia. The latter may be responsible for death following mustard exposure. Severe exposure to mustard may induce bone marrow damage leading to leucopenia. Ingestion of food or water contaminated by liquid mustard produces nausea, vomiting, pain and diarrhoea. Even exposure to the skin alone can cause malaise, vomiting and cardiac abnormalities.

The effects of lewisite are similar to those of mustard. An important difference between lewisite and mustard is that the action of lewisite is immediate. The victim feels a stabbing pain in the eyes and burning pain in the skin and respiratory tract. Liquid arsenicals, on the skin as well as inhaled vapour, are absorbed and may cause systemic poisoning, which include increased capillary permeability, pulmonary edema, diarrhoea, restlessness, hypothermia, hemoconcentration, and shock.

Phosgene oxime affects the skin severely without any latent period causing intense burning followed by painful inflammation. The rash spreads through the whole body even though the contact is in a small area. The affected areas swell with the formation of painful blisters. It also irritates the eyes and the respiratory tract.

Treatment: There are no specific antidotes for mustard toxicity and the treatment is similar to that of burn injuries. The eyes should be washed with uncontaminated water. If the eyelids are sticky then sterile petroleum jelly can be applied. Blepharospasm can be relieved by instilling one drop of atropine solution (1%) 3-4 times a day. Secondary infection if any can be treated by instilling ciprofloxacillin eye drops. The skin area should be immediately decontaminated with PDK-1 or PDK-2 and PDK-3. Povidone-iodine ointment or framycetin ointment should be applied on the mustard blisters. Systemic analgesics and antihistamines can be used to relieve itching and pain. Pharyngitis due to inhalation exposure can be relieved by taking alkaline gargle. For persistent cough codeine can be taken.

Unlike mustard, specific treatment for lewisite poisoning is available. 2,3-dimer-captopropanol commonly known as dimercaprol or British Anti Lewisite (BAL) is a specific chelating agent for arsenicals. If the eye or skin is contaminated, BAL ointment should be applied immediately. The other treatment measures are similar to that of mustard. If the contamination is very severe BAL should be administered systemically. BAL in oil (10% solution) should be given, by deep intramuscular injection at a dose of 5 $mg.kg^{-1}$ and repeated after 4, 8 and 12 hours. No specific antidote exists for phosgene oxime. The contaminated area should be thoroughly washed with water. Other treatment measures are purely symptomatic.

Blood Agents

These agents are also referred to as systemic agents or cell toxicants. Typical examples of this class of CW agents are Hydrogen Cyanide (AC), Cyanogen Chloride (CNCl) and Cyanogen Bromide (CNBr). The first two are regarded as Schedule 3 chemicals. All three agents share their main toxic properties, but CNCl and CNBr are additionally irritant to the respiratory tract.

Agents that interfere with the absorption of oxygen into the bloodstream

Name/Symbol	Means of Exposure	Lethal Dosage	Rate of Action	Effects	Antidotes/ Methods of Treatment
Hydrogen Cyanide (AC)	Inhalation	2,000 to 5,000 LCt_{50}	Rapid Exposure to low concentrations causes symptoms in 1 or more hours Exposure to high concentrations causes sudden unconsciousness	Agents inhibit cell respiration; heart and central nervous system are susceptible Cyanogen Chloride also greatly irritates eyes and lungs In moderate cases: • vomiting • dizziness • deeper, more rapid breathing In severe cases: • convulsions • respiratory failure • sudden loss of consciousness leading to death	Agents are highly volatile; flush eyes with water; remove contaminated clothing; rinse exposed skin with water Antidotes: intravenous administration of sodium nitrite and sodium thiosulfate for detoxification purposes (i.e., to assist body's ability to excrete cyanide from system) Pretreatment under development in the United Kingdom
Cyanogen Chloride (CK)	Inhalation	11,000 LCt_{50}	Rapid Lethal concentration produces effects within 15 seconds of exposure; death following within 6 to 8 minutes		

Toxicity Data: The LD_{50} of potassium cyanide is 200 mg for a man. The LCt_{50} of AC is estimated to be 5,000 $mg.min.m^{-3}$.

Signs and symptoms: The onset and intensity of symptoms depend on the concentration of inhaled toxic vapour and duration of the exposure. Symptoms on exposure to low doses of AC are weakness, giddiness, headache, confusion and sometimes nausea and vomiting. Clinical signs appear only at high levels of exposure which include fast and painful respiration, lack of coordination of movement, cardiac irregularities, hypoxic convulsions, coma and respiratory failure culminating in death. Diagnosis may be aided by the characteristic odour of cyanide (bitter almond) or a faint pale red hue of the skin.

Mechanism of Action: Cyanide has a very high affinity for iron in the ferric (Fe^{+3}) state. On entering the biological system, it readily reacts with trivalent iron of cytochrome oxidase (an end chain enzyme of cellular respiration) to form a complex, thereby impairing the utilisation of oxygen in the tissues. Eventually death follows as a result of respiratory failure.

Treatment: The patient should be removed from the contaminated environment. The aim of the treatment is to dissociate the cyanide ion from the cytochrome oxidase-cyanide complex. This can be accomplished by binders like amyl nitrite, sodium nitrite and 4-dimethylaminophenol (DMAP) that oxidise haemoglobin to methaemoglobin, which subsequently sequesters the cyanide ion to form cyanmethaemoglobin. Amyl nitrite is usually administered by inhalation while sodium nitrite (10 ml of 3%) is given Intravenously (i.v.). Sodium thiosulphate (50 ml of 25% solution, i.v.), a sulphur donor to enzyme rhodanese present in the liver, augments the elimination of cyanide as thiocyanate. Recent studies have also shown that a-ketoglutarate, either alone or in combination with sodium thiosulphate is very effective in antagonising lethal cyanide poisoning in experimental animals. Treatment of cyanide poisoning must be rapid to be effective.

Lung Injurants

Substances that damage the respiratory tract, causing extensive fluid build-up in the lungs

Name/Symbol	Means of Exposure	Lethal Dosage	Rate of Action	Effects	Antidotes/ Methods of Treatment
Chlorine	Inhalation	3,000 LCt_{50}	Rapid Lethal effects manifest 30 minutes after exposure	Shortness of breath, irritation of mucous membranes; coughing; tightness of chest Culminates in fluid build-up in lungs leading to fatal choking	No antidote once exposed Individuals should don gas masks and other protective gear to prevent inhalation Medical responses include: • Relocation to decontaminated environment • Enforced rest • Management of secretions in airways • Oxygen therapy • Prevention/treatment of pulmonary edema
Phosgene (CG)	Inhalation	3,200 LCt_{50}	Delayed Asymptomatic period can last up to 24 hours		
Diphosgene (DP)	Inhalation	3,200 LCt_{50}	Delayed Incapacitating and lethal effects felt after 3 or more hours		
Chloropicrin (PS)	Inhalation	20,000 LCt_{50}	Variable Produces tears in seconds; lethal effects felt after 10 minutes	Vomiting, fluid build-up in lungs	

Lung injurants are also known as choking agents. Phosgene and diphosgene belong to this group of CW agents. Phosgene is a Schedule 3 chemical.

Signs and symptoms: Inhalation of low concentrations of phosgene produces rapid and shallow breathing, reduced respiratory volume, bradycardia and hypotension. Many cholinergic symptoms like increased salivation, nausea, micturition and defaecation are also observed. Exposure to higher concentrations may produce more specific effects on the vital functions of the lungs and development of pulmonary oedema eventually, culminating in death. The immediate cause of death is usually paralysis of the respiratory centre due to anoxia.

Mechanism of action: There is no uniform view regarding the action mechanism of phosgene intoxication. Poisoning is mainly attributed to acylation of certain tissue elements of lungs, increased permeability of the alveolar mucous membrane resulting in pulmonary oedema with consequent anoxia and death.

Treatment: Treatment for phosgene poisoning is essentially palliative. The main objective of the treatment is to prevent the development of pulmonary oedema and other secondary effects arising out of anoxia. Treatment is extended in three steps. Under first aid, the victim should be allowed fresh air and kept warm. The treatment is phased in a manner to provide basic therapy within 30 minutes of exposure followed by selected additional therapy. Immediate medical aid involves artificial respiration along with administration of cortisone (hexamethasone or beclamethasone) and sodium bicarbonate assisted by positive pressure breathing. Coughing worsens the prognosis and can be suppressed with codeine. Sedatives are not recommended. Antibiotic therapy is recommended when bronchitis or pneumonitis develops. The selected additional therapy includes supplementary oxygen and i.v. injection of sodium bicarbonate. Relief from airway obstruction may be achieved by theophylline and prostaglandin E1 (PGE1) followed by surfactant supplementation with dipamitoyl phosphatidylcholine or cholesterol palmitate aerosols. Intensive care and supervision is required for more than 24 hrs.

Psychic Incapacitants

These agents are also called psychomimetic agents or hallucinogens. This class of compounds are represented by 3-quinuclinidinyl benzilate (BZ), Tetrahydrocannabinol (THC), Fentanyl and Lysergic Acid Diethylamide (LSD). These chemicals are basically central nervous system depressants or stimulants, causing various physiological or mental incapacitations leading to temporary disability. Only BZ is listed as a Schedule 2 chemical.

Signs and symptoms: BZ can enter the body as an aerosol by inhalation or via poisoned food or drink. In small doses BZ causes sleepiness and diminished alertness. Within a few hours of exposure increased heart rate, dizziness, vomiting, blurred vision, confusion and sedation occur. The victim may have a headache and high temperature. After 4–12 hours the patient experiences muscular in-coordination, visual and auditory hallucinations accompanied by loss of memory. Within 2–4 days after exposure the symptoms gradually recede.

Treatment: Symptomatic treatment is usually sufficient. The patient should be reassured and prevented from taking any harmful action. Risk of heat stroke can be avoided by keeping the patient in a cool environment. Intravenous administration of physostigmine (2–3 mg) may ameliorate the central action of BZ.

Riot Control Agents

Riot control agents are sensory irritants of low military value and are usually used as mob dispersing agents. They comprise of tear gases and coughing agents.

Substances that rapidly produce temporary disabling effects

Name/Symbol	Means of Exposure	Lethal Dosage	Rate of Action	Effects	Antidotes/ Methods of Treatment
Tear Agent 2 (CN)	Inhalation	7,000 LCt_{50}	Rapid	Instant pain in eyes and nose; tearing induced; coughing; chest tightness; vomiting if high doses are swallowed or if individual is especially sensitive	Relocate to fresh air Thorough washing of exposed eyes and skin with water Effects generally dissipate within 15 to 30 minutes of departure from contaminated area
Tear Agent O (CS)	Inhalation	61,000 LCt_{50}	Rapid		
Psychedelic Agent 3 (BZ)	Inhalation	N/A	Rapid Effects felt within 30 minutes	Induces altered states of consciousness, including hallucinations, stupor, forgetfulness, confusion	

Tear gases: These agents are also referred as lachrymators or tear producing compounds. These compounds may cause irritation to the eyes and skin, and a burning sensation in the upper respiratory tract. This group is represented by Orthochlorobenzylidene Malononitrile (CS), Chloroacetophenone (CN) and Dibenz (b.f), (1,4)-oxazepine (CR).

Toxicity data: The intravenous LD_{50} of CN, CS and CR in rabbits are 6–26, 20–31 and 47 $mg.kg^{-1}$, respectively.

Signs and symptoms: In general, lachrymators cause burning sensation in the eyes, conjunctivitis, erythema or photophobia. Nausea, headache, coughing may occur preceded by sneezing, running nose and irritation of the upper respiratory tract. Prolonged exposure to high concentrations may lead to erythema and vesication.

Treatment: The treatment for lachrymator exposure requires immediate decontamination of clothing and eyes. The victim should be brought to fresh air, and eyes and skin decontaminated with water. Inflammation of skin may be treated with calamine lotion.

Coughing Agents

These agents are also called sternutators and produce violent coughing and vomiting in addition to irritation of mucous membranes. Diphenylchloroarsine (DA), Diphenylcyanoarsine (DC) and 10-chloro-5,10-dihydrophenarsazine or Adamsite (DM) are the representatives of this group of chemicals. These are all white or yellowish crystalline solids, with relatively low solubility in water.

Toxicity data: The LCt_{50} of DA, DC and DM are 15,000, 10,000 and 15,000 $mg.min.m^{-3}$ respectively.

Signs and symptoms: Exposure to DM causes burning sensation in the eyes accompanied by runny nose, lachrymation, excessive salivation, sneezing, nausea and vomiting. Exposure to high concentrations may cause erythema.

Treatment: Exposure to coughing agents is not life threatening. The victim should be brought to fresh air, and eyes and skin decontaminated with water. Severe exposure causing impairment of lung function may be treated as recommended for lung injurants.

Toxins

Herbicides

Herbicides are also regarded as anti-plant agents and are used for destruction of crops or defoliation of natural vegetation. These agents comprise of plant defoliants, plant exterminators and plant growth modifiers. The typical examples of this class of compounds are 2,4-dichloro-phenoxyacetic acid (2,4-D) and 2,4,5- trichlorophenoxyacetic acid (2,4,5-T).

*Toxicity data***:** Technical preparation of 2,4,5-T may contain small quantities of dioxin which is very toxic and may have carcinogenic and teratogenic properties.

*Signs and symptoms***:** There are no specific signs and symptoms reported in herbicide exposures except some neuro-psychiatric, gastrointestinal and dermatological changes.

Treatment: Nonspecific and symptomatic

Annexure-II

Dual Use Chemicals

	DUAL USE CHEMICALS	CAS NO.	CWC-SCHEDULE
1.	2-Chloroethanol	(107-07-3)	Not Listed
2.	3-Hydroxy-1-methylpiperidine	(3554-74-3)	Not Listed
3.	3-Quinuclidinol	(1619-34-7)	2B
4.	3-Quinuclidone	(3731-38-2)	Not Listed
5.	Ammonium bifluoride	(1341-49-7)	Not Listed
6.	Arsenic trichloride	(7784-34-1)	2B
7.	Benzilic acid	(76-93-7)	2B
8.	Diethyl ethylphosphonate	(78-38-6)	2B
9.	Diethyl methylphosphonate	(683-08-9)	2B
10.	Diethyl methylphosphonite	(15715-41-0)	2B
11.	Diethyl N,N-dimethylosphoramidate	(2404-03-7)	2B
12.	Diethyl phosphite	(762-04-9)	3B
13.	Diethylaminoethanol	(100-37-8)	Not Listed
14.	Diisopropylamine	(108-18-9)	Not Listed
15.	Dimethyl ethylphosphonate	(6163-75-3)	2B
16.	Dimethyl methylphosphonate	(756-79-6)	2B
17.	Dimethyl phosphite (DMP)	(868-85-9)	3B
18.	Dimethylamine	(124-40-3)	Not Listed
19.	Dimethylamine hydrochloride	(506-59-2)	Not Listed
20.	Ethyldiethanolamine	(139-87-7)	3B
21.	Ethylphosphinyl dichloride	(1498-40-4)	2B
22.	Ethylphosphinyl difluoride	(430-78-4)	2B
23.	Ethylphosphonyl dichloride	(1066-50-8)	2B
24.	Ethylphosphonyl difluoride	(753-98-0)	1B
25.	Hydrogen fluoride	(7664-39-3)	Not Listed
26.	Methyl benzilate	(76-89-1)	Not Listed
27.	Methylphosphinyl dichloride	(676-83-5)	2B
28.	Methylphosphinyl difluoride	(753-59-3)	2B
29.	Methylphosphonic acid	(993-13-5)	2B
30.	Methylphosphonothioic dichloride	(676-98-2)	2B
31.	Methylphosphonyl dichloride (DC)	(676-97-1)	2B
32.	Methylphosphonyl difluoride (DF)	(676-99-3)	1B
33.	N,N-Diisopropyl-(beta)-aminoethane thiol	(5842-07-9)	2B
34.	N,N-Diisopropyl-(beta)-amino-ethanol	(96-80-0)	2B
35.	N,N-Diisopropyl-(beta)-aminoethyl chloride	(96-79-7)	2B
36.	N,N-Diisopropyl-2-aminoethyl chloride hydrochloride	(4261-68-1)	2B

Annexure-III

Classification of Toxic Industrial Chemicals as High, Medium and Low Risk Chemicals

High	Medium	Low
Ammonia	Acetone cyanohydrin	Allyl isothiocyanate
Arsine	Acrolein	Arsenic trichloride
Boron trichloride	Acrylonitrile	Bromine
Boron trifluoride	Allyl alcohol	Bromine chloride
Carbon disulfide	Allylamine	Bromine pentafluoride
Chlorine	Allyl chlorocarbonate	Bromine trifluoride
Diborane	Boron tribromide	Carbonyl fluoride
Ethylene oxide	Carbon monoxide	Chlorine pentafluoride
Fluorine	Carbonyl sulfide	Chlorine trifluoride
Formaldehyde	Chloroacetone	Chloroacetaldehyde
Hydrogen bromide	Chloroacetonitrile	Chloroacetyl chloride
Hydrogen chloride	Chlorosulfonic acid	Crotonaldehyde
Hydrogen cyanide	Diketene	Cyanogen chloride
Hydrogen fluoride	1,2-Dimethylhydrazine	Dimethyl sulfate
Hydrogen sulfide	Ethylene dibromide	Diphenylmethane-4,4'-diisocyanate
Nitric acid, fuming	Hydrogen selenide	Ethyl chloroformate
Phosgene	Methanesulfonyl chloride	Ethyl chlorothioformate
Phosphorus trichloride	Methyl bromide	Ethyl phosphonothioic dichloride
Sulfur dioxide	Methyl chloroformate	Ethyl phosphonic dichloride
Sulfuric acid	Methyl chlorosilane	Ethyleneimine
Tungsten hexafluoride	Methyl hydrazine	Hexachlorocyclopentadiene
	Methyl isocyanate	Hydrogen iodide
	Methyl mercaptan	Iron pentacarbonyl
	Nitrogen dioxide	Isobutyl chloroformate
	Phosphine	Isopropyl chloroformate
	Phosphorus oxychloride	Isopropyl isocyanate
	Phosphorus pentafluoride	n-Butyl chloroformate
	Selenium hexafluoride	n-Butyl isocyanate
	Silicon tetrafluoride	Nitric oxide
	Stibine	n-Propyl chloroformate
	Sulfur trioxide	Parathion
	Sulfuryl chloride	Perchloromethyl mercaptan
	Sulfuryl fluoride	sec-Butyl chloroformate
	Tellurium hexafluoride	tert-Butyl isocyanate
	n-Octyl mercaptan	Tetraethyl lead
	Titanium tetrachloride	Tetraethyl pyroposphate
	Trichloroacetyl chloride	Tetramethyl lead
	Trifluoroacetyl chloride	Toluene 2,4-diisocyanate
		Toluene 2,6-diisocyanate

Source : http://www.ncjrs.gov/pdffiles1/nij/184449.pdf (National Institute of Justice, List, June, 2000)

Annexure-IV

Important Legislations and Rules related to Different Aspects of Chemical (Terrorism) Disasters

1. The Environment (Protection) Act, 1986 (amended 1991)
   - The Environment (Protection) Rules, 1986 (amended 2004)
   - The Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 (amended 2000)
   - Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008
   - The Environment Impact Assessment Notification, 2006
   - The Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996
   - Bio-medical Wastes (Management and Handling) Rules, 1998 (amended 2000)
2. The Factories Act, 1948 (amended 1987)
   - State Factory Rules
3. The Inflammable Substances Act, 1952
4. The Motor Vehicles Act, 1988 (amended 2001)
   - The Central Motor Vehicles Rules, 1989 (amended 2005)
5. The Public Liability Insurance Act, 1991 (amended 1992)
   - The Public Liability Insurance Rules, 1991 (amended 1993)
6. The Petroleum Act, 1934
   - The Petroleum Rules, 2002
7. The Insecticide Act, 1968 (amended 2000)
   - The Insecticide Rules, 1971 (amended 1999)
8. The National Environment Tribunal Act, 1995
9. 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)
10. The Explosive Substances Act, 1908

11. The Drugs and Cosmetics Act, 1940 and various Rules framed thereunder
12. The Poison Act, 1919
13. The Weapons of Mass Destruction and their Delivery Systems (Prohibition of Unlawful Activities) Act, 2005
14. The Defence of India Act, 1971 and the Rules framed thereunder
15. The Civil Defence Act, 1968
16. The Water (Prevention and Control of Pollution) Act, 1974 and Rules, 1975
17. The Air (Prevention and Control of Pollution) Act, 1981 and Rules, 1983
18. The Chemical Weapons Convention (CWC) Act, 2000
19. The Disaster Management Act, 2005

Annexure-V

Chemical Security: Relevant Issues

There are a number of instances where simple observations can give rise to suspicions/indications of a chemical threat at the installation level, during transportation, and during sale/purchase of chemicals, or which can indicate the possibility of chemicals being used for the purpose of chemical attacks and other nefarious activities:

Installation level

- Repeated false alarms received at installations or repeated equipment failure.
- Probing at the installation, unnecessary questioning by strangers.
- Evidence of tampering or holes in fences of the installations observed during weekly checks.
- Suspicious vehicles, persons, unattended objects in the nearby vicinity of the installations.
- Addition of abnormal valves, connecting pipes that might be used to steal chemicals.
- Repeated telephonic enquiries about the operating hours of different key personnel and other employees.

Transportation

- Abandoned vehicles, unexplained delays in the process of delivering chemicals.
- Suspicious vehicles, irreconcilable quantity and quality discrepancies observed. Missing shipments, and damaged containers need to be reported immediately.
- Material contamination gives indication about possible tampering.
- Contact with unauthorised persons en route and unusual questioning.
- Security breach at the source and sink facilities.

Monitoring the orders placed by buyers

- Buyers who are not able to explain the usage of chemicals ordered in bulk.
- Cash payment of large amounts need to be followed up.
- Site of delivery is not a working chemical facility.
- New or unknown customer without reliable references.
- Unusual inquiries or quantities ordered not matching with the usage abilities indicate possible misuse.
- Unusual request for large number of samples of hazardous chemicals.

Miscellaneous

- Theft of information (hacking), PPE, data, keys, codes or loss of inventory from the installation.
- Unauthorised or unidentified persons seeking employment, abnormal individual behaviour, out of place personnel, negligence in professional behaviour, are indicators for suspicion.
- Inputs received from intelligence agencies regarding bomb threats, alerts, especially close to an important date of national/religious importance.

Annexure-VI

Principles of Permeation and Modes to Remove Contaminants from the Air

Permeation of chemicals through impermeable protective clothing

Permeation is a process by which the chemical moves through the material on a molecular level. The process of permeation involves:

i) Sorption of the chemical into the outer surface of the material.

ii) Diffusion of the sorbed molecule in the material.

iii) Desorption of the molecules from the opposite surface of the material.

Factors such as thickness, solubility of the contaminants, crystallinity or degree of cross-linking and temperature can affect the permeability of the chemical contaminant through them.

Permeation of chemicals through permeable protective clothing

Chemical contaminants permeate through the outer layer and come into contact with the adsorbent material which is generally carbon, and are adsorbed over the surface. They are held over the surface by dispersive forces such as van der Waal's forces. The adsorption capacity of the clothing, resistance to the contaminant and protection time depends on the type of chemical contaminant, their concentration, surface area of the adsorbent used, and the temperature.

Removal of contamination from the air

Air contaminants may be present in gaseous or aerosol forms. The dimensions of the particulate/aerosols may range between 0.1 to 10 microns. Two entirely different principles are utilised for the removal of contaminants. The aerosols are held over a fibrous medium while vapours and gaseous products are either adsorbed by microporous filters or chemically detoxified.

Removal of aerosols: The apparatus used for the removal of contaminant aerosols is known as High Efficiency Particulate Aerosol (HEPA) filter and is composed of glass fibres of diameter 1.0 to 10 microns embedded in a suitable matrix. The aerosol particles of the contaminant are captured on the surface of the filter medium by van der Waal's forces. There are four mechanisms at work here—interception, sedimentation, impaction and diffusion.

Interception: When a particle following a gas streamline comes in contact of a filter fibre, interception occurs.

Sedimentation: When particles come into contact with a filter fibre and settle down due to their motion under gravity.

Impaction: When a particle is large and unable to adjust quickly to the abrupt change in streamline direction near a filter fibre. The particle, due to inertia, will continue on its original path and hit the filter fibre.

Diffusion: When particle retention is the result of the Brownian motion of gas molecules when they come in contact with a filter fibre.

The efficiency of the filtration depends on the diameter of the fibre medium, particle size of the aerosols and rate of airflow through the filter. It is the fraction of influent amount of aerosol that is retained on the fibre.

i.e., % particulate removal efficiency = [C1-C2)x100]/C1

where C1 is the amount of aerosol given and C2 is the amount of aerosol penetrating through the filter for an observed particle size.

Experimentally it has been observed that small particles are captured by the diffusion mechanism while larger ones are removed from the air stream by impaction and interception. There appears to be a particle size for which all mechanisms are relatively ineffective. Aerosols of the dimensions of 0.3 microns and less are the most difficult to filter. Due to this, aerosol filters are tested against aerosol particles of various sizes. The particulate removal efficiency of the filter should not be less than 99.97%.

The penetration of aerosols is a function of the air flow reaching maximum values at linear air velocities of 10 to 20 cm/s. Under the influence of particles collected in the filter, the efficiency is not altered, however, the resistance to air flow increases. This filtration mechanism is applicable to all cases where HEPA filters are utilised.

Filtration of gases

Gaseous contaminants from air are removed by one of three processes—adsorption, catalytic decomposition, and chemisorptions, which are discussed below.

Adsorption

Gaseous materials are adsorbed on activated surfaces by physical forces (physiosorption), in which van der Waal's forces predominate. These forces act regardless of the chemical structure of the adsorbed molecules. Adsorption capacity and rate of adsorption are two important parameters in determining the usefulness of the adsorbent and the length of a time a filter can be used under a given condition. Protection time is determined by the breakthrough curves. When a filter is challenged with a constant concentration of the agent at a given airflow rate, adsorption of the agent occurs over the gas filter bed and it continues till the bed starts to breakthrough. The time interval from the initial input to the breakthrough of the agent is taken as the protection time of the filter under experimental conditions.

Adsorption capacity

Adsorption capacity of the adsorbent depends on a number of factors such as the surface area, micro-porosity and relative vapour pressure.

One of the common adsorbents of CW agents is activated carbon that weakly adsorbs water vapours. Water vapour also competes with other molecules as an adsorbate. The adsorption is directly related to the surface area of the adsorbent, the higher the surface area the greater will be its adsorption capacity. Moreover, the adsorption is related further to the accessibility of the pores to the shape and size of the adsorbate molecules. Surface functional groups also play an important role in the adsorption phenomenon. Polar substances will be adsorbed to a greater extent than non-polar ones on a polar surface.

Adsorption is a reversible process. Hence, desorption of the material should not be overlooked as it may take place even at normal airflow rates. At higher temperatures and airflow rates, it will be significant. It is essential to determine the service time of the filters at a temperature in the range of 60 degree Celsius, as the low boiling molecules make the process more complicated because of their high evaporation and desorption in a hot climate.

Catalytic decomposition

It is the most preferred process for detoxification of contaminants into a non-toxic product. Though a perfect catalyst capable of detoxifying CW agents is nowhere near realisation, the fact that all the toxic compounds can undergo oxidation, may hold the clue to the development of such a catalyst. Catalytic decomposition may probably be applied for individual respiratory protection in an industrial environment where the gases to be decomposed are known, unlike a military situation. The principle of catalytic decomposition has also been adapted for military canister cyclospor chloride, hydrogen cyanide and phosgene.

Annexure-VII

Decontamination of Chemical Warfare Agents

Introduction

For protection against CW agents, decontamination plays an important role. The aim of decontamination is to rapidly and effectively render harmless, or remove poisonous substances both on personnel and equipment. A high decontamination capacity is one of the factors which may reduce the effect of an attack with CW agents. In this manner it may act as a deterrent.

The need for decontamination should be minimised to the extent possible by contamination avoidance and early warning. For example, equipment which can be decontaminated easily by means of suitable design, and resistant surface covering can be preferred.

Decontamination is time-consuming and requires resources. Nerve agents and substances causing injury to the skin and tissue are easily soluble and penetrate many different types of material, such as paint, plastics and rubber, all of which render decontamination more difficult. If CW agents have penetrated sufficiently, then toxic gases can be released from the material for long periods. By adding substances which increase the viscosity of a CW agent, its persistence time and adhesive ability can be increased. These thickened agents will thus be more difficult to decontaminate with liquid decontaminants since they adhere to the material and are difficult to dissolve.

Decontaminants

Decontamination is based on one or more of the following principles:

- To destroy CW agents by chemically modifying them (destruction).
- To physically remove CW agents by absorption, washing or evaporation.
- To physically screen-off the CW agent so that it causes no damage.

Most CW agents can be destroyed by means of suitable chemicals. Some chemicals are effective against practically all types of substances. However, such chemicals may be unsuitable for use in certain conditions since they corrode, etch or erode the surface. Sodium hydroxide dissolved in organic solvent breaks down most substances but should not be used in decontaminating skin other than in extreme emergencies when alternative means are not available.

Decontaminants that have effect only against a certain group of substances can be an alternative in favour of a substance with general effect. The condition is that they will be faster and more effective against the substance in question and/or have a milder effect. Examples of such substances are chloramine solutions which are often used to decontaminate personnel. These are effective against mustard agents and V-agents but are ineffective against nerve agents of G-type (sarin, soman, tabun). A water solution of soda rapidly renders nerve agents of G-type harmless but when used in connection with V-agents, it produces a final product which is almost as toxic as the original substance. This does not prevent V-agents being washed-off with a soda solution, provided a sufficient amount is used. However, it should be kept in mind that the final product will always be poisonous.

The disadvantages of specifically-acting decontaminants are that it is necessary to know which CW agent has been used and that access to several different types of decontaminating substances is required.

Source: http://www.opcw.org/resp/html/decon.html

Decontamination methods

CW agents can be washed and rinsed away, dried up, sucked up by absorbent substances, or removed by heat treatment. Water, with or without additives of detergents, soda, soap, etc., can be used, as well as organic solvents such as petroleum products. Emulsified solvents in water can be used to dissolve and wash-off CW agents from various contaminated surfaces.

When decontaminating by washing, consideration must be taken to the poisonous substance remaining in the decontaminant unless the CW agent has first been destroyed. The penetration ability of a CW agent can be enhanced when mixed with solvent.

Today, there is an international development towards chemically resistant paints and materials, which implies that water-based methods will become more effective. However, the need for penetrating decontamination methods will remain for many years.

When washing with water—particularly with hot water and detergent—the CW agent will often be decomposed to some extent through hydrolysis. Detergents containing perborates are particularly effective in destroying nerve agents. Without an addition of perborates in the detergent, the hydrolysis products of V-agents may still remain toxic unless the pH is sufficiently high. Mustard agent is encapsulated by detergent and consequently, the hydrolysis rate decreases in comparison with clean water. However, the low solubility of mustard agent makes it difficult to remove without the addition of detergent, but the water used will still contain undestroyed mustard agent.

Small areas of terrain, e.g., first aid stations may be decontaminated by removal of the topsoil. Another alternative is to cover the soil with chlorinated lime powder (sludge), which is a decontaminant with a general effect and releases active chlorine. CW agents which have penetrated into the soil, from where they release toxic vapour, are screened-off since the gas and liquid is destroyed by the chlorinated lime.

The physical screening-off of CW agents by covering them can be done in the terrain by spreading a layer of soil or gravel over the contaminated area. The effect will be improved if bleaching powder is mixed into the covering material. Another example of covering is to use special plastic foil to cover contaminated areas inside vehicles. In this way, personnel will be protected against CW agents.

Individual decontamination

The most important decontamination measure naturally concerns the individual. If it is suspected that the skin has been exposed to liquid CW agents, then it must be decontaminated immediately (within a minute). All experience confirms that the most important factor is time—the means used in decontamination are of minor importance. Good results can be obtained with such widely differing means as talcum powder, flour, soap and water, or special decontaminants.

In complete decontamination, clothes and personal belongings must also be decontaminated. If clothes have been exposed to liquid contamination, then extreme care must be taken when undressing to avoid transferring CW agents to the skin. There may be particular problems when caring for the injured since it may be necessary to remove their clothes by cutting them off. This must be done in such a way that the patient is not further injured through skin contact with CW agents.

During subsequent treatment it is essential to ensure that the entire patient is decontaminated to avoid the risk of exposing the medical staff to the CW agents.

Source: http://www.searo.who.int/EN/Section23/Section1001/Section1471_6013.htm

In most countries, such equipment includes means for individual decontamination, generally a mixture of chlorinated lime and magnesium oxide. This decontaminant works by absorbing liquid substances and also by releasing free chlorine which has a destructive effect on CW agents. The dry powder also has a good effect on thickened agents since it bakes together the sticky substance which makes it easier to remove. Personal decontaminants containing chlorinated lime have, however, an irritating effect on the skin. Consequently, comprehensive use should be followed by a bath or shower within a few hours.

Liquid personal decontaminants are common in some countries. Sodium phenolate or sodium cresolate in alcohol solution are used for individual decontamination of nerve agents. Chloramines in alcohol solution, possibly with additional substances, are commonly used against, e.g., mustard agent. Instead of liquid individual decontaminants, it is possible to use an absorbent powder such as bentonite (Fuller's Earth).

In the USA. the wet method formerly used was replaced by a decontaminant powder based on a mixture of resins, which decompose CW agents, and an absorbent.

A factor common to all individual decontaminants is that they can effectively remove CW agents on the surface of the skin. However, they have only limited ability to remove CW agents which have become absorbed by the skin, even though very superficially. CW agents that have penetrated into the skin therefore function as a reservoir which may further contribute to the poisoning also after completed decontamination.

In some cases, a wet method may give a better result in decontaminating deeply penetrated agents than a dry method. Reports from France indicate that a solution of potassium permanganate gives effective destruction of CW agents on the surface of the skin and also a certain penetrating effect. There are also individual decontaminants which can simultaneously function as a protective cream for use as a prophylactic. Canada has developed a mixture of a reactive substance (potassium 2,3-butadion monoximate) in polyethyleneglycol, which has both these properties. It can be applied to the skin either as a cream or with a moist tissue.

Decontamination of equipment

Immediate decontamination of personal equipment and certain other kinds of smaller equipment is generally done with individual decontaminants. However, these substances are only capable of decontaminating liquid CW agents covering the surface. The decontamination is mainly done to prevent further penetration into the material and to decrease the risk when handling the equipment.

CW agents easily penetrate different materials and into crevasses and will thus be difficult to reach by methods only designed for superficial decontamination. When a CW agent has penetrated into the surface, it is necessary to use some kind of deep-penetrating method.

If such a method cannot be used, then it must be realised that the equipment cannot be used for a long period. Depending on the type of CW agent used and prevailing weather, i.e., temperature, wind velocity and precipitation (water solubility), the 'self-decontamination' may take many days or even weeks. The absorption into the surface and natural chemical degradation are important factors influencing the self-decontamination period.

The diffusion and evaporation rate of CW agents from material is speeded-up considerably when heated. The decontamination tent used by the Swedish army is heated with a mixture of hot exhaust gases and

Source: http://www.totse.com/en/bad_ideas/guns_and_weapons/deconcwa.html.

air from a small jet-pulse engine. The tent is used for decontamination of lighter articles, e.g., personal equipment. The decontamination container used by the civil defence forces is a development of the tent and heated with heat-exchanged hot air from a diesel burner.

The temperature in the tent is kept at about 130°C and in the container at 80–130°C, depending on the type of material to be decontaminated. Decontamination time varies between two and five hours depending on the temperature.

Other methods utilising heat are steam or hot air which is blown against the contaminated surface. Decontamination by boiling is also an effective method. The advantage in comparison with heat is that hot water hydrolyses and renders harmless many types of CW agents. The method may be of some interest in small-scale decontamination of rubber material, e.g., protective masks.

Decontamination of CW agents which have penetrated deeply into the surface can also be done with decontaminants which are capable of penetrating the contaminated material. There are different substances with varying properties. A modern decontaminant is the German emulsion which consists of calcium hypochlorite, tetrachlorethylene, emulsifier ('phase transfer' catalyst) and water. Instead of tetrachlorethylene, the more environmentally harmless xylene is sometimes used.

Decontamination of vehicles and other large objects sometimes is done with steam and suspension and/or emulsion systems. A German company has developed special equipment, C8-DADS (Direct Application Decontamination System), with which the emulsion is prepared and then dispersed onto the vehicle or the terrain.

Generally, it is an advantage to give the material an initial flushing with water before the chemical solution is added. A Swedish development of this approach is ongoing, where the intention is to spray water on, e.g., a vehicle which passes through a flushing arch. The flushing arch has several jets which are supplied with water from a powerful pump. Another type of equipment which can use water from lakes, etc., has been developed by a Norwegian firm. This is used for both flushing with cold and hot water/steam and also as a field shower.

In order to facilitate decontamination and decrease the risk when touched, the material can be painted with chemical resistant paint systems, e.g., polyurethane paint. Design of the equipment is also of major importance for ease of decontamination.

Annexure-VIII

Dos and Don'ts

Management of a terrorist incident involving CW agents—a quick reference to assist first responders: In case a chemical attack has occurred, the situation has to be managed so as to cause minimum possible damage to the population exposed to such an attack. This can be achieved by following certain Dos and Dont's enlisted below.

Dos

- Be alert for signs of secondary devices.
- Cordon off the chemical contaminated area (100 metre dia).
- Ascertain the wind direction and clear the downwind side immediately up to a distance of at least 500 metres with a corridor width of 50 metres.
- Alert hospitals immediately to expect mass casualties.
- The rescue team comprising of experts including medical doctors, nursing staff, chemists, police personnel, to put on full protective gear.
- Detect the agents using Three Colour Detector (TCD) paper and Residual Vapour Detection (RVD) kit.
- Use AP2C/CAM also, to detect and identify nerve or blister agents.
- In case a nerve agent is detected, antidotes to the victims to be given immediately using Autoject Injectors (AJI). In case of blister agents, skin contamination is to be removed using Personal Decontamination Kits (PDK).
- Demarcate the area of contamination using a spectroscopy based Chemical Agent Monitor (CAM) or flame photometry based monitor like AP2C.
- Wear a decontamination suit and decontaminate the area using Portable Decontamination Apparatus (DAP) and Decontamination Solutions (DS2).
- Simultaneously, casualties should be decontaminated with decontamination powder as first aid.
- Use casualty bag to remove affected people for treatment/hospital.
- The dressing and undressing of protective gear (PPE etc.) should be done by a trained person.

Personal Protective Gear: Sequence Of Dressing

IPG (Individual Protective Gear)

Shoes

Surgical (Inner) and Butyl Rubber Gloves

Face Mask and Canister

Personal Protective Gears: Sequence Of Undressing

Clean with Decontamination Kit
Remove Shoes
Butyl Rubber Gloves
IPG
Surgical Gloves (Inner Gloves)
Canister and Face Mask

Don’ts

- Do not touch any pool of liquid.
- Do not crowd near the victim to avoid further contamination.
- Do not go in the downwind direction.
- Do not enter cordoned-off areas until final clearance is given.
- Those in the rescue crew should not remove their protective gear until they are declared safe.
- Do not handle contaminated clothing and protective gear with bare hands; put these in sealed polythene cover for safe disposal later.

Annexure-IX

Important Websites

Ministry/Institute/Agency	Website
Ministry of Home Affairs	http://mha.nic.in/
Ministry of Environment and Forests	www.envfor.nic.in
Ministry of Health and Family Welfare	http://mohfw.nic.in/
Ministry of Labour and Employment	http://labour.nic.in/
Ministry of Agriculture	http://agricoop.nic.in/
Ministry of Petroleum and Natural Gas	http://petroleum.nic.in/
Ministry of Chemicals and Fertilisers	http://chemicals.nic.in/
Department of Road Transport and Highways	http://morth.nic.in/
Ministry of Commerce and Industry	http://commerce.nic.in/
Department of Economic Affairs	http://finmin.nic.in/the_ministry/dept_eco_affairs/
Ministry of Finance	http://finmin.nic.in/
Ministry of Defense	http://mod.nic.in/
Department of Atomic Energy	http://www.dae.gov.in/
IICT, Hyderabad	www.iictindia.org
ITRC, Lucknow	www.itrcindia.org
NEERI, Nagpur	http://neeri.res.in/
NCL, Pune	www.ncl.res.in/
NIOH, Ahmedabad	www.nioh.org
National Disaster Management Authority	www.ndma.gov.in
Council of Scientific and Industrial Research	http://www.csir.res.in/
Defence Research Development Organisation	http://www.drdo.org/
Indian Institute of Chemical Technology	www.iictindia.org
Indian Institute of Technology	http://www.iitd.ac.in/
National Civil Defence College	http://ncdcnagpur.nic.in
National Safety Council	www.nsc.org.in
United Nations Development Programme	www.undp.org.in
UNEP/DTIE	www.uneptie.org
World Environment Centre	http://www.wec.org
CWC information	http://chemicals.nic.in/chem4.htm
OPCW	http://www.opcw.org
AIIMS	www.aiims.edu
FICCI	www.ficci.com

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