Guideline
For the First Responders
In the Disasters
From
Chemical and Technological Hazards

Ministry of Disaster Management and Relief Government of the People's Republic of Bangladesh

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Abbreviations

ADPC Asian Disaster Preparedness Centre

APELL Awareness and Preparedness for Emergencies at Local Level

CAS Crisis Alert System

CCG Central Crisis Group

CCR Central Control Room

CDM Chemical Disaster Management

CETP Common Effluent Treatment Plant

CFEES Centre for Fire, Explosive and Environment Safety

CIF Chief Inspector of Factories

CIR Community Information Representative

CLI Central Labour Institute

CMVR Central Motor Vehicles Rules

CPAP Continuous Positive Air Pressure

CPCB Central Pollution Control Board

CRR Community Response Representative

DDMAP District Disaster Management Action Plans

DEA Department of Economic Affairs

DM Disaster Management

DMP Disaster Management Plan

DRM Disaster Risk Management

EIA Environment Impact Assessment

EIP Emergency Information Panel

EMP Emergency Management Plan

EOC Emergency Operations Centre

ERC Emergency Response Centre

ERF Environment Relief Fund

ERRIS Environment Risk Reporting and Information Systems

GIS Geographic Information System

GPS Global Positioning System

HAZAN Hazard Analysis

HAZCHEM Hazardous Chemical

HAZMAT Hazardous Material

HAZOP Hazard and Operability Study

HPC High Powered Committee

HPCL Hindustan Petroleum Corporation Ltd

HSE Health, Safety and Environment

IATA International Air Transport Association

ICAO International Civil Aviation Organization

ICSC International Chemical Safety Cards

IDLH Immediately Dangerous to Life and Health

ILO International Labour Organization

IMO International Maritime Organization

IPCS International Programme on Chemical Safety Chemicals

IRPTC International Register for Potentially Toxic

ISDR International Strategy for Disaster Reduction

ITRC Industrial Toxicology Research Centre

LCG Local Crisis Group

LNG Liquefied Natural Gas

LPG Liquefied Petroleum Gas

MAH Unit Major Accident Hazard Unit

MAHC Major Accident Hazard Control

MAHCAD Major Accident Hazard Control Advisory

Division MARG Mutual Aid Response Group

MARPOL Maritime Pollution

MFR Medical First Responders

MIS Management Information System

MSDS Material Safety Data Sheet

NAC National APELL Centre

NGOs Non-Governmental Organizations

NICNET National Informatics Centre Network

NOCs No Objection Certificates

PCC Pollution Control Committee

PESO Petroleum and Explosives Safety Organisation

PM Preventive Maintenance

PMS Pipeline Management System

PPE Personal Protective Equipment

PPP Public Private Partnership

PVOs Private Voluntary Organisations

PWD Public Works Department

QRMT Quick Reaction Medical

Team QRT Quick Reaction Team

QSP Quick Start Programme

RC Responsible Care

R&D Research and Development

SAICM Strategic Approach to International Chemical Management

SMEs Small and Medium Enterprises

SOLAS Safety of Life at Sea

SODs Standing Operating Disaster

STEL Short Term Exposure Limit

TOR Terms of Reference

TQ Threshold Quantity

TTE Table Top Exercise

UN United Nations

UNDP United Nations Development Program

UNEP United Nations Environment Program

USAID United States Agency for International Development

WAD Waste Air Destruction

WEC World Environment Centre

WHO World Health Organization

Vision

The Vision is to prevent chemical, biological, nuclear and radiological emergencies which are essentially man-made in nature. However, in rare cases of their occurrence, due to natural or man-made factors beyond human control, such emergencies will be so managed through certain pre-planned and established structural and non-structural measures by the various stakeholders, as to minimize risks to health, life and the environment.

Foreword

Bangladesh is traditionally vulnerable to natural disasters on account of its unique geo- climatic conditions and it has become equally vulnerable to various man-made disasters. In June, 2010 devastating fire at Nabab Katra, Nimtoli in old Dhaka due to poor management of highly flammable chemicals, has sent shock waves across the country and beyond. This incident alone to 124 lives and left 150 more critically injured. On 9 December 2014, an oil tanker accident in the Sundarbans of Bangladesh led to the release of approximately 350,000 liters of heavy fuel oil into the river and mangrove ecosystem which is listed as a UNESCO World Heritage and a Ramsar site. UNISDR coined this incident as 'Disasters related to chemical hazard' [1]. Another incident is Ammonia Gas leakage at Chittagong Urea Fertilizer Factory. Left hundreds of people with lung and other respiratory injuries. The investigation report mentioned that, "two pressure gauges of the tank were out of order long before the accident took place. Both the pressure transmitters of the reserve tank were inoperative. The condenser, safety valves and pressure vent were also out of order". As well as, "The factory authorities did not have any preparedness to tackle the emission of toxic gas. The gas spread far and wide so rapidly because the fire hydrant system of the fertilizer factory did not work after the accident".

A comparison of data between 1994 and 2007 on 22 hazardous waste generated by industries has shown that the number of hazardous waste units have increased rapidly. The most incremental increases are recorded in pesticides (more than six times), textiles including dyeing and printing (more than four times), paints and varnishes (more than three times), plastics (more than three times), industrial chemicals (nearly doubled) and pharmaceuticals (82 per cent) [2]. On average 21 people die in Bangladesh due to toxic chemicals each month [3]. Apart from textile

industries, the leather industry is of significance to the urban water cycle; there are reportedly around 155 tanneries operating in Bangladesh. Estimates of the number of factories with Effluent Treatment Plants (ETPs) vary from 40 to 80% although it is widely acknowledged that many of the installed plants are poorly designed or not operated in an appropriate and responsible manner [4]. Therefore, chemical, biological, nuclear and radiological emergencies as a subset of technological hazards one such facet of man-made disasters are of relevance and concern to us.

Chemical, nuclear and radiological hazards, as well as transport hazards are defined as those "originate from technological or industrial conditions, dangerous procedures, infrastructure failures or specific human activities. Examples include industrial pollution, ionizing radiation, toxic wastes, dam failures, transport accidents, factory explosions, fires and chemical spills. Technological hazards also may arise directly as a result of the impacts of a natural hazard event. A technological accident caused by a natural hazard is known as a Natech. This guide does not cover structural collapses of buildings and infrastructures such as bridges, dams and factories as this is subject of other guide. The Guide takes a practical approach in addressing man-made and technological (Man-made / Tech hazards), and builds upon previous analyses and recommendations relating to such hazards in the context of DRR for first responders.

Objective, Purpose and Scope

Emergency is sometimes used interchangeably with the term disaster, as, for example, in the context of biological and technological hazards or health emergencies, which, however, can also relate to hazardous events that do not result in the serious disruption of the functioning of a community or society. Chemical releases arising from technological incidents, natural disasters, conflicts and terrorism are common. There is likelihood of secondary effects following an earthquake or aftershocks which may include tsunami, fire, flood, liquefactions, subsidence, damming of rivers, landslides, and dam failure, release of hazardous and toxic chemicals. The consequences of Chemical, Biological, Radiological and Nuclear (CBRN) emergencies may stretch national capabilities to their maximum extent. Paragraph 15 of the Sendai Framework for Disaster Risk Reduction 2015-2030 stated the need to address hazards comprehensively as it applies to the risk of small-scale and large-scale, frequent and infrequent, sudden and slow-onset disasters, caused by both natural and man-made hazards as well as related environmental, technological and biological hazards and risks.

First response remains a national responsibility and it is essential therefore those nations build on their resources to respond and mitigate the consequences of emergencies affecting lives, property and the environment. The aim of this guidelines is to establish procedural guidelines for strategic, operational and tactical planners responsible for CBRN preparedness and response. It will provide generic advice and guidance on procedures, capabilities and equipment required to implement an effective response of the first responders.

The purpose of this Guide is to:

1. Improve understanding of risk management of man-made hazards as they relate to DRR;

2. Provide practical guidance to national DRR focal points and technical experts on how to address man-made hazards in the implementation of the Sendai Framework through the first responders; and

3. Raise awareness of man-made hazards within the overall DRR agenda, including the challenges and opportunities in adequately addressing these.

The Guidelines covers the management of manmade hazards at different scales. It will provide direction to the first responders for preparing detailed action plans to ensure inbuilt capabilities to handle chemical, biological, nuclear and radiological emergencies as part of an all hazard Disaster Management plan in the public domain. A selected number of man-made hazards have been chosen to illustrate the topic. These are:

1. Chemical/industrial hazards
2. Biological hazards
3. Nuclear and radiological hazards

Transport and Marine incidents can be a separate guide. By providing concrete examples of specific hazards, the guide will illustrate how similar guidance can be compiled for other types of man-made hazards.

The scope of this Guide is organized according to the Sendai Framework of disaster risk reduction [SFDRR, 2015]. Each of hazard is explored in terms of how and what practical steps can be taken to better prepare for, prevent and respond by the first responders.

Role of *stakeholders in Man-made / Tech hazards*

In difference to natural hazards, man-made / tech hazards are results of risks produced by humans. Hence, they have a "risk owner" that

- has created the hazard(s),
- operates the installation(s) etc. causing the hazard(s),
- should have the competence to manage the hazard(s),
- is responsible for the hazard(s),
- is liable for damage caused by the hazard(s),
- may profit from the existence of the (installation causing the) hazard(s).

1. Risk owners, such as governments, authorities and public as well as private operators have shared responsibilities regarding the reduction of man-made / tech hazard risk. All actors' roles are hence important and have to be known and acknowledged (SFDRR Chapter V, Article 35).
2. Key responsibilities are outlined in several international conventions and principles. They urge risk owners
   - To openly collaboration with public institutions and engage in the implementation of DRR plans and strategies across scales (SFDRR Chapter V, Article 36),
   - To raise public awareness and support a culture of prevention and education on disaster risk (SFDRR Chapter V, Article 36),
   - To advocate for resilient communities and an inclusive disaster risk management that strengthen synergies across groups (SFDRR Chapter V, Article 36),
   - to take practical as well as legislative, regulatory, administrative and financial measures to prevent and prepare for man-made / tech hazards and mitigate their

transboundary effects (UNECE Convention on the Transboundary Effects of Industrial Accidents (Article 3. & 8), OECD Guiding Principles on Chemical Accident Prevention, Preparedness and Response (General Principles),

3. Risk owners face liabilities regarding costs that result from man-made / tech hazards, following the "Polluter-Pays Principle" (OECD 26/5/1972, OECD C(89)88/FINAL, EU Directive on Environmental Liability (2004/35/EU) (Article 5,6,8)).

Organizational response to Man-made / Technological emergencies

A multi-agency framework will ensure a combined and coordinated response. The management of an emergency will involve one or more of 3 levels of coordination, command and control for emergency incidents:

- Bronze or Initial Operational Response (IOR) [operational]: first or on-scene responders
- Silver or Transition [tactical]: near to scene directing response and allocating resources
- Gold or Specialist Operational Response (SOR) [strategic]: off-site e.g. at headquarters coordinating multi-agency response. Attended by senior representatives from responding agencies; they must be able to commit to decisions and expenditure.

A 'bottom up' approach (bronze upwards) is taken, as not all emergencies will require multi-agency strategic or on scene tactical coordination.

The Gold command is supported by a team providing advice - Scientific and Technical Advisory Committee (STAC). It is chaired by Honorable Minister Ministry of Disaster Management and Relief, e.g. Director of Public Health. There should be multi-agency representation from the health services/commissioners.

Role of the STAC:

- Provide understandable scientific and technical advice during the response to the emergency
- Advise on impact on health of the population, and health impact of containment or evacuation policies

- Agree all media statements and advice to the public related to disaster with the Gold command chair
- Liaise with Armed forces Division, national departments of (public) health, other national and local agencies
- Formulates advice on strategic management of the disaster.

The National Emergency Coordination Center (NEOC) takes the strategic lead and is a forum of Ministers and senior officials from relevant Departments and agencies, brought together to make decisions on an emergency response. External representatives and experts are invited to attend NEOC meetings as appropriate; discussions are confidential.

Role of first responders in Man-made / Tech hazards

The term “First Responders” refers to individuals and teams that are involved in activities which address the immediate and short-term effects of a CBRN incident. This includes on-scene personnel from the police, fire brigades and health services acting to minimize the consequences of a CBRN incident. It also includes personnel in hospitals, crisis management institutions and those involved in detection, verification and warning.

Major steps to be followed by the first responders in Case of an incident

Information gathering, assessment and dissemination

Recognizing that a CBRN incident has, or may occur is critical. Information may be received and disseminated via a number of routes, including intelligence agencies, the public, emergency service control rooms, pre-determined risk information contained in operational response plans, labeling of hazardous substances and transportation containers, first responder observations of signs and symptoms (victims, animals, plants or the environment). Ask yourself the following questions and use a small blank notebook, writing pad, or other appropriate form(s) to record thoughts and ideas [Appendix-1]

Scene management

The scene should be isolated to mitigate any consequences. Effective scene management ("Hot-Zone" management) is required to control access to and from the incident scene, control the movement of contaminated victims, provide working methods for responders and contain the release of any substances. [Appendix-2]

Saving and protecting life

Saving of life is the first priority of all responding agencies. Contamination of victims/casualties must be considered as part of the initial assessment and an effective method for rescue, decontamination and medical treatment must be provided. The provision of timely warnings and/or evacuation of the public where

appropriate, may also contribute to the saving lives by reducing the risk of exposure. [Appendix-3]

Assess risk to health:

- Review health effects and exposure pathways (obtain expert clinical / toxicological advice, weather modelling of plume)
- Define affected population
- Consider sampling persons, animals, environment
- Establish register of exposed/symptomatic persons.

Response:

- Biological, chemical, or radiation release hazard: hazard containment, decontamination then primary treatment of victims, countermeasures, follow up
- Infectious epidemic: containment by case detection and isolation and contact tracing, control measures, prophylaxis for exposed, arrange definitive treatment of cases and follow up.

Communications:

Following the immediate operational response, specialist advice should be sought to assist with consequence management. This may include hazard identification or confirmation, establishing levels of contamination, medical support, transportation and treatment of casualties and supplementing emergency service resources. [Appendix-4]

- Advise partner agencies and professionals [Environmental Health Specialists, Epidemiologists, Safety and Health Specialists, Laboratory Personnel, Mental and Behavioral Health Personnel, Medical Officers/Nurses] via a STAC

- Media (statement/press release/briefings)
- Public (telephone helpline)

Post-acute-phase response – activate recovery plans:

- Site clean up
- Clinical follow up of those affected
- Initiate epidemiological study

When the cause of a CBNR is unknown, emergency personnel should use these safety triggers.

Step 1	One causality	Approach using **NORMAL** procedures CBRN contamination unlikely
Step 2	Two causalities	Approach with **CAUTION, consider all options** procedures CBRN contamination possible Report on arrival, update control If possible or suspected, below advice for step 3
Step 3+	Three causalities or more	**DONOT APPROACH – CBRN INCIDENT CONTAMINATION LIKELY** Identify hazards Control scene Give METHANE report as soon as possible Direct ambulant causalities to place of safety Make risk assessment and provide help to non-ambulant causalities if benefit outweighs risk using minimal personnel and appropriate PPE

Do NOT compromise your own safety or that of your colleagues or the public

- remember that the emergency services have staff trained and equipped to deal with CBRN incidents
- establish Shared Situational Awareness using the METHANE Model

METHANE
My call sign /major incident alert
Exact location
Type of incident
Hazards at the scene
Access
Number of causalities and severity
Emergency services present or required

Chemical / Industrial hazards

A chemical accident is defined as "any unplanned event involving hazardous substances that causes or is liable to cause harm to health, the environment or property, such as loss of containment of hazardous substances, explosions, and fires" [5]. The impact at a local level of a chemical or industrial accident can be significant for the surrounding community. Major accidents as well as smaller, recurrent chemical accidents cause severe harm to workers, communities, municipalities, businesses and the environment. In addition to loss of life, the major consequences of chemical disasters include impact on livestock, flora/fauna, the long-term impact on environment (air, soil, water) and losses to industry as shown in Figure 1.

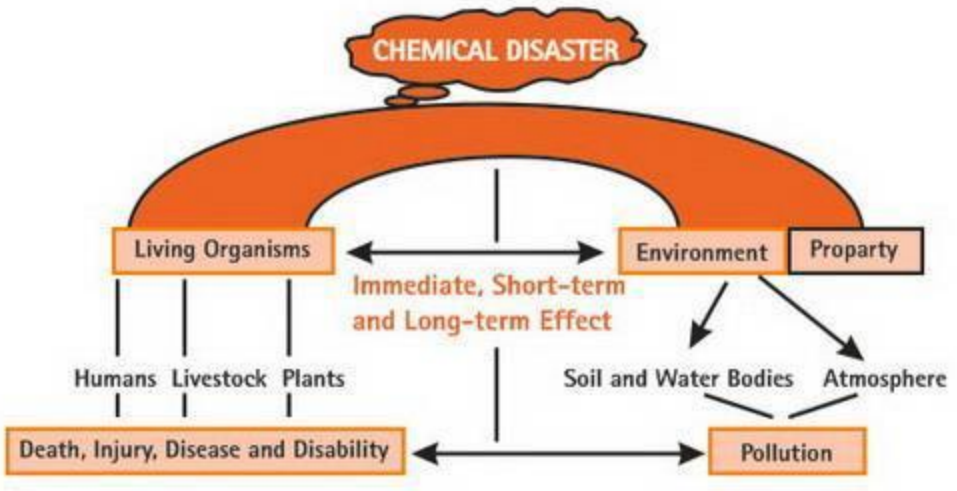

Figure 1: Effect of Chemical disaster [source [6]]

Sources of Chemical Disasters

Chemical accidents may originate in:

i) Purchasing and delivery areas

ii) Product storage areas

a. Chemical storage areas
b. Non-chemical storage areas

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

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

v) Waste storage areas
   a. Chemical waste storage areas
   b. Wastewater storage
   c. Non-chemical waste storage areas

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

1.1. Causative Factors Leading to Chemical Disasters

Chemical disasters, in general, may result from:

i) Fire
ii) Explosion
iii) Toxic release
iv) Poisoning
v) Combinations of the above

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

Hotspots

Urban area is heavily industrialized with most of the industries located in Dhaka, Narayanganj, Narsingdi and Mymensingh. Major rivers and rivers around the major cities like rivers around Dhaka and Narayanganj – Buriganga, Shitalakhya, Turag, Balu; rivers near Chittagong city – Karnafuli, Halda; rivers besides Barisal city – Kirtonnekhola; river besides Sylhet city – Surma; rivers besides Khulna city – Moyuri , Rupsa, Bhoirab; rivers across the Sundarbans and Mongla Port – Rupsa and Passur are very much vulnerable hazardous chemical pollutions. Haor and Flash Flood Area of Bangladesh has the highest annual average rainfall. Of this hotspot, Sylhet is one of the rapidly developing urban areas in the hilly region of the country. Gas based industries have boomed in Sylhet region. Surma and Khushiara are the two main rivers of this hotspot. Since the country is rapidly proceeding to industrial development rolling out 100 new economic zones across the country. That will definitely require more and more attention to the said issues to avoid such incident in future.

Incident scene priorities

- reduce the number of potential casualties by ensuring that:

  -- Injured people are removed from the site of any chemical release if possible without risk to responders

  -- Uninjured people outdoors are moved upwind of any chemical release

  -- Uninjured people indoors remain in shelter with doors and windows shut

  -- Decontamination is done promptly where caustic or irritating injuries are present, or organophosphate (nerve agent) poisoning is suspected

  -- Decontamination is NOT NEEDED if the chemical agent released is a gas

- decontaminate IF NECESSARY according to Joint Emergency Services Interoperability Programmed (JESIP) using the disrobing, and improvised dry or wet protocols for emergency decontamination
- radiation incidents ‑ if life-threatening injury present, treat before decontamination (including transfer to hospital if necessary) and decontaminate only after clinically stable; if no life-threatening injury, decontaminate at scene and then treat
- manage injuries and clinical symptoms using standard resuscitation ABCs guidance
- give counter-measures appropriate to first line use if indicated at the incident scene (high flow rate oxygen and atropine)
- record any treatment given on the triage tag attached to the casualty
- feedback relevant information regularly to MIO/AIO
- ensure that you and your equipment remain in a controlled area until decontaminated, and that you report to the MIO before you leave the site

Nuclear or radiological hazards

A nuclear or radiological emergency is an emergency in which there is, or is perceived to be, a hazard due to the energy resulting from a nuclear chain reaction or from the decay of the products of a chain reaction, or radiation exposure. The International Atomic Energy Agency (IAEA) defines an emergency as a non-routine situation or event that necessitates prompt action, primarily to mitigate a hazard or adverse consequences for human life, health, property or the environment [5]. This includes nuclear and radiological emergencies. It also includes situations for which prompt action is warranted to mitigate the effects of a perceived hazard.

Legislation and Institutions

Government of Bangladesh has enacted Disaster Management Act in September 2012 for prevention and mitigation of all types of disasters including Nuclear and Radiological Emergencies. The Disaster Management Act-2012 [8] regulates the role of different organizations and management schemes in case of natural and manmade disasters. National Disaster Management Council (NDMC) has form under the Act headed by the honorable Prime Minister as the apex body for development of policy and planning and directing relevant activities regarding National Disaster Management

Construction of the first unit of Raipur NPP is anticipated to start from third-quarter of 2017, with commercial operation of the first unit to be started in 2023, and the second one will be a year afterwards. On 21 September 1995, the People's Republic of Bangladesh signed the Convention on Nuclear Safety (CNS). Each Contracting Party of the CNS is obliged to apply widely accepted principles and tools in order to maintain a high level of safety in its nuclear installation(s). Under Bangladesh Atomic Energy Regulatory Act, 2012 [3], has established a regulatory body Bangladesh Atomic Energy Regulatory Authority (BAERA) on 12 February 2013 to regulate the nuclear and radiation safety in a better way to fulfill requirements set by the IAEA as well as other international instruments. BAERA's mission is to ensure the safe and secure use of nuclear energy in Bangladesh so that undue risk to human health and the environment is practically eliminated. According to BAER Act-2012, BAERA shall be the coordinator in formulating national nuclear and radiological emergency plan and for all activities concerning mitigation of emergency situation.

Sources

Let alone the nuclear power plant many other types of facilities and activities involve the use of radiation or radioactive material for agricultural, industrial, medical, scientific and other purposes. Such facilities and activities include, for example, the production, use, import and export of radiation sources; the transport of radioactive material; the decommissioning of facilities; or satellites carrying radioactive material. Governments and regulatory bodies have an important responsibility to establish both standards and the regulatory framework for protecting people and the environment against the risks associated with ionizing radiation exposure. A research finding showed that radionuclide contents and their activity concentrations in beach sand, sediment and adjacent soil samples collected from Inani sea beach, Cox's Bazar, indicated that natural radionuclides were present in the samples [7].

Radiation Protection

Main regulatory document to prescribe the requirement for Radiation Protection is the Nuclear Safety and Radiation Control Rules 1997 [6], which was developed based on the BSS 115. It covers the requirements of radiation surveillance and its procedures, Radiation Protection Programme (RPP), dose limits for different target groups, limits of radioactivity in environments, the duties and responsibilities of Radiation Control Officers (RCO), etc. [8].

Dose Limits for Occupational Workers

- An effective dose of 20 mSv/yr averaged over five consecutive years;
- An effective dose of 50 mSv in any single year;
- An equivalent dose to the lens of the eye of 150 mSv in a year;

- An equivalent dose to the extremities (hands and feet) of 500 mSv in a year

- An equivalent dose to the skin of 500 mSv in a year.

1.1. Dose Limits for members of public

The estimated average dose to the members of the public shall not exceed an effective dose of 1 mSv in a year.

Personal protective equipment (PPE)

Appropriate PPE will protect the responder, the patient and other patients and colleagues from infection and from other hazards, but only if selected, worn, and discarded correctly. PPE can only be part, though a necessary action, of a safety concept. The intent of PPE use should be protection during accidents and incidents that may occur despite appropriate management systems and operational procedures.

a. Eyes: Wear appropriate protective eyeglasses or chemical safety goggles
b. Skin: Wear appropriate protective gloves to prevent skin exposure.
c. Clothing: Wear appropriate protective clothing to prevent skin exposure.
d. Hands: Chemical resistance gloves
e. Nose, mouth, lungs : Respirators

PPE should not be removed. If necessary take advice on choosing and using PPE contact the infection control team (infection hazards) or for chemicals/radiation from local Health Protection Team who will liaise with national health protection experts. Standard precaution and double gloves are needed for radioactive contamination. In case of Biological hazard, Airborne infection isolation is needed following to microbiological testing and specific infections.

Education, Training and Capacity Development

Education

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

Training

Training programs for the first responders like National Disaster Volunteers [CPP, Urban volunteers, FSCD, Red Crescent], company personnel, police and ambulance staff and mutual aid agencies involved in responding to an emergency. Specific training modules need to be prepared for chemical and technological hazard with specialized packages for different stakeholders in a time-bound manner. These modules are required to be tested and implemented at different levels. The amount, type and frequency of training for each member should be clearly spelled out. Training should be provided at least annually and in the following situations:

- for new Volunteers, employees, police, firefighters, ambulance staff community people during their orientation period
- for existing Volunteers, employees, police, firefighters, ambulance staff community people
- when new equipment or materials are introduced
- when emergency procedures are revised
- when a drill indicates need for improvement

It is wise to extend training as far as possible. The paramedical staff lack knowledge on DM and need to be trained with appropriate knowledge of effects of chemicals and clinical modalities for management of their toxicities. The plan should provide for familiarizing local agencies such as fire, police and ambulance staff with the potential hazards of the operation.

Practice Drills

This section should provide for periodic simulation exercises or practice drills. It is important to develop Volunteers, employees, police, firefighters, and ambulance staff community people skills and evaluate the adequacy of the contingency plan through the use of mock exercises or drills. The objectives of a drill include evaluation of the following:

- practicality of the plan (structure and organization)
- adequacy of communications and interactions among parties
- emergency equipment effectiveness
- adequacy of first aid and rescue procedures
- adequacy of emergency personnel response and training
- public relations skills
- evacuation and personnel count procedures

Drills must be frequent enough to ensure that the response team maintains proficiency in all aspects of the contingency plan.

Evacuation

The purpose of this section is to ensure a safe and orderly emergency evacuation of each area or the entire plant. If required, the plan should also include procedures for the notification and evacuation of the surrounding community. The planning for communities is done as a joint effort with local government and industry. The following elements must be considered when developing evacuation plans:

- Need for an alarm system capable of defining different areas and/or degrees of evacuation.
- Maps showing both the primary and alternate evacuation routes.
- Designation of primary as well as alternate off-site assembly areas.
- Designation of employees responsible for checking the evacuation area and for taking personnel counts at the assembly area to ensure that the area has been safely evacuated.
- Designation of emergency escape equipment.
- Providing dispersion estimates for worst and most likely gas/vapour releases to better define the affected areas.
- Procedures to increase the degree/extent of areas to be evacuated if the emergency situation escalates.

Decontamination of casualties

Incidents involving HAZMAT are complicated because victims may become contaminated with the hazardous material. The purpose of decontamination is to make an individual and/or their equipment, or to the wider environment safe by physically removing toxic substances quickly and easily. The first indication of a CBRN incident may be the arrival of contaminated or symptomatic patients at urgent care center. Prompt decontamination after chemical exposure is needed if caustic or irritating injuries are present, or organophosphate (nerve agent) poisoning is suspected.

First responders need a rapid and efficient procedure to decontaminate individuals or large numbers of people in a short amount of time. Such a procedure should consider:

- The condition of the victims - for example, whether they are able to walk (ambulatory) or not; age and health-related factors; and whether they show symptoms of exposure to a hazardous material
- The need to observe victims for delayed symptoms of exposure or evidence of residual contamination
- The potential need for secondary decontamination
- Environmental factors (mainly cold weather)
- Decontamination is NOT NEEDED if the chemical agent released is a gas.
- In a radiation incident, treat and stabilize life-threatening injury before decontamination
- Be alert to the unusual, the unexpected, and the unexplained – and if in doubt, seek expert advice.

Set Up the Decontamination and Support Areas

The decontamination and support areas are established within the Warm Zone, also referred to as the Contamination Reduction Zone.

These include the:

1.1. Primary decontamination corridor :

Decontamination involves thorough washing to remove contaminants. It should be performed in an area upwind of the Hot Zone. An area that is uphill, with good drainage, and easily accessible for responders is preferred. In mass casualty incidents, decontamination corridors can be set up that consist of high volume, low pressure water deluges. An effective and expedient method for setting up a water shower deluge is to use the Ladder Pipe Decontamination System (LDS):

- Position two fire engines parallel to each other and approximately 20 feet apart to create a corridor of water spray from both sides using hose lines and deck guns
- Position an additional truck with a ladder pipe to provide high-volume, low-pressure water flow from above
- Assign personnel to decontamination stations to control and instruct victims when they enter the decontamination area

If the contaminant was a liquid — especially an oily liquid (e.g., sulfur mustard) — then secondary decontamination with an emulsifier (such as soap) may be necessary. Secondary decontamination corridors should be set up between:

- The primary decontamination corridor and the medical triage area
- The primary decontamination corridor and the safe refuge/observation area

If sufficient resources are available, multiple LDSs may be used to:

- Lengthen decontamination corridors to accommodate larger groups of victims
- Decontaminate different groups separately (for example, ambulatory vs. non-ambulatory victims)
- Decontaminate victims at hospitals

The decontamination system should be designed for:

- Children of all ages
- Parentless children
- Non-ambulatory children
- Children with special needs

It should also allow families to stay together.

Use step-by-step, child-friendly instructions that explain to children and parents what they need to do, why they are doing it, and what to expect.

Take into consideration that infants are slippery when wet. You may need an inventive way to get them through the decontamination process using plastic buckets, car seats, or stretchers. If necessary a Secondary decontamination corridors establishment.

Safe refuge/observation area

Set up or assign an area or building as a safe refuge/observation area for victims who do not require medical attention. Here they can be monitored for a delayed outbreak of symptoms or indications of residual contamination.

Unattended children may require supervision. Provide additional staff as necessary. Recommended age-appropriate staffing ratios for unattended children are:

- 1 adult to 4 infants
- 1 adult to 10 preschool children
- 1 adult to 20 school-age children

1.2. Medical triage area

Set up a separate medical triage area for victims who are symptomatic and might require treatment and transportation to a medical facility.

Take precautionary measures to preserve the health and safety of emergency responders working within the Contamination Reduction (Warm) Zone and the Exclusion (Hot) Zone. This includes ensuring responders wear appropriate personal protective equipment (PPE).

Decontaminate the Victims

Victims are decontaminated in the water shower deluge of the decontamination corridor.

Decontamination is most effective if victims first remove their clothing, since this alone may eliminate as much as 80-90% of all contamination. However, the

effectiveness of removing clothes prior to decontamination rapidly decreases with time following exposure, so victims should do so quickly.

While victims are waiting to be decontaminated:

- Keep them spaced apart to avoid secondary contamination and exposure to off-gassing.
- Collect personal items such as keys, wallets, hearing aids, phones, and valuables.

  Make sure you have a method to track victims' belongings to return to them later, such as labeling individual bags with a victim's name.

- Recommend that they remove their clothes.

  If victims are uncomfortable removing all their clothes, don't waste time arguing. In most cases, stripping down to underwear is a reasonable compromise.

  If victims must lift clothes over their head, tell them to avoid inhalation or ingestion by closing their mouth and to use their hands and arms to keep the clothing as far from their face and head as possible.

  Place clothing in a labeled, durable, 6-mil polyethylene bag.

Before victims go through the water shower, instruct them in the proper method for removing contamination (use signage with pictorial or written instructions in the appropriate language if possible). Tell them to:

- Cover all open wounds.

- Thoroughly wash and rinse contaminated skin and hair.
- Avoid breaking or abrading their skin.
- Tilt their heads back, raise their arms, and spread their legs to expose their armpits and groin.
- Prevent runoff from their head or hair from getting into their eyes, nose, or mouth.
- Turn 90 degrees (a 1/4 turn) periodically to expose their entire body to the cross stream of water.

If the contamination involves:

- *A particulate, fine aerosol, or gas:* Victims should rub with their hands, a soft cloth, or a sponge to remove contaminants, starting with their head and proceeding down their body to their feet.
- *A liquid:* Rubbing without the aid of soap is not recommended, since it may spread the agent over a larger surface area of the body, increasing the medical risk. Soap or a solution of detergent and water (which should have a pH of at least 8 but should not exceed 10.5) should be used as soon as possible, but its absence should not delay primary decontamination with water.

Direct victims through the primary decontamination corridor. Wash time should be at least 30 seconds but no longer than 3 minutes to ensure thorough soaking. (After 3 minutes, tissue damage from increased chemical absorption may occur with some chemical agents.)

Decontamination methods

Decontamination methods to be preferred are:

- disrobing
- improvised dry decontamination
- improvised wet decontamination

Standard Fire and Rescue Service frontline decontamination systems should only normally be used for planned and structured decontamination.

NHS secondary care decontamination facilities should be used to manage any casualties self-presenting at hospitals or where contaminated casualties have been transported directly to hospital and the nature of the contaminant may pose a risk to the secondary care environment if decontamination is not performed before admitting.

Disrobing:

Casualty disrobing/undressing is a critical step in the decontamination process and is highly effective at reducing exposure to CBRN materials. Undressing should be systematic and consistent with the steps outlined in the disrobe procedure.

Consideration must be given to ensuring the welfare and dignity of casualties as far as possible.

Improvised decontamination:

Improvised decontamination is the use of an immediately available method of decontamination.

DRY decontamination is the default decontamination method in the UK - primarily for no caustic chemical incidents.

Chemical, biological, radiological and nuclear incidents perform by using use any available dry, paper tissue (eg ‘blue roll) , kitchen towel, toilet roll or paper tissues, towels and clean rags or strips of blanket or sheeting to blot the exposed Skin

· Sufficient absorbent material should be used to avoid transferring contamination from one part of the body to another - rubbing or blotting should not be too aggressive

· All waste material arising from decontamination should be bagged and left in a safe well ventilated space for disposal at a later stage

WET decontamination – to be used if signs and symptoms of caustic substance - is the use of water from any available source such as taps, showers, hose-reels, sprinklers, etc.

• perform using any available source of water such as taps, showers, fixed installation hose reels, sprinklers, etc.

• when using water optimal decontamination takes 90 seconds and, ideally, uses a washing aid such as a cloth or sponge and soap / detergent

• the ‘RINSE-WIPE-RINSE’ Method of improvised wet decontamination should be used with preferably clean warm water and warm water containing detergent (5ml of detergent per liter of water or about three squirts of liquid detergent into a bucket of water), a sponge or soft brush

• do NOT use bleach

• Self-decontamination by casualties is the best approach to take, when possible, with emergency service or emergency department personnel supervising and assisting

• RINSE the affected areas of a disrobed casualty with clean water (no detergent) using showerheads or water from buckets. RINSE from the highest point downward. RINSE only contaminated areas of skin, to avoid spread to uncontaminated areas

• WIPE the affected areas of skin with absorbent material carefully

• RINSE the decontaminated casualty with clean warm water (no detergent) to Remove the detergent and any residual chemicals and dry the skin with a clean towel

• hearing aids should be removed, but should not be immersed in water: either wipe thoroughly with saline-moistened gauze, place in clear plastic specimen bag and keep with patient if patient cannot hear without them, or place with other personal effects

• Eyes: if contact lenses present, remove if possible without harm; use topical anesthetic if needed; flush eyes copiously with 0.9% saline

• If contaminated with radioactive material, survey for residual contamination and if more than 3 x background level, repeat decontamination process

• contain waste water where possible: if not possible do not delay or defer decontamination, seek advice, and inform Environmental Protection Authorities and local utility companies

Wear a disposable single use plastic apron for any task where there is a risk that your clothing or uniform may be exposed to the patient's body fluids or become wet; discard the apron safely when you complete the task and clean your hands before moving to another patient.

Wear a full-body, fluid-impermeable, gown for tasks where there is a risk of extensive splashing of body fluids or contamination of your skin.

Wear eye and face protection for tasks where there is a risk of splashes or spray to your face, eyes, nose or mouth.

Avoid using sharps if possible, and know how to use and discard sharps safely.

Do not re-sheath needles; discard used needles and syringes as a single unit into a sharps bin placed at point of use; do not overfill sharps bins.

Know what to do if there is a sharps injury or blood splash incident.

Always clear up blood spillages promptly and safely.

Never re-use single use disposable equipment (including single use ambo bags, laryngoscope blades/handles, suction equipment), and ensure that re-usable equipment is correctly decontaminated (eg by being sent to cussed) after use and before being used on another patient.

Always dispose of contaminated waste safely, and know how to deal with soiled linen.

Clean, disinfect and sterilize equipment, and decontaminate the environment as appropriate.

If you are in doubt, or unsure about any aspect of infection control, ask your infection control team for advice.

Infection control

Infection control is intended to prevent transmission of infection between patients, from patients to health care workers, and from health care workers to patients. Training in basic infection control and local policies should be provided as part of your orientation or induction.

If you are in doubt about any aspect of infection control, or need training, seek help from your infection control team.

Infection control includes adopting safe behaviors and working practices (eg hand hygiene) that reduce transmission of infection; choice and use of personal protective equipment (PPE: gloves, gowns, eye/mouth/face protection, masks); patient placement (eg protective isolation for immune suppressed patients, isolation rooms, cohort nursing); pre and post exposure prophylaxis (eg HBV immunization); environmental measures (eg cleaning, laundering, safe disposal of clinical waste); design and engineering controls (eg auto-destruct syringes, laminar air flow), and organizational culture - working in an organization where patient and worker safety is highly valued.

Infection control methods are used to prevent contact, droplet and aerosol transmission.

STANDARD PRECAUTIONS are applied by ALL STAFF in ALL HEALTH CARE SETTINGS to ALL PATIENTS, regardless of the patient's diagnosis or presumed infection status, ALL THE TIME.

Any high consequence infectious diseases spread by droplet or aerosol routes should preferably be assessed initially at a designated infectious disease assessment center where available.

Standard precautions – prevention of contact transmission

Practice good basic hygiene with regular hand cleaning.

Cover wounds or skin lesions with waterproof dressings.

Never touch your eyes, nose, mouth or face, or adjust PPE, with contaminated hands or gloves: you risk infecting yourself.

Limit your contact with items in the patient's immediate environment to the minimum necessary for patient care and select PPE for a task according to the anticipated risks

(Splash, spray, splatter, touch, infection, chemical, radiation).

Wear gloves (single use disposable vinyl or nitride) for: all invasive procedures; contact with sterile sites (including wound care and dressing changes); contact with mucous membranes, and all tasks assessed as carrying a risk of exposure to patients' blood or body fluids.

Don gloves immediately before starting the task, remove and discard them safely on

Completion, and clean your hands before moving to another patient.

Work from 'clean' to 'dirty'; change gloves during a procedure if you have to move from a 'dirty' body site to a 'clean' one.

If your gloves get torn or become heavily soiled during a procedure, remove them, discard them safely, clean your hands, and don a new pair.

Appendix- 1

Procedure	Capability	Equipment
Call taking and mobilizing centers • Recognize that a CBRN incident has or may occur • Gather, assess and disseminate all available information to First Responders • Establish an overview of the affected area • Provide and obtain regular updates to and from first responders	• CBRN awareness training for call takers • Method of gathering Information (public, intelligence etc.) • Method of sharing information between responding agencies • Pre-determined level of response to (suspected/ confirmed) CBRN incidents	• Questionnaire • Information technology • Direct telephone lines • Radios • Geographical information (maps) • Response plans for specific Risks
First Responders Approach and on arrival at scene		
• Approach scene with caution and upwind (the wind at your back and blowing to the incident) • Carry out scene assessment • Establish Incident Command (each responding agency) • Recognize the signs and indicators of CBRN • Determine whether CBRN or	• CBRN awareness training for responders • Weather information • Knowledge and understanding of risk assessment • Knowledge and understanding of responding to improvised explosive devices	• Personal Protective Equipment (PPE) • Chemical, Biological and Radiological Detection Identification and Monitoring Equipment (for personnel, boundary monitoring and analysis) • Pocket and/or emergency response guides • Inter-operable communications equipment

Hazmat • Estimate number of casualties/ victims • Estimate resource Requirements • Consider specialist advice/ resources requirements • Provide situation report to emergency control rooms etc. and request assistance if necessary • Carry out risk assessment • Undertake Hazard identification • Do not approach or touch suspect objects/packages– do not operate radios, mobile phones or other electronic Devices within vicinity (Think safe distance 400m?) • Consider secondary devices/ Targets • Establish and agree multiagency response plan • Identify safe rendezvous point for additional first responder vehicles • Search for secondary devices • Consider critical infrastructure	• Knowledge and understanding of roles, responsibilities and capabilities of each responding agency • Effective inter-agency coordination on site • Common command system and structure • Multi-agency communication channels • Knowledge of geographical Area • Search capability • Analysis capability • Knowledge of facilities and critical infrastructure • Protection of unaffected critical infrastructure and key sites (local, regional, national targets)	(handheld radios) • Main scheme radios • Geographical information (maps) • Response plans for specific risks

Sample Questionnaire

- Details of incident: what type of incident; where and when; source of contamination/chemical/infection; what chemical/agent is involved [Annex- D Form or METHANE report]?
- Adverse health effects or complaints: How many exposed; how many affected; what symptoms; how serious; decontamination started or not; antidotes or first aid given; weather conditions if plume?

  Initial response: What agencies are involved; what are the command and control arrangements; should other agencies be called; is the site secure; has sheltering or evacuation been advised; what has been said to the media?

Appendix- 2

SCENE MANAGEMENT:

Isolate scene to mitigate the consequences

Procedure	Capability	Equipment
Initial: • Consider wind direction • Established multi-agency command point in safe area (cold zone) • Establish inner and outer cordon (hot/warm/cold zone)	• Weather information • Common command system and structure • Knowledge and understanding of hot/warm/cold zone	• Pocket and/or emergency response guide • Detection Identification and Monitoring Equipment (for personnel, boundary monitoring and analysis) • Personal Protective Equipment (respiratory protection, chemical protection suits) • Cordon tape and signage
Containment: • Contain contaminant material/ liquid • Establish quarantine(holding) area for contaminated victims/ casualties (where necessary) • Establish decontamination and triage areas	• Knowledge and understanding of signs symptoms and effects of substances (Chemical, Biological and Radiological) • Knowledge and understanding of Hazmat management • Knowledge and understanding of decontamination	• Pocket and/or emergency response guide • Cordon tape, signage, barriers • Detection Identification and Monitoring Equipment (for personnel, boundary monitoring and analysis) • Personal Protective Equipment

• Cordon off contaminated areas	(emergency, mass, clinical) • Knowledge and understanding of medical triage	(respiratory protection, chemical protection suits) • Decontamination equipment (emergency, mass, clinical) • Shelter for victims/casualties form adverse weather
Additional considerations: • Identify and establish multiagency marshalling area for additional resources • Establish traffic cordon • Preserve scene and maintain evidence to the extent possible (criminal investigation) • Carry out coordinated evidence collection	• Identify sites/locations to accept large numbers of multiagency vehicles and resources • Use pre-determine sites/ Locations where possible. • Use available/suitable space With solid foundation. • Knowledge and understanding of scene preservation for criminal investigation (evidence, forensics) • Effective exhibit handling	• Cordon tape, signage and barriers • Recording equipment (Video/ still cameras) • Evidence bags • Detection Identification and Monitoring Equipment (for personnel, boundary monitoring and analysis)

Appendix- 3

SAVING AND PROTECTING LIFE

Save lives, giving warnings or managing evacuation

Procedure	Capability	Equipment
Determine immediate actions and priorities • Evacuate inner cordon (to quarantine area) • Restrict inner cordon access (protected first responders only) • Provide safe system of work for rescuers • Carry out necessary rescues • Implement decontamination as appropriate (emergency, mass, clinical) • Consider decontamination of personal property • Implement medical triage and treatment • Implement	Knowledge and understanding of decontamination (emergency, mass, clinical) • Knowledge and understanding of medical triage • Sufficient numbers of trained personnel to provide (rescue, decontamination, medical support, operational scene management) • Safe system of work for hot zone personnel (recording entry and duration of exposure) • Transportation for contaminated victims/ casualties • Method of communicating timely advice/warnings to the	Personal Protective Equipment (respiratory protection, chemical protection suits) • Recording system for hot zone personnel • Decontamination equipment (emergency, mass, clinical) • Personal property bags (for decontaminated victims) • Post decontamination clothing for victims • Detection Identification and Monitoring Equipment (for personnel, boundary monitoring and analysis) • Medical treatment (Trauma, Prophylactics etc.) • Transport (ambulance, bus etc.)

responder/rescuer decontamination • Consider requirements and provide transport for victims/ casualties • Provide timely warning and advice to the public (immediate vicinity and beyond as necessary) • Consider evacuation (immediate vicinity and beyond as necessary) • Consider utility shutdown • Consider public order • Consider hospital defense (self-presenters)	public • Emergency evacuation plans • Effective link with utility companies • Management of any potential public order problems • Provision of survivor reception center	• Cordon tape, signage and barriers • Prepared documentation • Website • SMS-message • Use of media (Television, Radio) • Use of Social Media (Facebook, Twitter)

Appendix- 4

ADDITIONAL/SPECIALIST SUPPORT

Alert specialists, notify appropriate authorities, and integrate specialist advice and resources

Procedure	Capability	Equipment
Notification: • Notify appropriate authorities at local, regional and national level (governmental and responder agencies) • Notify specialists (chemical, biological, radiological/nuclear, medical) • Consider international support and conventions (IAEA, WHO, OPCW) • Provide situation report to all notifications	• Pre-agreed responsibilities for notification • Scientific support (chemical, biological, radiological/nuclear, medical) • Local, regional, national response plans • Method of requesting regional, national and international support • Bilateral agreements (cross, border assistance) • Methods to transport specialists to required location	• List of notifications (specialists etc.) for mobilizing centers • Information technology • Direct telephone lines • Geographical information (maps) • Response plans for specific risks • Transport for specialists
Assessment: • Prepare impact assessment (en-route/on site) • Establish effect on population • Establish effect on critical infrastructure • Establish effect on	• Prediction (dispersion modelling) • Plan for short, medium and long term actions and effects • Analyze samples • Knowledge of critical infrastructure locations • Pre-established agreement to augment resources (private	• Detection Identification and Monitoring Equipment (for personnel, boundary monitoring and analysis) • Geographical information (maps) • Response plans for specific risks • Critical infrastructure site

environment • Carry out incident specific and environmental sampling • Hazard prediction • Dispersion modeling • Radiation monitoring • Consider emergency provision requirements for immediate and wider area	industry, public service, international aid/support)	locations • Hazard Prediction tools • Meteorological equipment
• Assess resource requirements (short, medium and long term)		
Integration of support:	Integration of support:	Integration of support:
Substance identification: • Substance confirmation	• Additional analysis capability	• Designated laboratories
Victim/casualty support: • Provide information to hospitals • Provide clinical countermeasures • Provide information to General Practitioners • Provide health surveillance (short-medium term) • Provide emergency accommodation	• First aid and treatment centers • Post incident clinical counter measures • Post incident medical care • Sufficient numbers of trained personnel to provide (short – medium term) medical support, casualty bureau staff	• Pre-identify potential accommodation • Prophylactics etc • Information technology • Dedicated telephone numbers/lines • Provision of: food and drink, sleeping accommodation and administration facilities, for victims

• Establish casualty bureau		
Information to public: • Implement communication plan • Provide timely warnings or advice to public • Provide regular updates • Provide health advice to public	• Pre-agreed communication plan • Pre-agreed communication channels/method • Pre-agreed advice (what to do, Where to go, what to expect etc.)	• Prepared literature • Website • SMS-message • Use of media (Television, Radio) • Use of Social Media (Facebook, Twitter) • NATO Practical Guide to Public Information During a Crisis (Budapest Guidelines ll)
Site decontamination/ restoration and remediation: • Decontaminate responder vehicles/equipment • Decontaminate hospitals • Recovery and decontamination of contaminated bodies • Decontaminate/restore affected buildings • Decontaminate and remediate impact on environment	• Environmental impact assessment • Declared environmental/ infrastructure decontamination capability • Legal powers of enforcement regarding building and environmental decontamination • Effective staged implementation plan • Mass fatality plan • Body identification	• Detection Identification and Monitoring Equipment • Specialist equipment and personnel to decontaminate large sites • Mortuaries for contaminated bodies • Personnel and equipment to remove contaminated waste/ rubble

• Dispose of medical waste • Disposal of site waste/rubble	• Waste/rubble removal	
Post incident and long term considerations: • Provide multi-agency debrief for all responders • Provide psychological counselling for victims and responders • Provide long term health monitoring (victims and responders)	• Critical incident debriefing • Psychological counselling (responders, victims, affected population) • Large scale health monitoring • Liaison with effected families • Long term accommodation • Financial assistance for victims	• Network of counsellors • Health monitoring facilities • Temporary/permanent accommodation • Fund raising facility

Appendix- 5

OPERATIONAL GUIDELINES

Types of information that may be included in the appendices include:

1. response team and key company personnel call out list
2. government agencies, news media and medical services telephone list
3. community residents contact list
4. facility maps, drawings and product hazard list organization, roles and responsibilities
5. emergency incident report forms
6. emergency shutdown procedures
7. on-site mobile and emergency equipment list by location
8. off-site mobile and emergency equipment list by location
9. equipment inspection and maintenance schedules
10. air, and water-quality monitoring procedures
11. weather information contacts
12. statutes/laws/regulations (e.g., Spill Reporting Regulation)
13. emergency evacuation plan and escape routes
14. cleanup contractors
15. decontamination procedure
16. material safety data sheets
17. emergency response manual distribution list

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