MINISTRY OF HEALTH MALAYSIA

In partnership with Canada

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, NUCLEAR, AND EXPLOSIVES

MANAGEMENT GUIDELINES

BY
DISASTER, OUTBREAK, CRISIS, AND EMERGENCY MANAGEMENT SECTOR
PREPAREDNESS, SURVEILLANCE, AND RESPONSE SECTION
DISEASE CONTROL DIVISION
MINISTRY OF HEALTH MALAYSIA
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DIRECTOR GENERAL OF HEALTH

The adoption of an all-hazards approach has been guided by the principles set in the International Health Regulations (IHR), reflecting the increasing complexities of international travel and trade, the emergence or re-emergence of global disease threats, and the potential hazards posed by chemicals, toxins, and radiation.

Incidents involving Chemical, Biological, Radiological, Nuclear, and explosives (CBRNe) materials highlights thorough preparedness, strategic planning, and effective management to proactively prevent, identify, respond to, and mitigate such incidents. While these materials are commonly associated with warfare and criminal activities, CBRNe events may also result from natural or accidental releases, requiring a collaborative, multi-agency intervention.

Aligned with the Disaster Management Plan 2025 issued by the Ministry of Health (MOH) Malaysia, this CBRNe Management Guidelines developed by the Disease Control Division, MOH serves as a comprehensive national guidelines for managing CBRNe emergencies. Articulated in a systematic, step-by-step approach based on the disaster management cycle, this plan will be disseminated within the ASEAN Emergency Operations Centre (EOC) Network as a pivotal regional reference document.

Thank you.

DATUK DR. MUHAMMAD RADZI ABU HASSAN
Director General of Health

FOREWORD
DEPUTY DIRECTOR GENERAL OF HEALTH (PUBLIC HEALTH)

First and foremost, I wish to extend my sincere gratitude and appreciation to the organizing committee for successfully completing the Chemical, Biological, Radiological, Nuclear, and explosives Management Guidelines.

As a fundamental responsibility, the Ministry of Health (MOH) is dedicated to ensuring health security across all members of the society and mitigating the adverse consequences of emergencies. This CBRNe Management Guidelines plays an important role in enhancing the preparedness and readiness of agencies in Malaysia, particularly within the Ministry of Health personnel. The significance of this guidelines lies in efficiently managing CBRNe hazards at all levels, particularly those with the potential to trigger national or international emergencies.

The publication of this guideline aligns with the ASEAN Health Cluster Work Program under ASEAN Health Cluster 2: "Responding to All Hazards and Emerging Threats." This initiative is established to meet the requirements outlined in the International Health Regulations (IHR) Article 13 (2005), which mandates State Parties to develop, strengthen, and maintain the capacity to promptly and effectively respond to public health risks and emergencies of international concern.

In conclusion, I express my profound gratitude to all parties involved for sharing their invaluable experience and expertise, contributing significantly to the realization of this CBRNe Management Guidelines publication.

Thank you.

DATUK DR. NORHAYATI RUSLI
Deputy Director General of Health
(Public Health)

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The development of the Chemical, Biological, Radiological, Nuclear, and explosives (CBRNe) Management Guidelines has been a collaborative effort involving the dedication and expertise of numerous individuals and organizations. We would like to extend our heartfelt gratitude to the following:

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  We extend our heartfelt gratitude to ASEAN Secretariat, Global Affairs Canada (GAC), Datuk Dr. Chong Chee Kheong, Senior Advisor for ASEAN Mitigation of Biological Threats (MBT) Programme and Dr. Novia Kuswara, Project Coordinator for ASEAN Emergency Operations Centre (EOC) Network for their unwavering dedication in developing the guidelines. Your vision and commitment have significantly impacted our progress, inspiring us all to strive for excellence. Thank you for your guidance and support.

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  We express our deepest appreciation to the experts in emergency response, disaster management, public health, and related fields who generously shared their knowledge and insights throughout the development of these guidelines. Your expertise has been invaluable in ensuring the relevance, accuracy, and effectiveness of the guidelines.

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- End Users
  Finally, we express our gratitude to the end users of these guidelines, including emergency responders, healthcare professionals, policymakers, and community leaders. It is your commitment to excellence and your tireless efforts to safeguard lives and livelihoods that inspire and drive our collective pursuit of preparedness and resilience.

The successful completion of these guidelines would not have been possible without the dedication, collaboration, and support of all those mentioned above. Thank you for your unwavering commitment to excellence in emergency response and for your tireless efforts to build a safer, more resilient future for all.

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ABBREVIATIONS

AAR	-	After-Action Review
ABC	-	Airway, Breathing, and Circulation
ABG	-	Arterial Blood Gas
AEGL	-	Acute Exposure Guideline Levels
ALARA	-	As Low As Reasonably Achievable
ALOHA	-	Areal Location of Hazardous Atmosphere
AMO	-	Assistant Medical Officer
APPL	-	Approved Products Purchase List
APR	-	Air-Purifying Respirator
ARS	-	Acute Radiation Syndrome
ART	-	Ambulance Response Team
ASEAN	-	Association of Southeast Asian Nations
BAL	-	British Anti-Lewisite
BCP	-	Business Continuity Plan
BIODOS	-	Biological Dosimetry
BRITE	-	Biological Response, Investigation, Training, and Evaluation
BSC	-	Biosafety Cabinet
BSL	-	Biosafety Level
BZ	-	3-Quinuclidinyl Benzilate
CAMEO	-	Computer Aided Management of Emergency Operations
CAS	-	Chemical Abstracts Service
CAT	-	Computerised Axial Tomography
CBRNe	-	Chemical, Biological, Radiological, Nuclear, and explosives
CCC	-	Contingent Control Centre
CCP	-	Casualty Collection Point
CE	-	Cardiac Enzyme
CIR	-	Critical Information Requirement
CMT	-	Crisis Management Team
CN	-	2-Chloracetophenone
CNS	-	Central Nervous System
cpm	-	Counts per Minute
CPRC	-	Crisis Preparedness and Response Centre
CS	-	2-Chlorobenzalmalonitrile
CW	-	Chemical Warfare
CWA	-	Chemical Warfare Agent
CWC	-	Chemical Weapons Convention
DCC	-	District Control Centre
DHO	-	District Health Officer
DHOR	-	District Health Operations Room
DMPS	-	Dimercaptopropane Sulphonate
DO	-	District Officer
DOCC	-	Disaster Operations Control Centre
DOE	-	Department of Environment
DOSH	-	Department of Occupational Safety and Health
DVS	-	Department of Veterinary Services
EMT		Emergency Medical Team
EMTCC	-	Emergency Medical Team Coordination Cell
EP	-	Emergency Physician
EPA	-	Environmental Protection Agency
ERTA	-	Emergency Radiation Treatment Area

ETD	-	Emergency and Trauma Department
FBC	-	Full Blood Count
FBI	-	Federal Bureau of Investigation
FCC	-	Fire Command Centre
FFRA	-	Families and Friends Reception Area
FMS	-	Family Medicine Specialist
FRDM	-	Fire and Rescue Department of Malaysia
g	-	Gram
GA	-	Military code for the nerve agent tabun
GAC		Global Affairs Canada
GB	-	Military code for the nerve agent sarin
G-CSF	-	Granulocyte Colony-Stimulating Factor
GD	-	Military code for the nerve agent soman
GF	-	Military code for the nerve agent cyclohexyl sarin
GHSA	-	Global Health Security Agenda
GIRN	-	Government Integrated Radio Network
GIS	-	Geographical Information System
HAZMAT	-	Hazardous Material
HCN	-	Hydrogen Cyanide
HCW	-	Healthcare Worker
HD	-	Military code for distilled sulphur mustard
HEPA	-	High-efficiency Particulate Air
HOD	-	Head of Department
HME	-	Homemade Explosives
HN	-	Military code for nitrogen mustard
IAEA	-	International Atomic Energy Agency
IAP	-	Incident Action Plan
ICS	-	Incident Command System
ID	-	Infectious Disease
IED	-	Improvised Explosive Device
IHR	-	International Health Regulations
IM	-	Intramuscular
IMR	-	Institute for Medical Research
IMS	-	Incident Management System
IND	-	Improvised Nuclear Device
Ir-192	-	Iridium-192
IRIS	-	Integrated Risk Information System
IV	-	Intravenous
JIC	-	Joint Information Centre
kg	-	Kilogram
L	-	Military code for lewisite
LEL	-	Lower Explosive Limit
LFT	-	Liver Function Test
LP	-	Local Purchase
LRN	-	Laboratory Response Network
MAF	-	Malaysian Armed Forces
MARPLOT	-	Mapping Application for Response and Planning of Local Operational Task
MBS	-	Medical Base Station
MCC	-	Malaysia Control Centre
MCI	-	Mass Casualty Incident
MDD	-	Major Depressive Disorder
MECC	-	Medical Emergency Coordination Centre
MERS	-	Malaysian Emergency Response Services
MERT	-	Medical Emergency Response Team

MHPSS	-	Mental Health and Psychosocial Support
MINDEF	-	Ministry of Defence
mg	-	Milligram
ml	-	Milliliter
MO	-	Medical Officer
MOH	-	Ministry of Health
MOSTI	-	Ministry of Science, Technology, and Innovation
MMEA	-	Malaysian Maritim Enforcement Agency
MRSD	-	Medical Radiation Surveillance Division
mSv	-	Millisievert
mU	-	Milliunit
NACWC	-	National Authority for Chemical Weapons Convention
NADMA	-	National Disaster Management Agency
NCEMH	-	National Centre of Excellence for Mental Health
NCNRM	-	National Centre for Nuclear Response Management
NGO	-	Non-Governmental Organisation
NPHL	-	National Public Health Laboratory
NRC	-	Nuclear Regulatory Commission
NSC	-	National Security Council
OD	-	Once Daily (*omne in die* in Latin)
OEH	-	Occupational and Environment Health
OMC	-	On Scene Medical Commander
OP	-	Organophosphate
OPCW	-	Organisation for the Prohibition of Chemical Weapons
OSC	-	On Scene Commander
OSCP	-	On Scene Command Post
OR	-	Operations Room
OT	-	Operating Theatre
PAPR	-	Powered Air-Purifying Respirator
PFA	-	Psychological First Aid
PHMS	-	Public Health Medicine Specialist
PIO	-	Public Information Officer
POMAR	-	*Pusat Operasi Maritim*
PPE	-	Personal Protective Equipment
PR^3	-	Preparedness, Response, Recovery, and Resilience
PTSD	-	Post-Traumatic Stress Disorder
PTSR	-	Post-Traumatic Stress Reaction
QID	-	Four Times a Day (*quarter in die* in Latin)
RA	-	Risk Assessment
RAT	-	Rapid Assessment Team
RC	-	Risk Communication
RCA	-	Riot Control Agent
RDD	-	Radiological Dispersal Device
RED	-	Radiological Exposure Device
RETCOM	-	Radiation Emergency Treatment Committee
RMP	-	Royal Malaysia Police
RP	-	Renal Profile
RPO	-	Radiation Protection Officer
RRT	-	Rapid Response Team
RT	-	Room Temperature
SALT	-	Sort, Assess, Life-saving Interventions, Treatment, and/ or Transport
SAR	-	Search and Rescue
SCBA	-	Self-contained Breathing Apparatus
SITREP	-	Situation Report

SMART	-	Special Malaysia Disaster Assistance and Rescue Team
SME	-	Subject Matter Expert
SOB	-	Shortness of Breath
SOP	-	Standard Operating Procedure
SPOTREP	-	Spot Report
START	-	Simple Triage and Rapid Treatment
STRIDE	-	Science and Technology Research Institute for Defence
TCE	-	Threat Credibility Evaluation
TDS	-	Three Times a Day (*ter die sumendum* in Latin)
TIC	-	Toxic Industrial Chemical
TC	-	Teleconference
UNODA	-	United Nations Office for Disarmament Affairs
UNSC	-	United Nations Security Council
U.S. CDC	-	United States Centre for Disease Control and Prevention
U.S. EPA	-	United States Environmental Protection Agency
VC	-	Video Conference
VOC	-	Volatile Organic Compound
VHF	-	Viral Hemorrhagic Fever
VRI	-	Veterinary Research Institute
VX	-	Military code for the nerve agent O-ethyl-S-[2(diisopropylamino)ethyl] methylphosphonothioate
WHO	-	World Health Organisation
WISER	-	Wireless Information System for Emergency Responders

CHAPTER 1

INTRODUCTION TO CBRNe

CHAPTER 1: INTRODUCTION TO CBRNe

1.1 What is CBRNe?

CBRNe is the common abbreviation for chemical, biological, radiological, nuclear, and explosives. Responses to CBRNe incidents are made under the assumption that they are intentional and malicious. The use of explosives involving CBRNe materials, including Improvised Explosive Devices (IED) and Homemade Explosives (HME), is frequently associated with criminal and terrorist activity. Nonetheless, these incidents may also be due to natural or accidental release and, in all cases, require a multiagency approach[1].

Regardless of the nature of CBRNe event, its impact can be manifested as:

a) Physical – human and animal deaths, injuries, and diseases.

b) Psychological – stress, anxiety, fear, mass panic, and disruptive daily life.

c) Economic – business disruption, travel restriction, treatment expenses, and recovery costs.

d) Environmental – effects on contaminated sites, animals, plants, foods, water, and air.

Examples of CBRNe event are[2]:

a) A chemical attack that may produce rapid onset of severe symptoms. Many chemical agents can be readily detected and potentially identified with specialised equipment.

b) A biological release may not be identified for some time and may only be recognised through health monitoring. The scene of any release may be unidentified.

c) A radiological release may be accompanied by explosives (a dirty bomb), or the dispersal of radioactive particulates into the air, with no obvious sudden onset of symptoms.

d) A nuclear attack is likely to be readily identified and result in immediate, catastrophic consequences and has a long lasting radiation hazard.

e) Explosives may be used as means of dissemination for the above materials or as an additional method of attack.

Characteristics of chemical agents:

a) Exposure is usually through skin contact, inhalation, or ingestion.

b) Onset of symptoms can be almost immediate in some cases.

c) Victims may exhibit symptoms such as vomiting, shortness of breath, coughing, convulsions, or complain of burning skin.

d) Some very toxic chemicals can cause death almost immediately.

e) There may be a visible cloud or plume of gas.

f) An unusual and/ or pungent odour may be apparent.

g) Dead vegetation or animals present strongly suggests the presence of a toxic chemical agent.

h) Releases from containers.

i) Physical senses and street smarts – if the situation doesn't seem right to first responders.

Characteristics of biological agents:

a) There is usually no taste or odour.

b) They are invisible to the naked eye.

c) Microscopic amounts may cause infection.

d) Symptoms may be delayed by hours, days or weeks (due to incubation period).

e) Some infectious disease can be transmitted from human to human.

f) People may exhibit similar symptoms at an increasing rate until the first cases are diagnosed.

g) Many agents are sensitive to environmental conditions (e.g., to sunlight) although some may survive in the environment for a long time (e.g., anthrax spores).

Characteristics of radioactive materials:

a) Odourless and tasteless.

b) Can be in the form of powders, ceramics, metallic pellets/ wires, liquid, or gases.

c) Substance will emit radiation i.e. alpha or beta particles, x-rays, gamma rays, or neutrons.

d) Radiation type will determine how far the radiation will penetrate whereby gamma rays and neutrons are highly penetrating while alpha and beta particles travel only short distances.

e) Symptoms of exposure may include reddening of the skin or burns, nausea, vomiting, diarrhoea, fatigue, and headaches.

f) Levels of radiation can be detected and measured with the use of specialised equipment such as handheld survey instruments (e.g., Geiger counters, ionisation chambers), personal dosimeters, or radiation portal monitors.

1.2 Scope

In line with the Disaster Management Plan issued by the Ministry of Health (MOH) Malaysia in 2025[3], this CBRNe Management Guidelines serves as a guide to manage CBRNe emergencies effectively via multiagency approach.

1.3 Objectives

The objectives of these guideline are:

a) To enhance the awareness of the CBRNe emergency event management;

b) To provide a reference on the best practices of CBRNe emergency event management; and

c) To empower MOH staffs with the knowledge and skills in managing CBRNe emergency event management.

1.4 United Nations Security Council Resolution 1540

The United Nations Security Council (UNSC) has primary responsibility for the maintenance of international peace and security. Resolution 1540 (2004) adopted by the Security Council on 28 April 2004 urges members countries to take necessary measures to adopt laws which "…prohibit any non-State actor to manufacture, acquire, possess, develop, transport, transfer or use nuclear, chemical or biological weapons and their means of delivery, in particular for terrorist purposes, as well as attempts to engage in any of the foregoing activities, participate in them as accomplice, assist or finance them". The resolution also mentions that States shall, "…take and enforce effective measures to establish domestic controls to prevent the proliferation of nuclear, chemical or biological weapons and their means of delivery, including by establishing appropriate controls over related materials…"

Several international instruments have been developed in order to control the development of and use of chemical, biological, and nuclear weapons which are:

a) Chemical Weapons Convention (CWC), 1997.

b) Geneva Protocol, 1925 (prohibiting use of biological agents in warfare).

c) Biological Weapons Convention, 1972.

d) International Health Regulations (IHR), 2005.

e) Global Health Security Agenda (GHSA), 2014.

1.5 All Hazards Approach

An all hazards approach has been used for many years in emergency and disaster management to describe natural, technological, or man-made events that require action to protect life, property, environment, and public health or safety, and to minimise social disruption. It is applied to public health events that require an immediate response and are potentially caused by more than one hazard, including biological, chemical, and radio nuclear hazards[4], whether naturally occurring or as a result of an accident or deliberate release, and natural disasters such as fires, floods, other extreme weather events, volcanic eruptions, earthquakes, and tsunamis. This all hazards approach has been driven by the IHR, which were revised in 2005, to reflect growth in international travel and trade, emergence or re-emergence of international disease risks, and threats posed by chemicals, toxins, and radiation[5]. The IHR requires all States Parties to the Regulations to develop a set of core capacities in surveillance and response covering any illness or medical condition, irrespective of origin or source that presents or could present significant harm to humans.

Many organizations have include all hazards approach in their disaster management. This include Barcelona Institute for Global Health (IS Global) which has coined the term Preparedness, Response, Recovery, and Resilience (PR^3) as a concept that combines different phases for the efficient preparedness and response to health crises within an all-hazards preparedness and response framework.

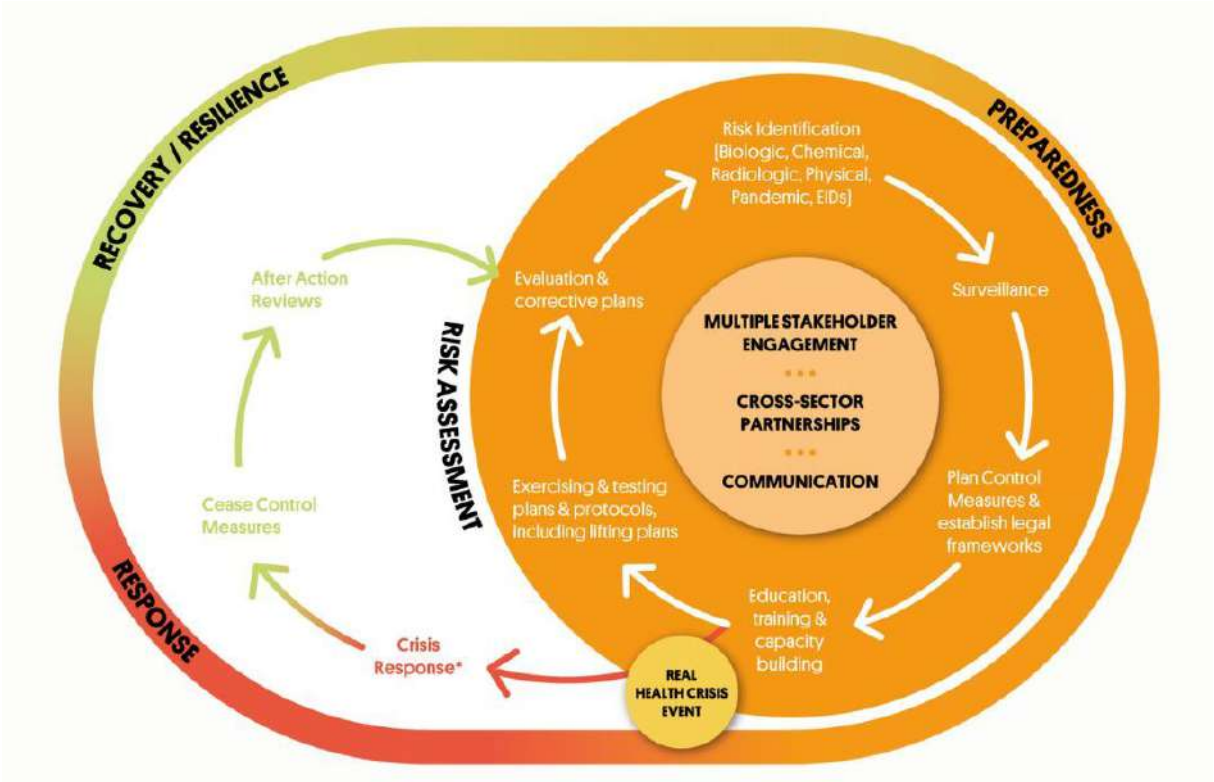


Figure 1.1 Diagram of PR^3 Concept (Preparedness, Response, Recovery, and Resilience)
Source: IS Global

1.6 Disaster Management Cycle

Medical and public health management is important in all phases of disaster management cycle (Figure 1.2), although often these phases overlap and the duration of each one will vary depending on the nature and severity of the CBRNe incident. For further details on Medical Management of patients that involved in CBRNe incident can be refer to An Overview of Disaster Life Support in Disaster Management book[6].

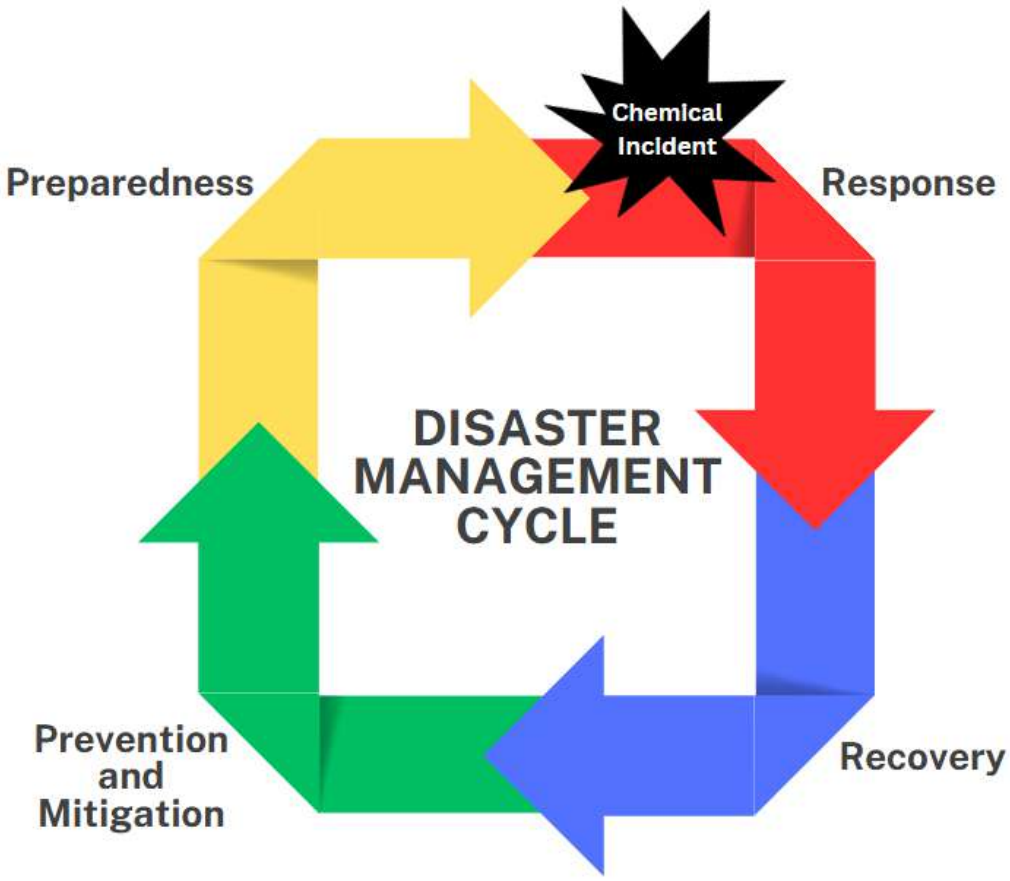


Figure 1.2 A Basic Disaster Management Cycle

CHAPTER 2

APPROACHING CBRNe SCENE

CHAPTER 2: APPROACHING CBRNe SCENE

2.1 Initial Medical Response

First responders via Malaysian Emergency Response Services (MERS) 999 from Royal Malaysia Police (RMP), Fire and Rescue Department of Malaysia (FRDM), Ambulance Response Team (ART) from the MOH hospitals and health clinics, and Civil Defence are exposed to the danger of CBRNe materials when despatching to the CBRNe site. Hence, following steps are required to ensure safety of personnel before, during and after responding to the scene:

a) Verify the 999 call/ notification whether the incident involves CBRNe materials. Examples of CBRNe event and their characteristics are shared in previous sub section 1.1.

b) If a CBRNe incident is suspected a trained medical team should be dispatched by the Medical Emergency Coordination Centre (MECC). The team leader will be the designated On Scene Medical Commander (OMC). Subsequent teams responding must report to the OMC immediately on arrival to the scene for further instructions.

c) Wear appropriate Personal Protective Equipment (PPE) for chemical, biological or radiological situation; and bring basic medical equipment and medications (**Annex 1**).

d) The OMC will Report to On Scene Commander (OSC), who is the Police Chief, at On-Scene Command Post (OSCP) and FRDM Chief at the scene and comply to their security and safety instructions.

e) FRDM and/ or Hazardous Material (HAZMAT) team will demarcate the red zone. Medical personnel have to wait at holding/ assembly area outside the red zone to receive patients.

f) HAZMAT will perform quick triage of patients in the red zone using START triage system or other suitable triage systems.

g) All patients (red, yellow, and green cases) will undergo decontamination.

h) After decontamination of patients by FRDM or HAZMAT, the medical team should re-triage using START/ SALT or other suitable triage system and treat patients accordingly.

i) Red and yellow tag cases will receive emergency treatment for stabilisation before transfer to hospital for further treatment as decided by the OMC.

j) Green tag cases should receive treatment at the field, if feasible, or at the nearest health clinic.

k) Decontaminate vehicles and equipment used after each case transported. Medical personnel must change PPE after each case transported in ambulance.

l) It is advised to change personnel after each case transferred by ambulance. After completing their shift all responders must remove and dispose PPE appropriately and perform self-decontamination with soap and water at their respective hospitals at a designated shower area.

m) All personnel who were involved should be allowed rest at home for an appropriate period of time with self-monitoring for CBRNe signs and symptoms.

n) Respective supervisors must ensure that staff seek treatment if unwell. All staff should receive counselling as well as psychiatric assessment to identify signs of post-traumatic stress early.

2.2 Level of Personal Protective Equipment (PPE)

PPE is specialised clothing or equipment worn by responders for protection against health and safety hazards. Levels of PPE are further elaborated and shown below (Figure 2.1):

a) **Level A**: Offers the highest level of respiratory and dermal protection by combining an encapsulating, gas-tight suit with built-in booties and gloves, and SCBA. This is used in situation characterised by a large degree of uncertainty where the biological hazards are unknown and mandate the highest levels of protection.

b) **Level B**: Offers the highest level of respiratory protection, Self-Contained Breathing Apparatus (SCBA), and a splash-protective suit (not gas-tight) which may or may not be fully encapsulating, and chemical-resistant gloves and boots that may or may not be built into the suit.

c) **Level C**: Offers a lower level of respiratory protection and some suits may offer limited splash protection. Suits may include hooded coveralls with built-in booties. The level C ensemble will include the suit, gloves, foot coverings, and a full-face respirator or Powered Air-Purifying Respirator (PAPR) with high-efficiency particulate air (HEPA) filters.

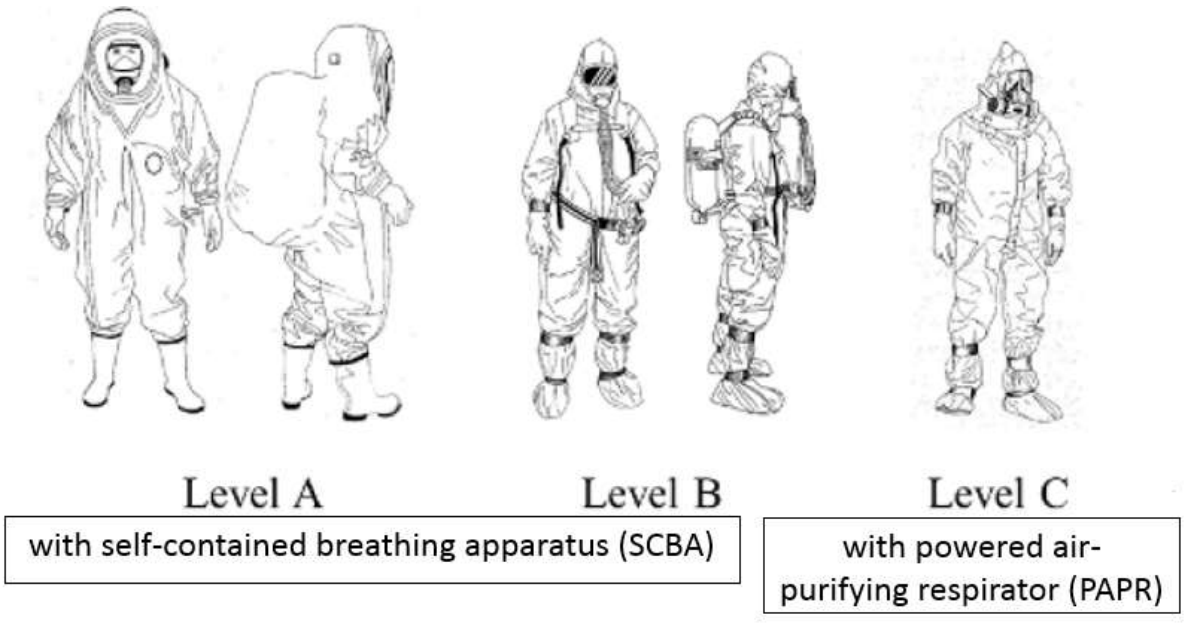


Figure 2.1 Level of PPE
Source: US Environmental Protection Agency (EPA)

2.3 Initial Size Up at Site

Safety is the first priority to all responders. Arriving at the scene, FRDM personnel will determine the exact location of the hot zone i.e. the dangerous zone and its perimeter. The perimeter or radius will be further assessed by HAZMAT during CBRNe field screening using detection and monitoring method then reassessed by relevant lead agency which will arrive later at the scene. The radius of the hot zone ranges from few metres to kilometres away depending on the hazardous characteristics of the CBRNe materials.

The hot zone of CBRNe scene must be neutralised first from any bomb threats by the RMP bomb squad before being entered by other responders. FRDM/ HAZMAT will further size up the perimeter creating the warm zone at the outer layer of the hot zone. Decontamination of patient/ victims, responders, equipment, and samples take place at the warm zone. The next outer layer is the cold zone which is a clean area after decontamination. Together, the hot, warm, and cold zones make up the red zone (Figure 2.2). Further outer layers will be created which are yellow and green zones (Figure 2.6).

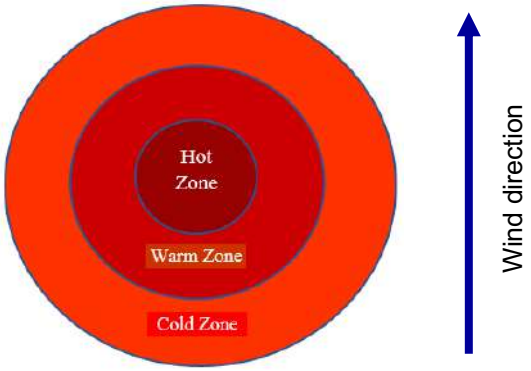


Figure 2.2 Red Zone consists of Hot, Warm, and Cold Zones

2.4 CBRNe Field Screening

Field screening is the hazard characterisation of any evidence suspected of being a CBRNe material or contaminated by a CBRNe material. At the site, field screening is performed by HAZMAT which have screening tools to detect the presence of certain gases, flammability, chemicals, and radiation. However, CBRNe field screening is not designed to identify materials, radioisotopes, chemicals, toxins, or pathogens. Field screening should be done prior to physically collecting CBRNe evidence. If already packaged by relevant agency, evidence should be field screened prior to submission into the laboratory.

Ideally, field screening is done where the evidence is found. Moving evidence while conducting field screening increases the chance of spreading the contaminants. In addition, CBRNe field screening is conducted to:

a) Ensure personnel safety during collection and transportation of CBRNe materials.

b) Ensure appropriate laboratory selection for material identification.

c) Ensure laboratory personnel safety upon receiving CBRNe materials.

d) Ensure appropriate packaging, shielding, and over-packing of the materials.

Figure 2.3 Field Screening conducted by HAZMAT at CBRNe Scene

Figure 2.4 Examples of CBRNe Field Screening Tools (from left and clockwise – gas detector; portable radioactive contamination monitor; radiation survey meter; AP4C chemical detector)

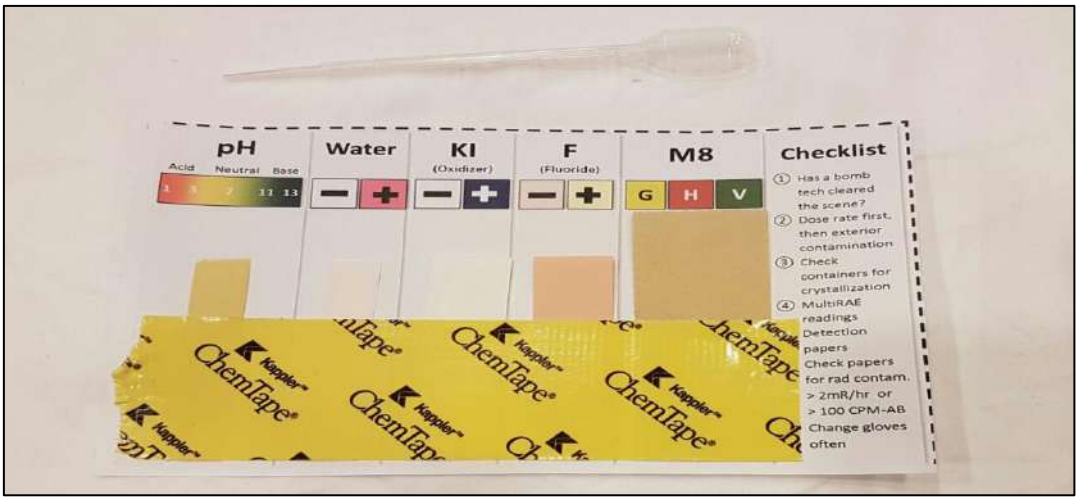


Figure 2.5 Field Screening Testing Paper for Chemical Agent

2.5 Colour Coded Disaster Zones

Trained Search and Rescue (SAR) Teams with appropriate PPE from FRDM e.g., HAZMAT, Special Malaysia Disaster Assistance and Rescue Team (SMART), or other competent team will operate in the red zone. MOH personnel and the medical base are stationed at the yellow zone which is the outer layer of the red zone. RMP will set up OSCP in the yellow zone to give command and coordinate all multiagency efforts at the scene through Incident Command System (ICS). All other operational supportive units and services are located at the green zone which is at the outer most layer (Figure 2.6).

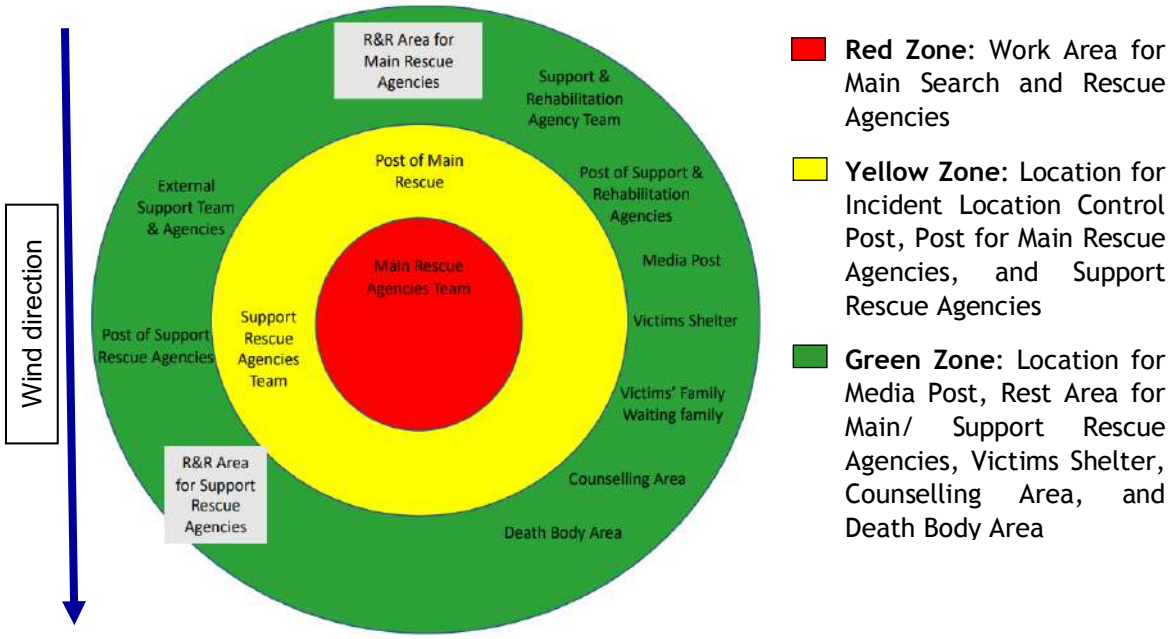


Figure 2.6 Colour Coded Disaster Zones Demarcation as Highlighted in the National Disaster Management Agency (NADMA) Directive No. 1

2.6 Command and Control

At the OSCP, the OSC is the Police Chief; the Forward Field Commander is FRDM Chief and the OMC is an Emergency Physician (EP), Family Medicine Specialist (FMS) or a trained Senior Medical Officer (MO) from MOH (the most senior officer will relinquish command). Responders from all agencies must report at OSCP (sign in and sign off) (Figure 2.7).

The health ministry is responsible to lead and provide emergency and health services during crisis and disaster. Private healthcare providers and non-governmental organisations (NGOs) providing medical aid and health support must report to the MOH health authority and given approval before delivering their services at the scene.

OSCP at site will report to Disaster Operations Control Centre (DOCC) on regular basis. Certain operational activities must get approval from DOCC. At the same time, DOCC gives technical and financial supports to OSCP to fulfil its objectives as identified in Incident Action Plan (IAP).

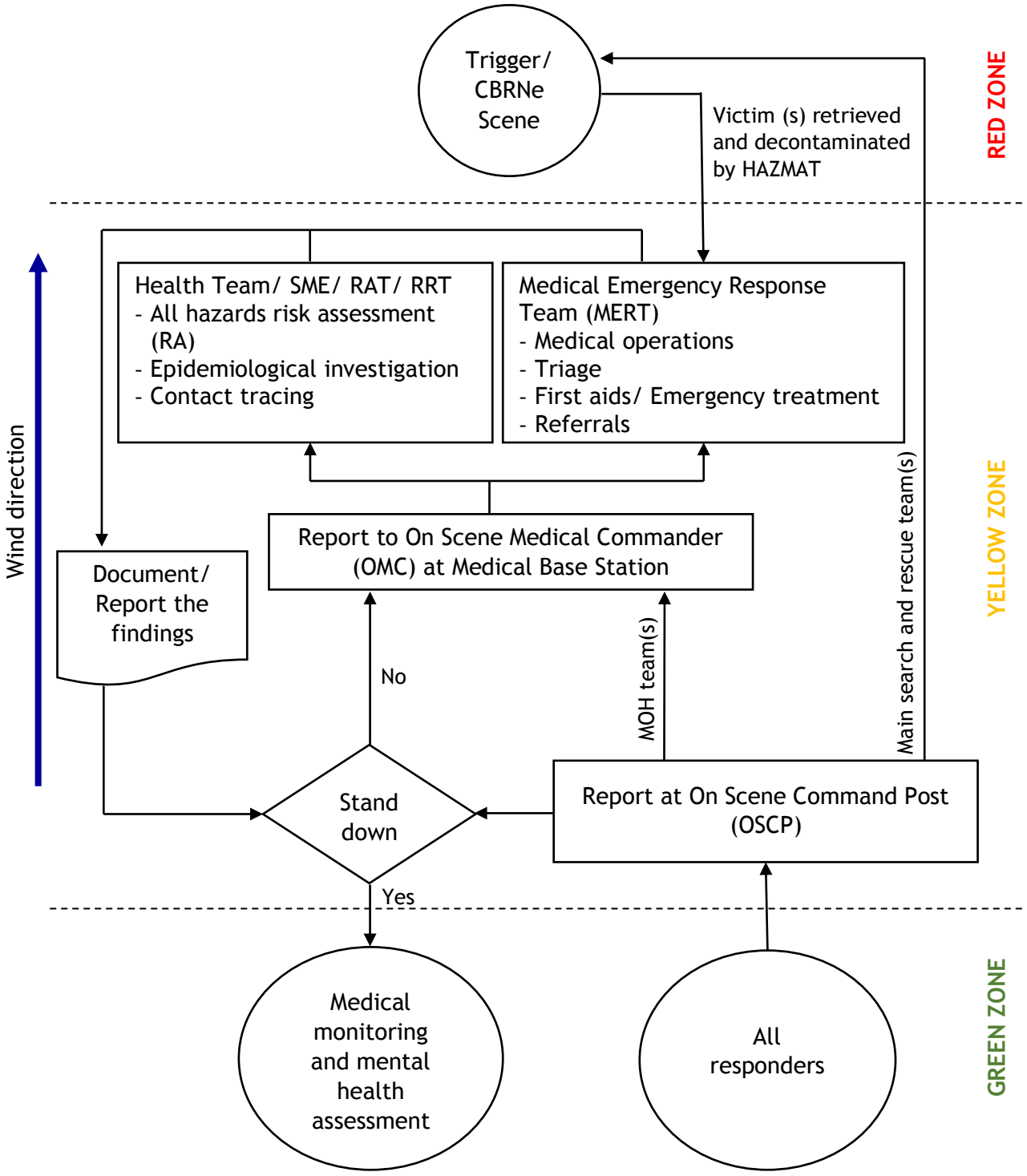


Figure 2.7 Flow Chart of Medical and Health Response under Unified Command at CBRNe Site

Note: Subject Matter Expert (SME); Risk Assessment Team (RAT); Rapid Response Team (RRT)

For crisis/ disaster confined at the District Level (Level I), the District DOCC is manned by the district committee chaired by the District Officer (DO). The secretariat at the District DOCC is Civil Defence whereas all relevant heads of department at the affected district are the committee members. The health ministry is represented by the District Medical Officer of Health for Level I. For crisis/ disaster event declared at the State Level (Level II), the State Secretary chairs the state committee which runs the State DOCC assisted by Civil Defence as secretariat. The State Health Director represents the health ministry. Moreover, for the disaster declaration at the National Level (Level III), the prime minister will appoint a relevant Minister to chair the national committee at the National DOCC assisted by NADMA as secretariat. The health ministry is represented by the Director General of Health.

2.7 NADMA's and National Security Council's Directives

The NADMA Directive No. 1 will be activated if a CBRNe event of a natural cause fulfils the disaster criteria[7]. Together, NADMA's standard operating procedure (SOP) on relevant CBRNe incident will be implemented. When the event is of security concern thus the National Security Council (NSC) Directive No. 18 will be activated[8] by the NSC and the affected site will become a crime scene or restricted security zone.

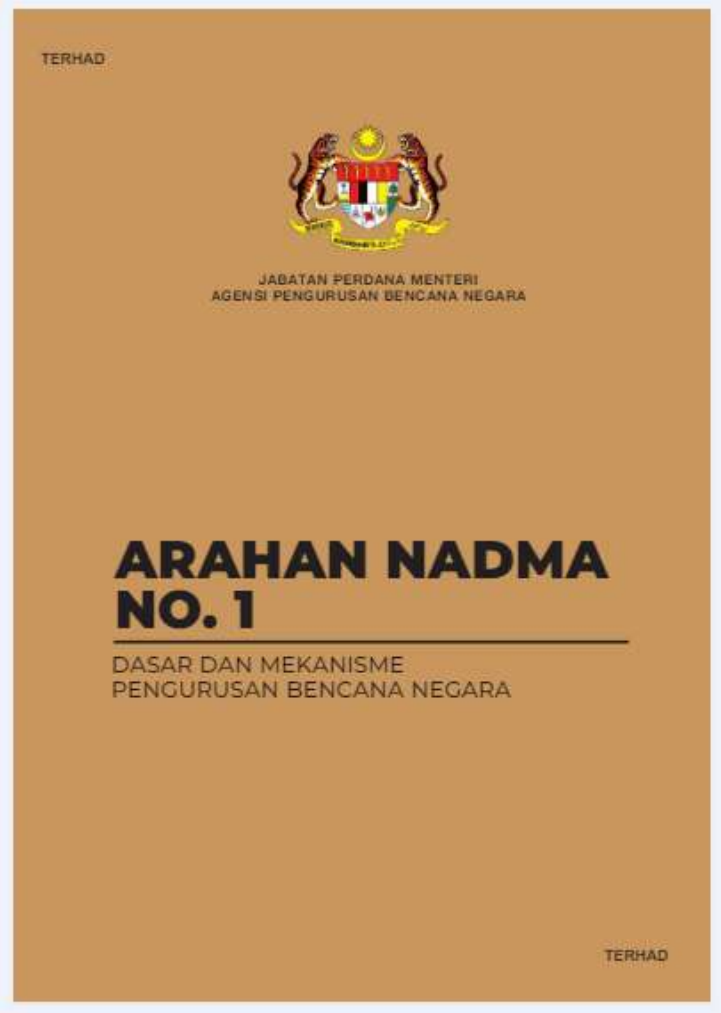


Figure 2.8 NADMA Directive No. 1

CHAPTER 3

DECONTAMINATION

CHAPTER 3: DECONTAMINATION

3.1 Objective of Decontamination

The objective of decontamination is to remove CBRNe materials from human or equipment in order to eliminate the hazardous effects of CBRNe contaminants. Decontamination shall be performed immediately to prevent secondary contamination and in order to provide medical treatment effectively hence reducing morbidity and mortality. Entry to and exit from the decontamination unit must be restricted to prevent further possible contamination. Prior to the decontamination process, decontamination triage needs to be conducted.

3.2 Decontamination Triage

Decontamination triage is a process to determine which patients or victims require decontamination. By identifying those who may not require decontamination, resources and time required for mass decontamination can be significantly reduced. Life-saving medical procedures can be administered to casualties awaiting decontamination by medical personnel wearing appropriate PPE.

3.3 Decontamination On-site/ Off-site

Removal of outer layer of clothing reduces contamination by up to 85%. Decontamination (dry or wet decontamination) requires more resources with help especially from HAZMAT which will set up decontamination corridor at the warm zone. The location of the warm zone needs to be a safe distance away from the contaminated area as well as uphill and upwind from the incident area. For wet decontamination, exposed/ contaminated patients and victims must strip and shower with clean water and soap then change to new clothes before being examined thoroughly by medical personnel. Due to religious and cultural sensitivities, privacy of those undergo decontamination shall be respected and secured, at all times. Detail of decontamination process by different CBRNe elements will be further highlighted in subsequent chapters.

Figure 3.1 Decontamination triage is conducted prior to decontamination process

CHAPTER 4

CHEMICAL EMERGENCIES

CHAPTER 4: CHEMICAL EMERGENCIES

4.1 Background

Chemical emergencies can occur in a number of different situations where hazardous chemicals are released into the surroundings. Chemical agents are all chemical elements and compounds in a natural or processed state as well as their by-products. Exposure by inhalation, ingestion, or to the skin may result in illness or injury to human health depending on the chemical substance, the dose, and the duration of exposure. The standard terminology referring to industrial chemicals that are hazardous are Toxic Industrial Chemicals (TICs); CBRNe agents for deliberate release can be either Chemical Warfare Agents (CWAs) or TICs. The use of chemical weapons by criminals and terrorist groups poses a significant threat in every country.

Some characteristics of chemical agents:

a) Exposure is usually through skin contact, inhalation, or ingestion.

b) Onset of symptoms can be almost immediate in some cases.

c) Victims may exhibit symptoms such as vomiting, shortness of breath, coughing, convulsions, or complain of burning skin.

d) Some very toxic chemicals can cause death almost immediately.

e) There may be a visible cloud or plume of gas.

f) An unusual and/ or pungent odour may be apparent.

g) Dead vegetation or animals present strongly suggests the presence of a toxic chemical agent.

h) Releases from containers.

i) Physical senses and street smarts – if the situation doesn't seem right to first responders.

In any chemical events, we shall implement the international chemical conventions/ agreement as listed below:

a) Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals in International Trade.

b) Stockholm Convention on Persistent Organic Pollutants.

c) Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

d) Minamata Convention on Mercury.

e) United Nations Economic Commission for Europe Convention on the Transboundary Effects of Industrial Accidents.

f) International Labour Organization Convention 174 on Prevention of Major Industrial Accidents.

g) International Labour Organization Convention 170 on Safety in the Use of Chemicals at Work.

4.2 Risk Assessment

4.2.1 Rapid Risk Assessment

Rapid risk assessment performed by the RAT begins from the onset of a hazard is known, a threat is established, or an incident has happened.

Risk assessment is conducted to:

a) Confirm the existence of chemical incident or emergency by getting the verification from related agency that is also involved in the incident such as FRDM and Department of Environment (DOE).

b) Identify the hazardous material (s) and its/ their toxicity effect to individuals or environment that has been exposed or contaminated by getting information of offending chemical identity from related agency (FRDM and DOE) and their toxicity effect (chemical experts or using open source information/ application such as Integrated Risk Information System (IRIS), Wireless Information System for Emergency Responders (WISER), and others).

c) Determine the population at risk:

- To get information of the population at risk from relevant agency such as local authority and local leaders.
- Emphasise on vulnerable population: elderly, children, and those with existing co-morbidity.
- Those located surrounding area of the incident taking into account possibility of chemical dispersal via air, waterworks, and other methods.

d) Identify the need for decontamination of individuals and equipment by working with HAZMAT on the decontamination needs. Extra assistance can be requested from the Malaysian Armed Forces (MAF) hence resources by HAZMAT can be used elsewhere.

e) Assess the ability to respond to the incident in terms of availability of specialised protective equipment, availability of trained responders, and capacity of managing casualties showing signs of toxic effects to the hazardous material.

f) Identify the ability to contain and prevent further spread of the contaminant by getting information from relevant agencies such as FRDM, Department of Irrigation, DOE, and Department of Chemistry Malaysia for spread and containment.

g) Recognize that a threat or incident could potentially be a deliberate act of terror, and liaise with the RMP if the chemical incident is suspected to be a terror attack.

Based on the RAT findings, it is vital to understand the risk of the situation for the safety of the on-site medical and health team as well as the risk of the chemical exposure to nearby population. RAT has to evaluate and produce a preliminary report (listed in **Annex 2** Table A) of the chemical situation which is a Hazard Identification approach (**Annex 2** Table B) within one (1) hour; a detailed assessment needs to be prepared with input from the Subject Matter Experts (SMEs), e.g., clinical toxicologist, in the event of threat (**Annex 2** Table B and C) within four hours; and when a chemical incident had occurred (**Annex 2** Table C and D).

4.2.2 Risk Mapping

Another important data to be generated would be a risk mapping of the projected outcome of the chemical crisis. The objective of a risk map would be to produce threat zone estimates in terms of chemical toxicity, thermal radiation, and others. Besides that, the risk map would provide information such as the hazard sites/ location and suggest possible mitigation strategies to contain the hazard. An effective risk mapping (Figure 4.1) would be able to identify the risk targets of chemical agents, risk intensity after a population is exposed to the hazard, and the physical vulnerability of the affected community in terms of infrastructure and logistics of services that are spared from the chemical contaminants.

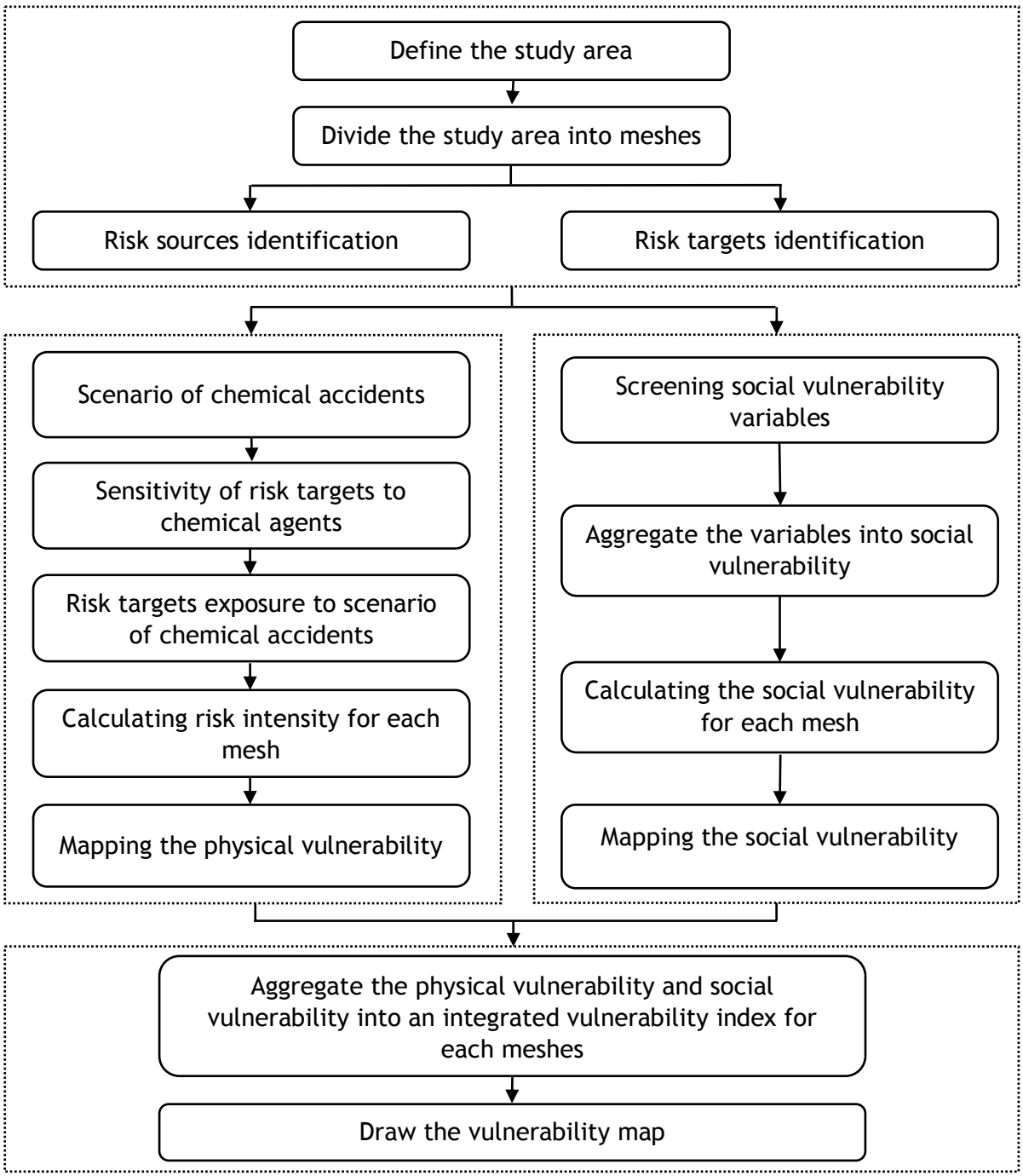


Figure 4.1 Dynamics of a Risk Map

Physical vulnerability describes the toxicity effects particularly the physical well-being of the exposed individual. The risk map would be able to predict the hazard zone where the toxic gas concentration is high to harm the surrounding community. The risk map would add value in hazards that involve airborne contaminants by the chemical accidents. Social vulnerability on the other hand includes the population demographic (e.g., age, gender, or health conditions), location of the events (e.g., residential areas, schools, or hospitals) and quality of population lifestyle (e.g., belief, customs, political situation, population, and structure/ density, individual perception, access to emergency resources, or economic status). Geographical Information System (GIS) in Risk Mapping (an example shown in Figure 4.2) would produce spatial variation of the total vulnerability of the affected community. The results of the risk map would provide new comprehensive perspective for the emergency management of the affected community.

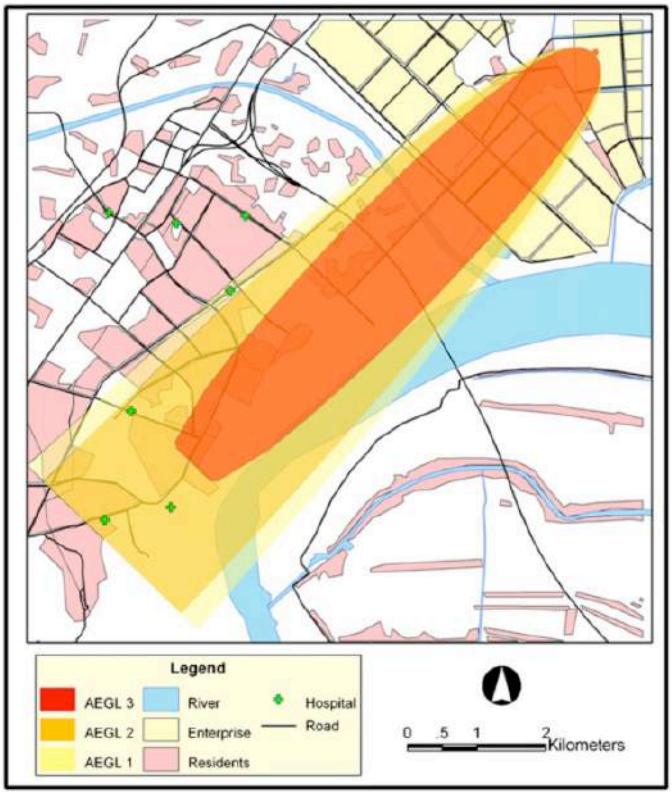


Figure 4.2 Example of a Risk Map

Note: Acute Exposure Guideline Levels (AEGL) for airborne chemicals by U.S. Environmental Protection Agency (EPA)

In practice, assistance from Malaysian Meteorological Department, DOE, Ministry of Science, Technology and Innovation (MOSTI), Agency of Remote Sensing Malaysia is coordinated by NADMA to develop an informative risk map. Based on the risk mapping, mobilisation of resources to the affected population would be more effective and efficient. Based on the prediction on the risk map, policy makers could plan for mitigating strategies and Business Continuity Plan (BCP) of affected services either to be relocated or re-established. Common risk mappings include Areal Location of Hazardous Atmosphere (ALOHA), Mapping Application for Response and Planning of Local Operational Task (MARPLOT), and Computer Aided Management of Emergency Operations (CAMEO).

4.3 Prevention and Mitigation Phase

This phase focuses on medium-term and long-term measures for reducing or eliminating risk thus reducing or eliminating the impact of the chemical incident or disaster. Main responsible agencies to prevent chemical mishap in Malaysia are DOE for ambient environment and Department of Occupational Safety and Health (DOSH) for workplace. Air, water, and soil quality as well as enforcement on illegal chemical dumping are carried out by DOE. Awareness programmes among industrial players and the community are conducted as part of integral strategies during this phase.

4.4 Preparedness Phase

Assessments from the first phase lead to the development of the plan to manage the chemical incident, including the acquisition of capabilities and training programmes. The plan should clearly integrate medical capabilities at the local, state, and national levels. It requires the establishment of agreed coordination between different services and agencies so that they can be integrated smoothly into the command and control system.

4.4.1 Alert Notification

Upon receiving the information of possible chemical emergency, the National CPRC shall inform all relevant states of the occurrence. The information dissemination can be done via official letter, e-mail, or any other methods that may expedite the process. The information to be relayed to the State Health Departments should include, but not limited to, the details of incidence, chemical situation during the incidence, current chemical situation, and possible adverse health effects to human.

4.4.2 Interagency Communication and Coordination

During a chemical emergency, the details of the incidence, technical chemical information and adverse health effects shall be shared and exchanged between the MOH and other agencies such as NADMA, FRDM/ HAZMAT, Department of Chemistry Malaysia, DOE, RMP, DOSH, and other related agencies. Any cases due to chemical exposure that coming to MOH facilities shall be recorded, listed, and reported daily to the National CPRC. For an effective preliminary assessment, regular intra- and interagency coordination meetings should be conducted.

4.4.3 Rapid Assessment Team (RAT) and Rapid Response Team (RRT)

The National CPRC will guide and give technical advice to RAT and RRT of public health component from the district/ state/ national level in dealing with chemical event using all hazards approach. The National CPRC may ask for technical assistance from other agencies such as Department of Chemistry Malaysia, HAZMAT, or DOE (e.g., in conducting chemical screening to RAT/ RRT members and providing decontamination facility at the site).

4.4.4 Medical Emergency Response Team (MERT)

Medical Emergency Response Teams (MERTs) from all government hospitals should be able to respond to any Mass Casualty Incident (MCI) or disaster whereby management of chemical cases should be coordinated and supervised by an EP or trained senior MO at the scene. The

On Scene Medical Commander (OMC) can supervise management and coordinate ambulances to be dispatched to appropriate hospitals as well as request MERT assistance/ reinforcement from other hospitals.

4.4.5 Chemical Exposure Cases Attending to Health Clinic

Suspected cases of exposed and contaminated patients attending to health clinic shall undergo chemical screening at the clinic before being referred to hospital. The health clinic may ask assistance from HAZMAT to conduct chemical screening on patients and personnel. If assistance is not readily available, patients are required to take a bath (strip and shower) with clean water and soap then change to new clothes before being attended to by the doctor or health staff.

4.4.6 Mental Health and Psychosocial Support (MHPSS)

All district and state MHPSS teams shall be able to be deployed to deliver Psychological First Aid (PFA) to patients, victims, responders, and family members. MHPSS teams will be stationed at receiving hospitals or other designated locations as required. The National Centre of Excellence for Mental Health (NCEMH) must be alerted to coordinate and further assist the needs on the mental health and psychosocial support services.

4.4.7 Personal Protective Equipment (PPE)

The PPE levels differ in respiratory and skin protection, and selection is based on the type of agent, toxicity, and concentration. All medical and health responders at the scene must wear level C unless recommended otherwise by HAZMAT. Level C has the same skin protection as Level B, but uses an Air-Purifying Respirator (APR) instead of SCBA. There are different classes and types of commercially available filters with established colour-coding systems to indicate the chemical substances against which they can be used.

Table 4.1 Level C PPE

Level of Protection	Respiratory Protection	Skin Protection	Scenario
C	Full-face or half-mask APR.	- Non-encapsulated hooded chemical-resistant clothing. - Chemical-resistant inner and outer gloves and boots/ shoes.	- Agent and environment concentration known to be removed by an APR. - Skin contact with known agent is non-hazardous and significant transdermal absorption does not occur. - Atmosphere contains at least 19.5% oxygen.

Source: www.opcw.org

4.4.8 Antidotes

An antidote is a substance that can counteract a form of toxicity or poisoning in humans. Availability of antidotes in MOH is depending on the type of Ministry of Health Malaysia Drug Formulary category and stock shown in **Annex 4**, whereas, recommended antidotes for Chemical Warfare Agents (CWAs) are shown in **Annex 5**.

4.4.9 Decontamination Stations for Chemical Casualties

No person or casualty case should exit the hot zone without going through the decontamination corridor. In the same manner, no person or casualty case who has not gone through decontamination should enter hospital. Level C PPE is acceptable at decontamination stations, although it may need to be upgraded depending on the scenario. Working hours must be monitored to prevent fatigue, dehydration, and heat stress. Emergency plans should establish schedules for the rotation of personnel.

During primary triage, casualties will be registered or coded where available personal information is recorded. Personal belongings are separated and secured depending on decontamination and safety procedures. Whenever possible, children and parents, or accompanying adults should remain together through the decontamination process and evacuation.

Some decontamination stations include a contamination control step at the entrance if detectors (Table 4.2) are available. If the person is declared clean, he or she can exit the decontamination process. A mass-casualty or disaster scenario would lengthen the decontamination process.

Table 4.2 Recommended Detectors for Decontamination Corridor and Decontamination Process Monitoring

Type of Detector	Type of Chemical
AP4C	CWA and TICs
Multigas detector	TICs, Carbon Monoxide, Hydrogen Sulphide, Oxygen, LEL
pH paper	TICs (acid/ alkaline)

Note: The detectors can be sourced from HAZMAT or Department of Chemistry Malaysia

For critically ill casualties, the Emergency Medical Team (EMT) on site can administer vital life support after the patient has gone through decontamination process. Medical personnel must use appropriate PPE, and unless adequate equipment and medication is available e.g., APR ventilation equipment adapted for a contaminated atmosphere or antidotes in auto-injectors, only limited critical care will be provided.

Decontamination stations should have two (2) separate lines, one (1) for ambulatory patients who can perform the rinse-wipe-rinse technique by themselves or with assistance under supervision. A second decontamination line with a special litter will be required for non-ambulatory patients. Some commercial decontamination lanes (requiring time and personnel to install) reduce this effort by using rollers to move stretchers along the lane. If available, multiple showers in gender-specific tents provide privacy. Some decontamination stations also include a contamination control at the end of the decontamination process. Detectors are used to verify whether decontamination has been completed.

4.4.10 Laboratory Services by Department of Chemistry Malaysia

The Department of Chemistry Malaysia provides analytical services which covers analysis of environmental and clinical samples for verification of TICs, chemical weapons, and explosive chemicals. Sampling requirement for chemical testing is shown in Table 4.3.

Table 4.3 Chemical Sampling Requirement for Laboratory Testing

Item		Responsibility
Type of Samples	- Swab samples from body (dry or solvent assisted). - Clinical samples (serum, plasma, whole blood, organs, hair, and saliva).	MOH
Sample Containers	- Sterile blood collection tubes. - Specimen bags. - Specimen container.	MOH
Type of Test	- Chemical weapons, forensic toxicology, DNA, Schedule waste	Department of Chemistry Malaysia

Note: Solvents – dichloromethane, methanol, and/ or de-ionized water

4.5 Response Phase

This phase deals with the general considerations in management of chemical casualties and provides an overview of basic concepts that should be considered by medical personnel involved in the management of a chemical weapon incident. This phase begins as soon as the chemical event occurs which activates the ICS at the scene and Incident Management System (IMS) at the Operation Room (OR) in District Health Office (DHO) or CPRC at the state/ national level. Response action is intended to save lives and minimise the impact of the crisis/ disaster on human, property, and environment.

4.5.1 Medical Response

Upon receiving call/ trigger of a chemical event through MERS 999, an appropriate medical response team will be dispatched via the MECC covering the area affected. This initial response team will provide feedback to the MECC. If a significant chemical emergency has occurred as decided by the EP covering the MECC, an advanced team consisting of an EP or trained senior MO will be dispatched to the scene. This EP or senior MO will act as the OMC. The nearest hospital will be alerted by MECC via the EP on call to be on standby. The Hospital Director will be alerted on the event by the EP on call. The Hospital Director will inform the State Health Director. The Hospital Operations Room shall also notify the District Health Office, and the State CPRC. Therefore, subsequent alert and response by other MOH components at the district, state, and national levels can be activated and executed immediately as necessary (Figure 4.3).

A step wise medical response is activated upon receiving the MERS 999 call (Figure 4.4). At the site, all responders must wait for HAZMAT to arrive and establish zoning radius of hot, warm, and cold zones, which are within red zone, and subsequently yellow and green zones. At the scene, the OMC should take charge of the medical command and set up the Medical Base Station (MBS) in a designated area of the yellow zone. Any medical responders shall report to the OMC for further instruction. All responders from any agencies who first arrived shall be in green or yellow zone as advised by the OSC. Tasks by relevant agencies at the chemical scene are summarised in **Annex 3**.

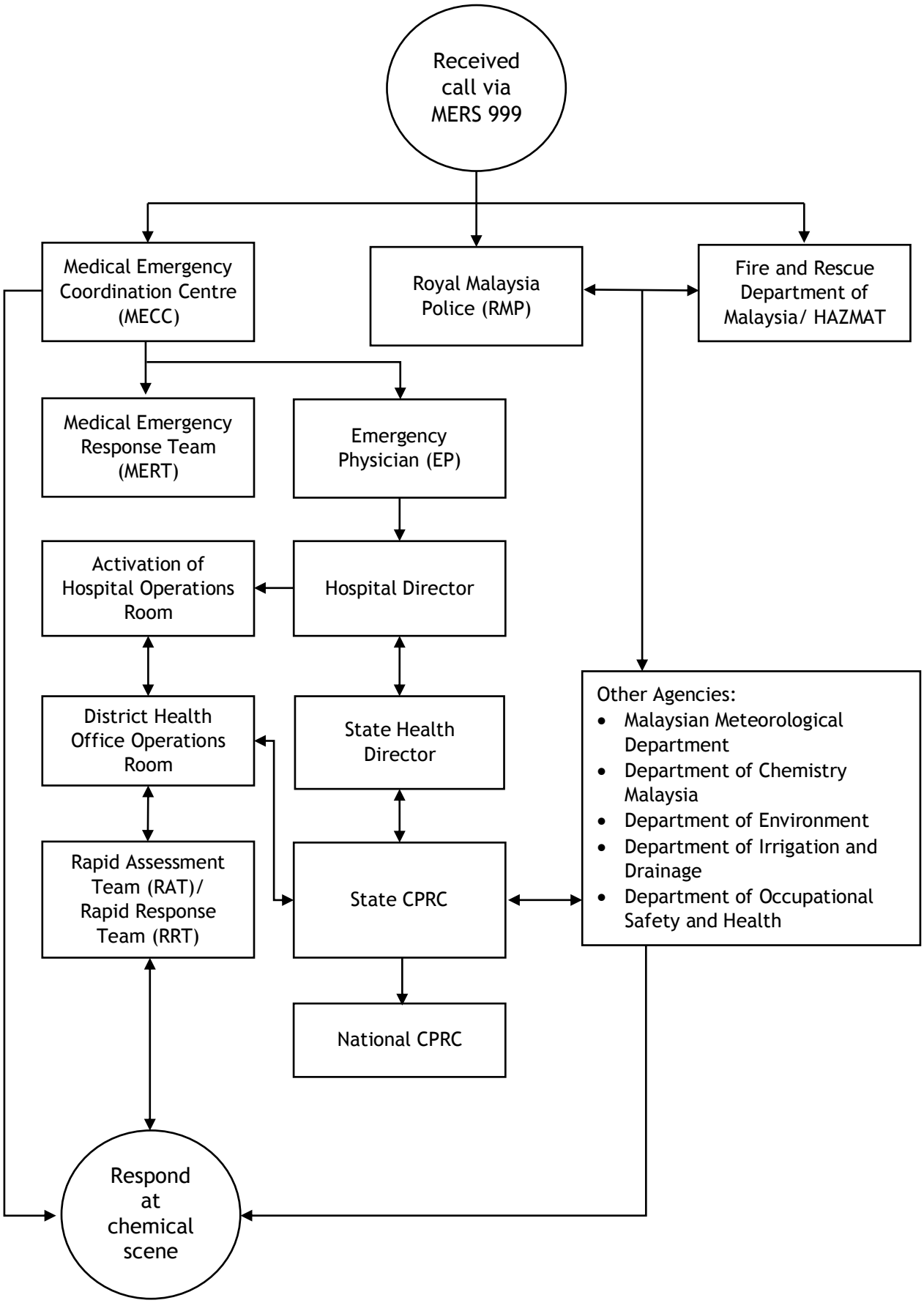


Figure 4.3 Communication Flow from MERS 999 to Responding Agencies and MOH Malaysia at the District, State, and National Levels

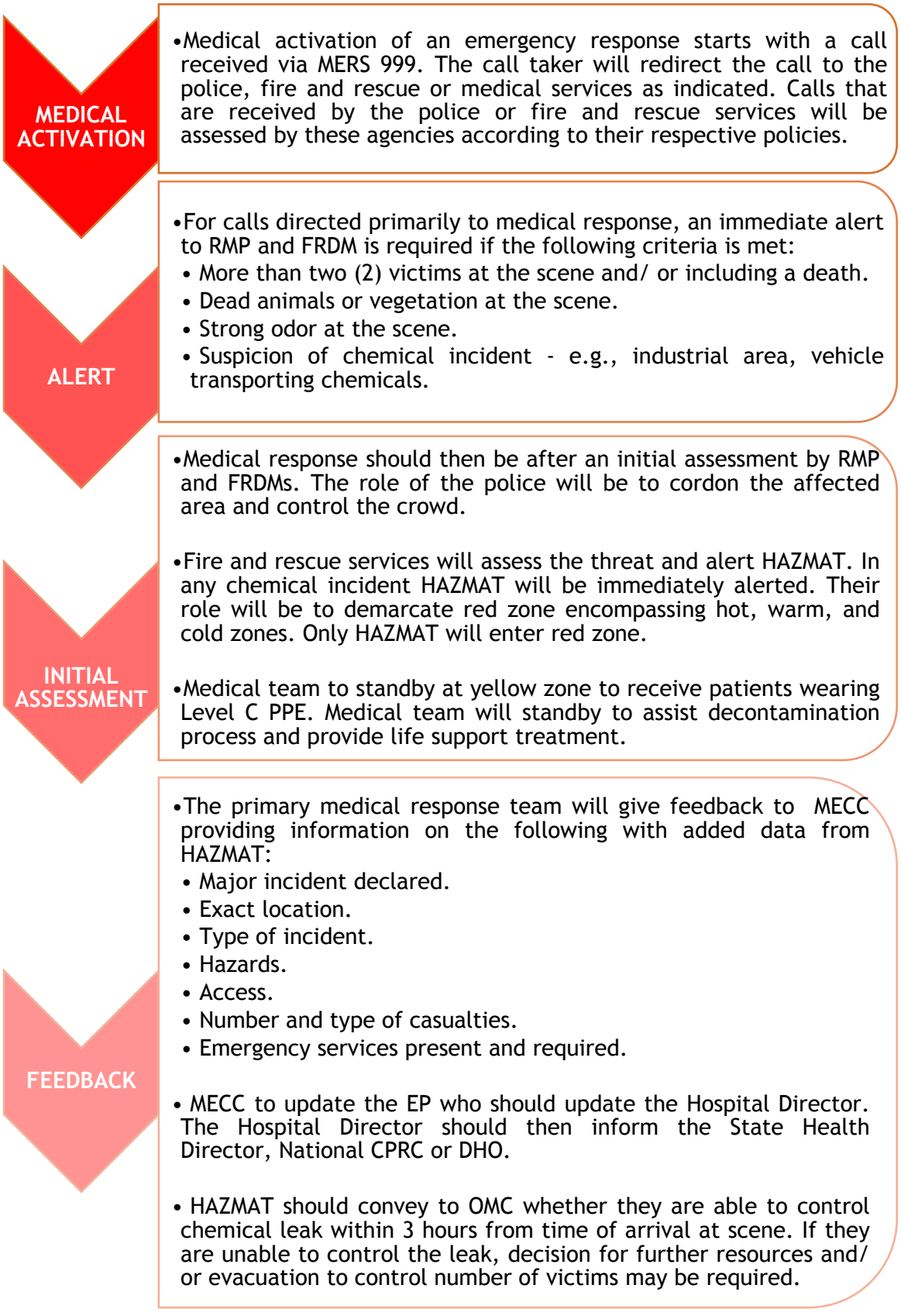


Figure 4.4 Medical Response on Receiving MERS 999 Call with Possible Chemical Threat

4.5.2 Decontamination

Decontamination of patients should be performed at the scene before transferring the patients to hospital (Figure 4.5 and Figure 4.6). Decontamination with copious amounts of water is usually sufficient for chemical decontamination. Some chemicals which are oil based may require decontamination with soap and water. Dead bodies in the red zone will be decontaminated by HAZMAT before the bodies are transferred to the Forensic Department by the police. Patients who have arrived at the health facility on their own must be decontaminated before entering the health facility. A decontamination unit can be set up outside the facility in a designated area by the health staff. Ambulance decontamination is usually done by the private cleaning services concessionaires at the health facility. The cleaning services staff have to be trained on proper techniques of decontamination. All cases should preferably be decontaminated before entering the ambulance. If patient's decontamination is not done, the ambulance will have to be decontaminated after the patient has been transferred.

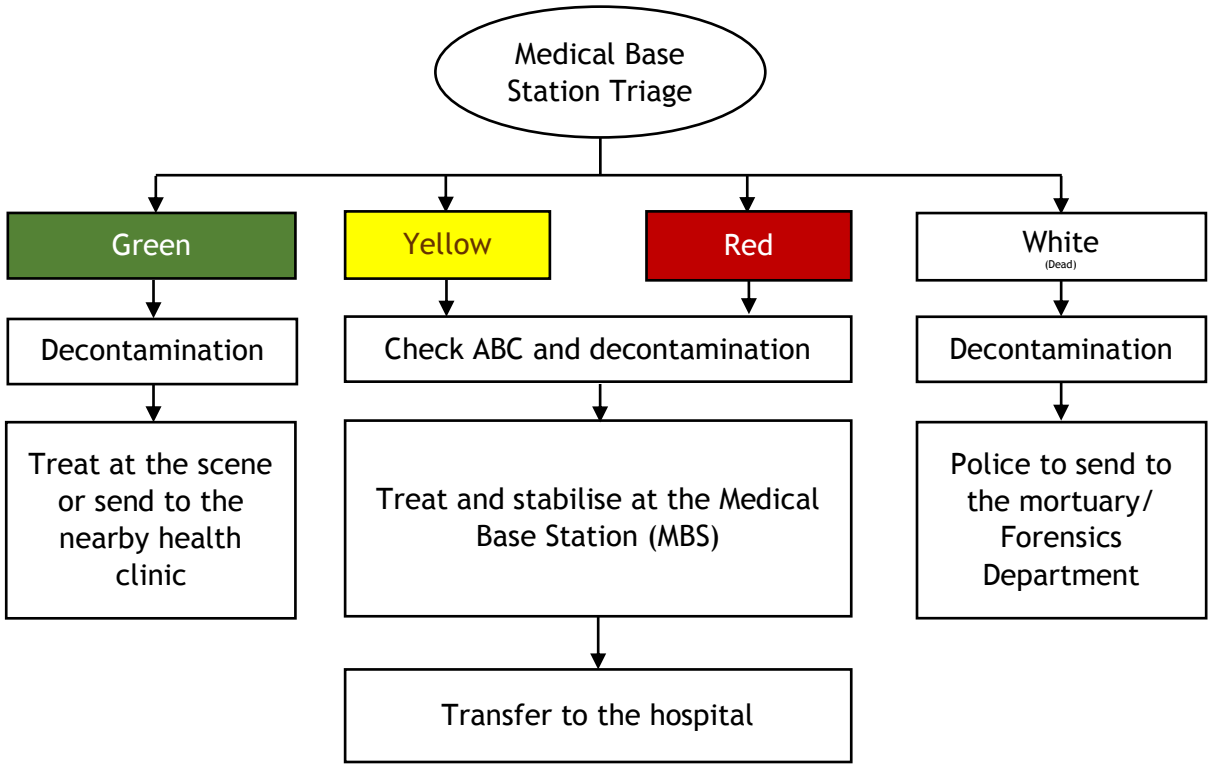


Figure 4.5 General On-site Decontamination Procedure

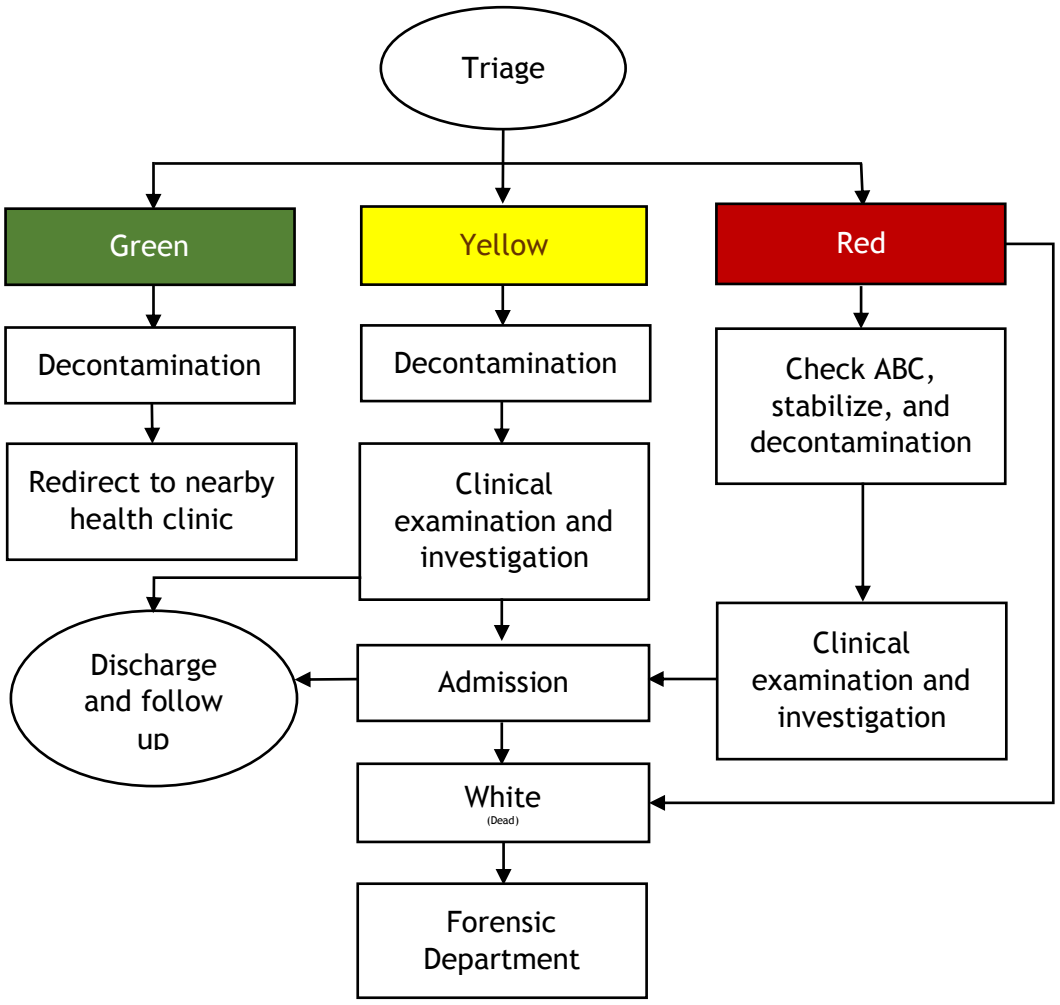


Figure 4.6 General Off-site (Hospital) Decontamination Procedure

Note:

- Dead patients shall undergo decontamination before sending to Forensics Department.
- Decontamination – planned and systematic process of reducing contamination to a level that is ALARA. Achieved by screening, registering, removal of clothing, gross shower, secondary shower, and finally detection.

4.5.3 Treatment Plan for Chemical Emergency

Characteristics of Chemical Agents are shown in Table 4.4 and treatment plan for chemical emergency is summarized in Figure 4.7.

Table 4.4 Chemical Warfare Agents (CWAs)

Characteristics of Chemical Agents					
Agent	Persistency	Rate of Action	Mode of Action	Physiological Effect	Dispersal
Choking Agents • Chlorine (Cl) • Phosgene (CG) • Diphosgene (DP) • Chloropicrin (PS)	• Low • Low • Low • Low	• Variable • Delayed • Delayed • Rapid	Absorption through lungs	Fluids builds up in lungs, choking victim	Gas
Blister Agents • Sulfur mustard (H, HD) • Nitrogen mustard (HN) • Phosgene oxime (CX) • Lewisite (L)	• Very high • High • Low • High	• Delayed • Delayed • Immediate • Rapid	Absorption through lungs, skin	Burns skin, mucous membranes and eyes; causes large blisters on exposed skin; blisters windpipe and lungs; large number of casualties, low percentage of deaths	Liquid, aerosol, vapour, and dust
Blood Agents • Hydrogen cyanide (AC) • Cyanogen chloride (CK) • Arsine (SA)	• Low • Low • Low	• Rapid • Rapid • Delayed	Absorption through lungs	Cyanide destroys ability of blood tissues to utilise oxygen, causing them to 'starve' and strangling the heart	Gas
Nerve Agents • Tabun (GA) • Sarin (GB) • Soman (GD) • Cyclosarin (GF) • VX	• Low • Low • Moderate • Moderate • Very high	• Very rapid • Very rapid • Very rapid • Very rapid • Rapid	Absorption through lungs (G-Series); contact with skin (VX)	Causes seizures, loss of body control; paralyses muscles, including heart and diaphragm; lethal doses can cause death in five minutes	Liquid, aerosol, vapour, and dust
Riot Control Agents • Tear Gas (CS) • Pepper Spray (OC)	• Low • Low	• Immediate • Immediate	Absorption through lungs, skin, eyes	Causes tears, coughing and irritation to eyes, nose, mouth and skin; constricts airway and shut eyes (OC)	Liquid, aerosol

Source: www.opcw.org

Toxic Industrial Chemicals (TICs)

TICs are industrial chemicals that are manufactured, stored, transported, and used throughout the world. TICs can exist in gaseous, liquid, or solid states. They can pose chemical hazards (e.g., carcinogens, reproductive hazards, corrosives, or agents that affect the lungs or blood) or physical hazards, such as flammable, combustible, explosive, or reactive (e.g., ammonia, chloroform, acetonitrile, hexane).

Figure 4.7 Treatment Plan for Chemical Emergency

4.5.4 Public Health Response

At the District Health Office level, the RAT will be despatched to the scene to do risk assessment of all hazards[4]. Risk assessment and field findings gathered by the RAT will be immediately analysed and discussed at the district level for further actions and measures to be taken by the RRT. If necessary, the RRT should conduct an initial literature search, perform a retrospective review, or consult with experts to determine the possible nature of the event. This will greatly facilitate subsequent investigation and control/ mitigation activities. Decisions taken at the district level may require consultation and approval from the state level and/ or the national level. Most of the acute public health events require within MOH and interagency coordination and efforts at the district, state, and national levels depending on the scale, complexity, and severity of the event. The National CPRC will lead within MOH and interagency coordination for medical and health needs at the national level.

4.5.5 Additional Resources Mobilisation

Potentially overwhelming needs and demands that may go beyond the medical base's and/ or hospital's capability must be identified and sought for assistance from the State and the National CPRC. Therefore, additional manpower and resources from other MOH facilities nationwide or other agencies can be mobilised immediately. High influx of many responding RATs, RRTs, MERTs, and MHPSS teams, including an international assistance to the chemical scene may require an activation of Emergency Medical Team Coordination Cell (EMTCC) by the National CPRC.

4.5.6 Psychological First Aid (PFA)

MHPSS team (s) need to be deployed early to provide mental health and psychosocial support services to the victims (including responders, if any) at the receiving hospital (s). If need arises, other MHPSS team (s) will be deployed to rehabilitation centre (s) and/ or families and friends reception area at the scene in the green zone.

4.6 Recovery Phase

In recovery, measures are taken to return to the pre-event situation. Such measures might include disposal of hazardous materials and remediation of the incident site, as well as giving further assistance to victims.

4.6.1 Medical Recovery Action

Following are recommended medical recovery actions to be taken:

a) Debriefing and After-Action Review (AAR) - Interagency meetings to discuss issues and problems faced should be done within a month. This include remedial measures to be taken and supplies to be restocked.

b) Victims – Regular medical check-up for those exposed as necessary which include psychosocial support.

c) Personnel - Compulsory medical check-up for staff involved and directly exposed to chemicals. This include psychosocial support and hazard exposure leave.

d) Disposal of chemical and contaminated materials - dispose contaminated clothes and PPE through health facility related concession. Disposal of chemical and other contaminated materials will be advised by related agencies. For medico-legal, all material should be sealed and handed to RMP. Water used for decontamination process may need to be collected and disposed through advice from related agencies.

4.6.2 Modified Community Impact Assessment by Public Health

The following is modified community impact assessment[9], which comprises of four (4) steps, to be conducted by public health team:

a) Determine Exposure Pathways:

- Involve the zone surrounding the chemical incident that is vulnerable to exposure. If possible, produce a map of vulnerable zone to the chemical migration (exposure pathways by air, soil, or water contamination).
- Possible receptors to be taken into account are victims; responders; the public via direct contact to soil and air; water reservoir, drinking water, and soil.

b) Population Vulnerability Assessment:

- Facilities in and around the vulnerable zones, such as stadiums, schools, and community halls should be identified to be used as shelters.
- Identify farmland, water bodies, recreational areas, and areas that support wildlife that may later give exposure to the public. Take into account transboundary spread of chemical across administrative borders. Create registry of victims that fulfil case definition of chemical incident.

c) Health Impact Assessment, if feasible:

- Should consider the environmental consequences of the chemical release, as these impacts can have long-term effects on public health based on actual exposure data. Conduct assessments on victims to document their health effects which includes any delayed effects from primary or secondary contaminations.
- With regards to secondary contamination to population at risk, a schedule community assessment would be beneficial in detecting delayed clinical manifestation post disaster. Take into account the offending chemical characteristics, the pathway of exposure, and the population vulnerability assessment.
- Result of the assessment can be produced in a form of risk matrix (qualitative).

d) Evaluation:

- Estimate the need of improvement in the factors of community preparedness, health care resources including trained Healthcare Workers (HCWs) in responding to chemical incidents, emergency response plan status, and availability and proximity of backup resources for future preparedness. The evaluation assessments could be as qualitative (high, medium, or low) or quantitative (population at risk) estimates. Based on findings, outline steps to maintain or augment the factors for future preparedness.
- Raise concern of contamination of plant, animal, soil, water, and air to related governmental agencies.

CHAPTER 5

BIOLOGICAL EMERGENCIES

CHAPTER 5: BIOLOGICAL EMERGENCIES

5.1 Background

Biological agents include bacteria, viruses, fungi, and parasites or products they generate e.g., toxin. Exposure in sufficient quantities and over a given duration may result in illness or injury to human health, and this can happen through natural exposure or release (intentional or unintentional) of microorganisms. The threat from bioterrorism is real whereby a biological attack may not be detected until days or even weeks after it happens. Biological weapons are often called weapon of mass destruction because they are cheap and easy to produce.

Characteristics of biological agents:

a) There is usually no taste or odour.

b) They are invisible to the naked eye.

c) Microscopic amounts may cause infection.

d) Symptoms of infection may be delayed by hours (toxin), days, or possibly weeks.

e) Some infections can be transmitted from person to person.

f) People may be exhibiting similar symptoms at an increasing rate until the first cases are diagnosed.

g) Many agents are sensitive to environmental conditions (weather, sunlight, or air pollution) but some may survive in the environment for a long time (e.g., spores causing anthrax).

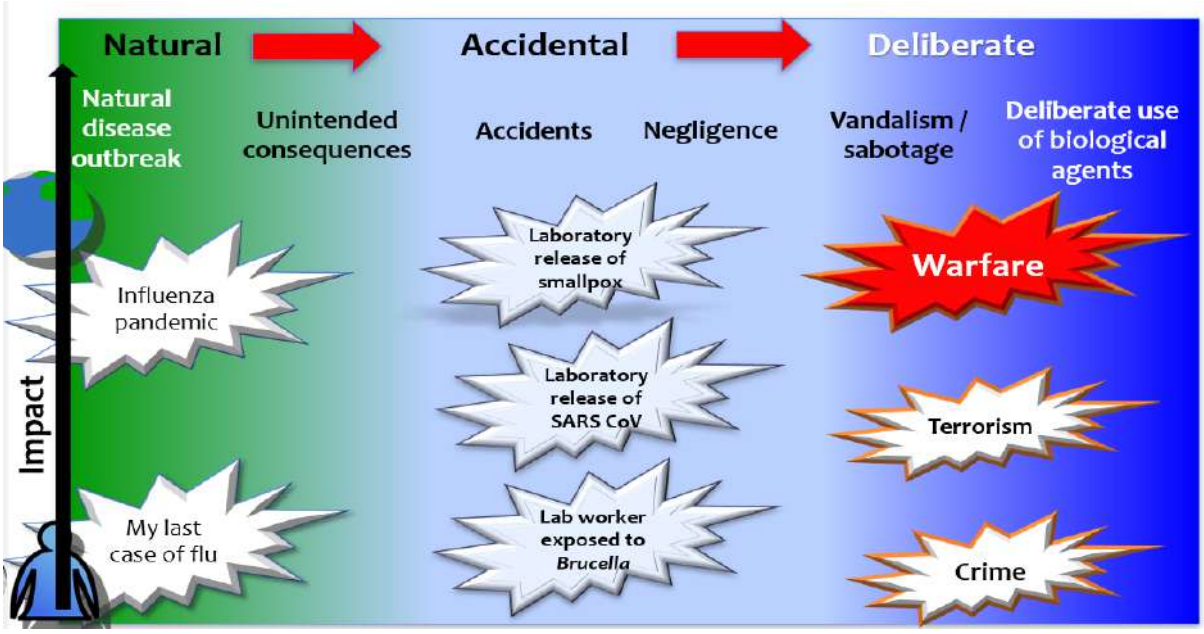


Figure 5.1 Biological Threat Spectrum

Source: Bioincident Emergency Response and Joint Investigation Guideline

5.2 Potential Biological Weapons

There are two (2) types of biological agents:

a) Pathogens**:** These are disease-causing organisms, some of which can reproduce and keep spreading long after the attack.

- Pathogens can be bacteria such as anthrax, viruses such as smallpox, or fungi like yeast and molds, mycoplasmas that cause pneumonia and similar problems, or rickettsiae. Plague, smallpox, anthrax, haemorrhagic fever, and rabbit fever are known to be potential biological weapons. Category of biological agents is shown in **Annex 6**.
- Not all diseases are contagious, and many have a low mortality rate when properly treated.

b) Toxins: Toxins are poisonous substances produced by living things. Many toxins are extremely lethal and small quantities can kill very large numbers of people. Some possible toxin weapons are ricin, botulinum toxin, and aflatoxin. Again, the difficulty for the terrorist is to find an effective way to disperse or distribute the toxin.

5.3 Risk Assessment

5.3.1 Biohazard Risk Assessment

Biohazard assessment is the identification of a biohazard causing the event and of the associated adverse health effects. Hazard assessment (**Annex 7**) is determined by a few criteria, such as:

a) Identifying the hazard (s) that could be causing the event.

b) Reviewing key information about the potential hazard (s) i.e., characterising the hazard.

c) Ranking potential hazards when more than one (1) is considered a possible cause of the event (equivalent to a differential diagnosis in clinical medicine).

Table 5.1 Risk Assessment and Management Matrix

Risk Assessment	Risk Management
Pathogen The risks associated with the biohazard	**Practices** Good microbiological work practices
Procedures Additional risks posed by the proposed manipulations	**Protective Equipment** Protective clothing and engineering controls or containment equipment
Personnel Review of the people who will handle biohazards	**Place** A review of the work location where biohazards will be handled

Source: https://research.uncc.edu/departments/biosafety/risk-assessment-and-biosafety-levels

5.3.2 Risk Group Comparisons

Risk group comparison according to categories is shown in table below:

Table 5.2 Risk Group Comparison According to Categories

Categories	Risk Group 1	Risk Group 2	Risk Group 3	Risk Group 4
Characteristics	Does not cause disease in healthy adults	Can cause infection of varying severity. Rarely lethal. Can be controlled using standard laboratory practices	Agents associated with moderate to severe disease outcome. Can be lethal	Capable of causing severe disease with lethal outcome.
Availability of Treatment	Not applicable	Treatment may be available or host immune system is capable of controlling the infection	Treatment may not be available	Treatment is generally not available. Experimental treatment regimens possible
Routes of Transmission	Not applicable	Ingestion, through the skin, and via facial mucous membranes	Same as Risk Group 2 plus inhalation	Same as Risk Group 3
Disease Severity to Individual	None in healthy adults	Low to moderate	Moderate to high Higher mortality and morbidity	High Highest mortality rates in this category
Community Risk	Low	Low	Low to Moderate	High Perception risk also very high
Infections Dose	Not applicable	Generally high (variable)	Lower doses capable of infection	Can be as low as 1 organism
Example of Agents	Non-conjugative strains of *E.coli*, *Sacchromyces cerevisiae*	Parasites (i.e. Plasmodium, Trypanosomes, Leishmania) GI pathogens (*Salmonella*, *Shigella*) Bloodborne Pathogens (HBV, HCV, Borrelia)	Mycobacterium tuberculosis, West Nile Virus, Yellow Fever Virus, Rickettsia rickettsi	Ebola virus, Marburg virus, Sabia virus, Equine Morbillivirus
Rule of Thumb**	Don't drink it! Never eat, drink or smoke in the laboratory	Don't touch it! Wear gloves, decontaminate work surfaces, avoid touching your face, make sure wounds are covered, work in a BSC, wear eye protection, work behind a shield	Don't breathe it! Because of inhalation risk, perform all work inside of a biosafety cabinet. Wear respiratory protection if needed	Don't do it! Don't do it in your state unless you have a federally approved BSL4 laboratory) Risk Group 4 agents require significant containment

Source: https://research.uncc.edu/departments/biosafety/risk-assessment-and-biosafety-levels

RAT shall conduct risk characterisation by completing risk assessment task (Figure 5.2). After performing risk assessment for biological agent, actions will be taken based on the Table 5.3 below. If the level of overall risk is more than Moderate Risk, notify the RMP and CPRC.

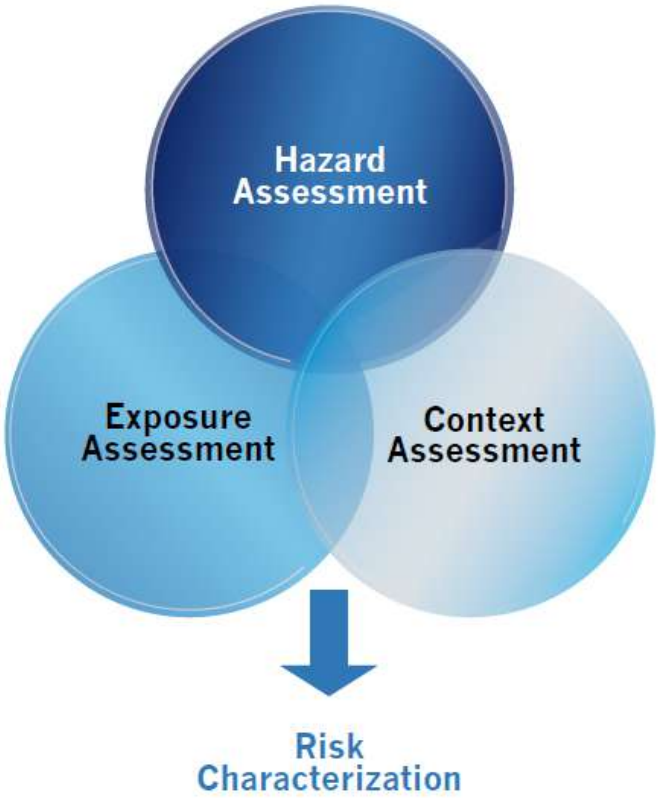


Figure 5.2 Risk Assessment is Performed by Assessing Hazard, Exposure, and Context

Table 5.3 Recommended Actions based on Level of Overall Risk

	Level of overall risk	Actions
	Low Risk	Managed according to standard response protocols, routine control programmes and regulation (e.g., monitoring through routine surveillance systems).
	Moderate Risk	Roles and responsibility for the response must be specified. Specific monitoring or control measures required (e.g., enhanced surveillance, additional vaccination campaigns).
	High Risk	Senior management attention needed: there may be a need to establish command and control structures; a range of additional control measures will be required some of which may have significant consequences.
	Very High Risk	Immediate response required even if the event is reported out of normal working hours. Immediate senior management attention needed (e.g., the command and control structure should be established within hours); the implementation of control measures with serious consequences is high likely.

Source: WHO. Rapid Risk Assessment of Acute Public Health Events, 2012

5.4 Preparedness Phase

This phase encompasses early warning and preparation for intervention and control measures in order to ensure the safety of the community as well as the responders whenever a biological incident occurs.

5.4.1 Surveillance for Bio-incidents

Existing surveillance activities within MOH to be enhanced for timely detection of any potential bio-incidents so that appropriate actions can be taken immediately. Intelligence information by RMP, e.g., on terrorist activity, and biosecurity surveillance on animals by Department of Veterinary Services (DVS) are equally important.

5.4.2 Interagency Communication and Coordination

Effective management of bio-incidents requires multiagency approach. Details of the incidence, epidemiological findings and non-sensitive patient's information shall be shared and exchanged between the MOH and other related agencies such as RMP. These information are crucial in establishing joint threat assessment. Focal person from each agency shall be identified. Any biothreat case shall be recorded, listed, reported to the National CPRC. For effective preliminary assessment, within MOH and interagency coordination meetings should be held regularly.

5.4.3 Event Notification

Any news, reports or rumours (also known as signal or trigger) of all biological related incidents at the field may eventually reach relevant agencies including health authority. After receiving the initial report of the event, the District Health Office is required to notify the event to the State CPRC and subsequently, the State CPRC will notify the National CPRC through an online system and electronic messages within 24 hours[10] Also, hospital should notify the District Health Office and the State CPRC on any potential bio-incidents.

5.4.4 Referral Hospitals for Bio-incident Cases

Bio-incident cases to be sent to the designated hospitals for infectious disease with the availability of infectious disease (ID) physician.

5.4.5 Mental Health and Psychosocial Support (MHPSS)

All district and state MHPSS teams shall be able to be deployed to deliver PFA to patients, victims, responders and family members. MHPSS teams will be stationed at receiving hospitals or other designated locations as required. The MOH Mental Health Unit must be alerted to coordinate and further assist the needs on the mental health psychosocial support services.

5.4.6 Personal Protective Equipment (PPE)

PPE is specialised clothing or gear or equipment used to shield or isolate individuals from biological hazards that may be encountered during an emergency response. The activities associated with emergency response and operations that may require the wearing of PPE are presented below:

a) Site survey (reconnaissance)

   Individuals conducting an initial investigation of a biological incident site. These situations are usually characterised by a large degree of uncertainty and mandate the highest levels of protection.

b) Emergency rescue

   Individuals entering a bio-hazardous area for the purpose of removing an exposure victim. Special considerations must be given to how the selected PPE may affect the ability of the wearer to carry out rescue operations.

c) Biohazard mitigation

   Individuals entering a bio-hazardous area to reduce the hazards from further release. PPE must accommodate the required tasks without sacrificing adequate protection.

d) Biological crime scene investigation

   Individuals entering a bio-hazardous area for the purpose of collecting biological and criminal evidences/ samples.

e) Decontamination

   Individuals providing decontamination support to personnel or equipment leaving the contaminated site.

f) Laboratory testing

   PPE must be made available to laboratory workers. The PPE selected is dependent on the nature of the laboratory work performed and is determined through a risk assessment. Refer to **Annex 8**, i.e., Biosafety Level (BSL) for Laboratory for the type of PPE recommended for laboratory personnel.

Components forming an effective protective ensemble may incorporate a wide variety of protective equipment and clothing items which include:

a) Respiratory equipment (e.g., APR and supplied air respirators).

b) Protective garments (e.g., positive pressure suits, encapsulated suits, coveralls, and overgarments).

c) Other protective apparel/ equipment (e.g., face shields, boots, gloves, goggles).

No single or combination of protective equipment and clothing is capable of protecting against all biohazards. Thus, PPE should always be used in conjunction with other protective methods. For example, proper decontamination and engineering or administrative controls

should always be employed as additional measures for preventing exposure. The use of specific PPE required is determined through a risk assessment. Refer to Standard Precautions published by Ministry of Health, 2002, for appropriate use of PPE that can be utilised by health care personnel for successful infection control in health care setting.

5.4.7 Decontamination

Decontamination process should consist of a series of procedures performed in a specific sequence. Advice and help from HAZMAT are sought to set the decontamination station for responders, environmental samples and equipment at the site. The responsible authority to decontaminate incident site to be decided by DOCC with the advice from relevant agencies.

5.4.8 Laboratory Services

Laboratory services are critical to identify causative biological agent (s) responsible in bioterrorism. Other important function of laboratory is to assist responders by providing them with accurate information on the selection, collection, and transportation of specimens (**Annex 9**). In addition, the laboratory must handle these specimens in a manner that will result in the greatest probability of success in establishing a diagnosis and minimise the exposure of healthcare workers, responders, and patients to infectious/ biological agents.

In preparation for a potential biological incident, the laboratory shall:

a) Maintain a continuous supply of diagnostic reagents at the designated laboratories.

b) Establish molecular methods for microbial strains, including unusual or drug resistant strains.

c) Develop diagnostic/ confirmatory tests for biological agents.

d) Identify designated laboratories networking and their focal points.

e) Establish communication programmes between laboratory networks to ensure delivery of accurate information, standardised laboratory protocols, and continuous collaboration.

f) Establish and maintain bioterrorism-related education and training for laboratory personnel and responders.

5.4.8.1 Networks of Designated Laboratories

Peripheral laboratories (including district and state hospital laboratories, primary care clinic laboratories, private hospital laboratories, and private laboratories) shall serve as early detectors of and communicators about a suspicious agent that cannot be ruled out as a possible bioterrorism-associated organism.

The peripheral laboratory is not responsible for and should not make the decision that a bioterrorism event has occurred. That responsibility rests with the Designated Reference Laboratories.

The peripheral laboratory should not accept environmental (powders, letters, packages), animal, food, or water specimens for examination, culture, or transport for bioterrorism-associated agents. Such specimens should be submitted directly to the nearest Designated Reference Laboratories.

Designated Reference Laboratories (veterinary, water, food, chemical, military, agricultural) possess the reagents and technology for definitive confirmation of organisms referred by Peripheral Laboratories. Designated Reference Laboratories shall have BSL-3 containment facilities and practice guidelines. These laboratories shall possess the capability of advanced genetic characterisation and archiving of all bioterrorism agents.

Refer **Annex 10** for list of the designated Reference Laboratories with their contact numbers and email addresses.

5.4.8.2 List of High Priority Biological Agents for Sample Collection Preparation

Tables 5.4 and Table 5.5 shows list of high priority biological agents for laboratory investigations and specimen selection, transportation and processing for anthrax, respectively.

Table 5.4 Specimen Collection and Handling for High Priority Biological Agents

Agent	BSL		Specimen Exposure Risk	Recommended Laboratories Precautions	
	Specimen Handling	Culture Handling			
Alphaviruses	2	3	Blood, CSF. Tissue culture and animal inoculation studies should be performed at BSL-3 and are not sentinel laboratory procedures.	BSL-2: Activities involving clinical material collection and transport.	
Bacillus anthracis	2	3	Blood, skin lesion exudates, CSF, pleural fluid, sputum, and rarely urine and faeces.	BSL-2: Activities involving clinical material collection and diagnostic quantities of infectious cultures.	BSL-3: Activities with high potential for aerosol or droplet production.
Brucella spp.[a]	2	3	Blood, bone marrow, CSF, tissue, semen, and occasionally urine.	BSL-2: Activities limited to collection, transport, and plating of clinical material.	BSL-3: All activities involving manipulations of cultures.
Burkholderia pseudomallei	2	3	Blood, sputum, CSF, tissue, abscesses, and urine.	BSL-2: Activities limited to collection, transport, and plating of clinical material.	BSL-3: All activities involving manipulations of cultures.

Agent	BSL		Specimen Exposure Risk	Recommended Laboratories Precautions	
	Specimen Handling	Culture Handling			
Burkholderia mallei	2	3	Blood, sputum, CSF, tissue, abscesses, and urine.	BSL-2: Activities limited to collection, transport, and plating of clinical material.	BSL-3: All activities involving manipulations of cultures.
Coxiella burnetii[b]	2	3	Blood, tissue, body fluids, faeces. Manipulation of tissues from infected animals and tissue culture should be performed at BSL-3 and are not sentinel laboratory procedures.	BSL-2: Activities limited to collection and transport of clinical material, including serological examinations.	
Clostridium botulinum[c]	2	3	Toxin may be present in food specimens, clinical material (serum, gastric, and faeces). Toxin is extremely poisonous!	BSL-2: Activities with materials known to be or potentially containing toxin must be handled in a BSC (class II) with a lab coat, disposable surgical gloves, and a face shield (as needed).	BLS-3: Activities with high potential for aerosol or droplet production.
Francisella tularensis[d]	2	3	Skin lesion exudates, respiratory secretions, CSF, blood, urine, tissues from infected animals, and fluids from infected arthropods.	BLS-2: Activities limited to collection, transport, and plating of clinical material.	BLS-3: All activities involving manipulations of cultures.
Yersinia pestis[e]	2	3	Bubo fluid, blood, sputum, CSF, faeces, and urine.	BSL-2: Activities involving clinical material collection and diagnostic quantities of infectious cultures.	BSL-3: Activities with high potential for aerosol or droplet production.

Agent	BSL		Specimen Exposure Risk	Recommended Laboratories Precautions	
	Specimen Handling	Culture Handling			
Smallpox[f]	4	4	Lesion fluid or crusts, respiratory secretions, or tissue.	BSL-2: Packing and shipping. Do not put in cell culture.	
Staphylo-coccal enterotoxin B	2	2	Toxin may be present in food specimens, clinical material (serum, gastric, urine, respiratory secretions, and feces), and isolates of *S. aureus*.	BSL-2: Activities involving clinical material collection and diagnostic quantities of infectious cultures.	
Viral Hemorrhagic Fever (VHF)[g]	4	4	Blood, urine, respiratory, and throat secretions, semen, and tissue.	BSL-2: Packing and shipping. Do not put in cell culture.	

Notes:

a. Laboratory-acquired brucellosis has occurred by sniffing cultures; aerosols generated by centrifugation; mouth pipetting; accidental parenteral inoculations; and sprays into eyes, nose, and mouth; by direct contact with clinical specimens; and when no breach in technique could be identified.
b. Laboratory-acquired infections have been acquired from virulent phase I organisms due to infectious aerosols from cell culture and the use of embryonated eggs to propagate *C. burnetii*.
c. Exposure to toxin is the primary laboratory hazard, since absorption can occur with direct contact with skin, eyes, or mucous membranes, including the respiratory tract. The toxin can be neutralised by 0.1 M sodium hydroxide. *C. botulinum* is inactivated by a 1:10 dilution of household bleach. Contact time is 20 minutes. If material contains both toxin and organisms, the spill must be sequentially treated with bleach and sodium hydroxide for a total contact time of 40 minutes.
d. Laboratory-acquired tularemia infection has been more commonly associated with cultures than with clinical materials or animals. Direct skin/ mucous membrane contact with cultures, parenteral inoculation, ingestion, and aerosol exposure have resulted in infection.
e. Special care should be taken to avoid the generation of aerosols.
f. Ingestion, parenteral inoculation, and droplet or aerosol exposure of mucous membranes or broken skin with infectious fluids or tissues are the primary hazards to laboratory workers.
g. Respiratory exposure to infectious aerosols, mucous membrane exposure to infectious droplets, and accidental parenteral inoculation are the primary hazards to laboratory workers.

Source: https://www.asm.org/ASM/media/Policy-and-Advocacy/LRN/Sentinel%20Files/BT-Readiness.pdf

Table 5.5 Specimen Selection, Transportation, and Processing for Anthrax

Disease/ Agent	Specimen Selection		Transport and Storage	Specimen Plating and Processing				
				SBA	CA	MAC	Stain	Other
Anthrax (*Bacillus anthracis*)	Possible *Bacillus anthracis* exposure in an asympto -matic patient.	Swab of anterior nares: Only to be collected if so advised by local public health authorities.	<24 h, RT	No	No	No	None	Follow public health instructions on anterior nares swab only if advised to collect these.
	Cutaneous	Vesicular stage: Collect fluid intact vesicles on sterile swab(s). The organism is best demonstrated in this stage.	<24 h, RT	X	X	X	Gram stain	
		Eschar stage: Without removing eschar, insert swab moistened in sterile saline beneath the edge of eschar, rotate, and collect lesion material.	<24 h, RT	X	X	X	Gram stain	
		Vesicular stage and eschar stage: collect 2 punch biopsies. Place one biopsy in 10% formalin to be sent to CDC for histopathology, immunohistoch emical staining, and PCR.	One punch biopsy in 10% formalin. Once in formalin, can be stored until transported to laboratory.	No	No	No	Performed at laboratory.	Contact LRN Reference Level Laboratory before collecting specimen.
		Submit second biopsy for culture.	<24 h, RT	X	X	X	Gram stain	

Disease/ Agent	Specimen Selection		Transport and Storage	Specimen Plating and Processing				
				SBA	CA	MAC	Stain	Other
Disease/ Agent	Specimen Selection		Transport and Storage	Specimen Plating and Processing				
				SBA	CA	MAC	Stain	Other
Anthrax (*Bacillus anthracis*) (cont'd)	Cutaneous (cont'd)	Blood cultures: Collect 2 sets (1 set is 2 bottles) per institutional procedure for routine blood cultures.	Transport at RT. Incubate at 35-37°C per blood culture protocol.	Blood culture bottles.			Positive in some cases during late stage of disease.	
		Purple-top tube (EDTA): for inpatients only, collect for direct Gram stain.	<24 h, RT	No	No	No	Gram stain	
		Red-top for serology; EDTA, heparin, and citrate are all acceptable.	<24 h, 4°C	No	No	No	No	Contact laboratory for indication and direction for this testing.
	Gastro-intestinal	Stool: Collect 5-10 g in a clean, sterile, leakproof container.	<24 h, 4°C	Inoculate routine stool plating media plus CAN or PEA.				Minimal recovery.
		Blood cultures: Collect 2 sets (1 set is 2 bottles) per institutional procedure for routine blood cultures.	Transport at RT. Incubate at 35-37°C per blood culture protocol.	Blood culture bottles.			Positive in late stage of disease.	
		Purple-top tube (EDTA): for inpatients only, collect for direct Gram stain.	<24 h, RT	No	No	No	Gram stain	

Disease/ Agent	Specimen Selection		Transport and Storage	Specimen Plating and Processing				
				SBA	CA	MAC	Stain	Other
		Red-top tube for serology. EDTA, heparin, and citrate are all acceptable for PCR.	<24 h, 4°C	No	No	No	No	
Disease/ Agent	**Specimen Selection**		**Transport and Storage**	**Specimen Plating and Processing**				
				SBA	**CA**	**MAC**	**Stain**	**Other**
Anthrax (*Bacillus anthracis*) (cont'd)	Inhalation	Sputum: Collect expectorated specimen into a sterile, leakproof container.	<24 h, 4°C	X	X	X	Gram stain	Minimal recovery.
		Pleural fluid: Collect specimen into sterile. leakproof container.	<24 h, 4°C	X	X	X	Gram stain	Save excess (if any) for PCR.
		Blood cultures: Collect 2 sets (1 set is 2 bottles) per institutional procedure for routine blood cultures.	Transport at RT. Incubate at 35-37°C per blood culture protocol.tocol.	Blood culture bottles.			Positive in late stage of disease.	
		Purple-top tube (EDTA): For inpatients only, collect for direct Gram stain.	<24 h, RT	No	No	No	Gram stain	
		Red-top for serology; EDTA, heparin, and citrate are all acceptable for PCR.	<24 h, 4°C	No	No	No	No	

Disease/ Agent	Specimen Selection		Transport and Storage	Specimen Plating and Processing				
				SBA	CA	MAC	Stain	Other
	Meningitis	Cerebrospinal fluid culture: Aseptically collect CSF per institutional procedure.	<24 h, RT	X	X		Gram stain	May be seen in late stages of disease; consider adding broth medium such as brain heart infusion.
		Blood cultures: Collect 2 sets(1 set is 2 bottles) per institutional procedure for routine blood cultures.	Transport at RT. Incubate at 35-37°C per blood culture protocol.	Blood culture bottles.			Positive in late stage of disease.	

Source: https://www.asm.org/ASM/media/Policy-and-Advocacy/LRN/Sentinel%20Files/BT-Readiness.pdf

5.4.8.3 Laboratory Guideline on Packing and Shipping Diagnostic and Clinical Specimens, Infectious Substances, and Biological Agents

To refer to Standard Operating Procedure for Transport of Biological Specimens in Malaysia, Ministry of Malaysia, 1st Edition 2012, and Standard Procedure for Packing and Shipping of Biological Agents.

5.4.8.4 Laboratory Personnel Training and Competency

Training for laboratory personnel in handling and processing biological agents shall be conducted according to the respective Designated Reference Laboratories' SOPs for handling specific biological agents, PPE, decontamination, and chain of custody. A registry with a list of these trained personnel should be maintained at the Designated Reference Laboratories.

5.5 Response Phase

This phase begins as soon as the suspected biothreat event occurs which initiates further assessment of the threat; determination of its impact; and next course of action to be taken (Figure 5.3).

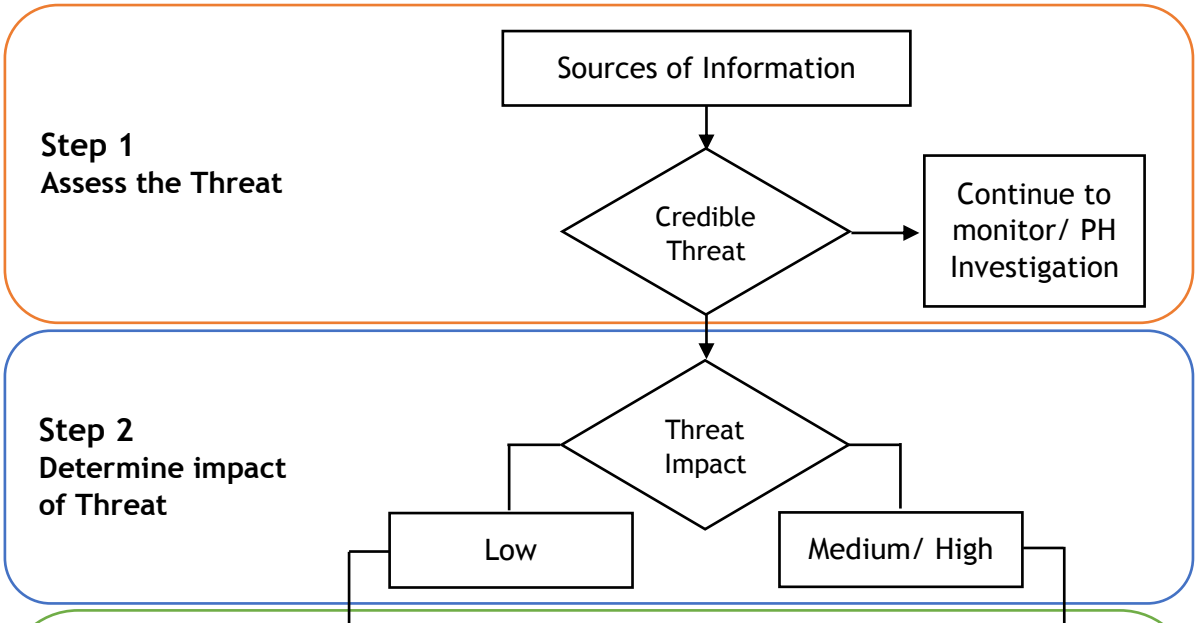


Figure 5.3: Overall Steps in Responding to Biothreat Event

Figure 5.3 Response Phase

5.5.1 Critical Information Requirement

Critical Information Requirement (CIR) is a high priority of information received that triggers immediate action for response. Response specific CIRs for biothreat incidents are:

a) Unusual event/ number of affected persons.

b) An illness unusual for the time of year (e.g., flu in summer).

c) An illness unusual for the patient's age group.

d) An illness in an unusual patient (e.g., cutaneous anthrax in a patient with no history of contact with animals, animal hides, or products).

e) An illness acquired in an unusual place.

f) Cluster of atypical syndromic clinical presentation.

g) Unexplained death (s).

h) Unusual magnitude or severity of a known/ suspected agent.

i) Unusual progression of an illness.

j) Theft/ misused/ mishandling/ security breach of biobanking or protocol.

k) Unusual progression of an illness.

Upon detecting or receiving above CIR (s), verification and preliminary investigation will be conducted to classify the event as natural, accidental, or deliberate (Figure 5.4). A police report must be made for any suspected deliberate acts. A deliberate event will lead to the activation of multiagency ICS and IMS with the formation of Bio-incident Emergency Response and Joint Investigation Team (Figure 5.5). Whereas, an accidental event will be managed mainly by MOH with some assistance from relevant agencies (Figure 5.6).

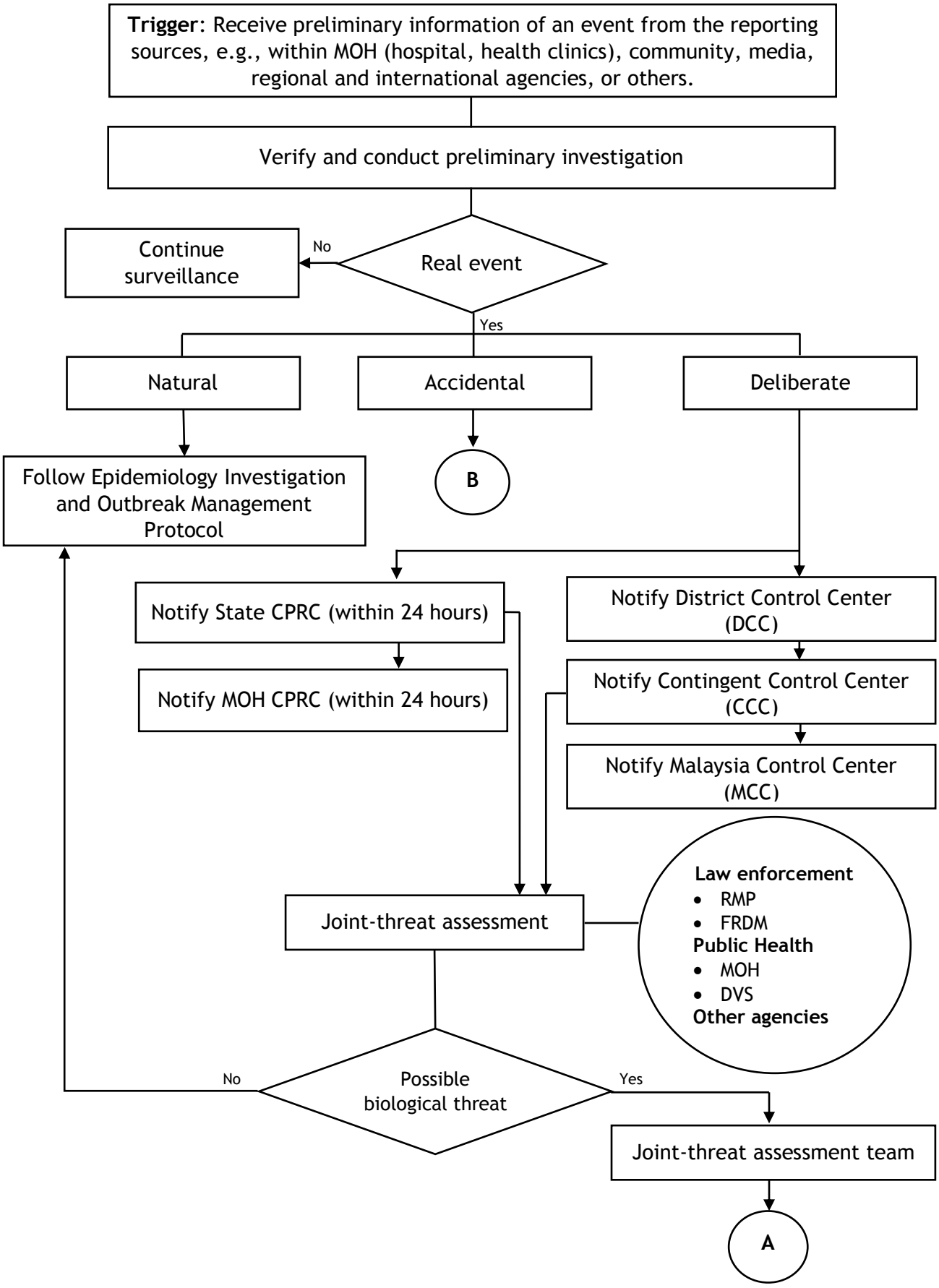


Figure 5.4 Steps in Verifying, Classifying, and Notifying Biothreat Event

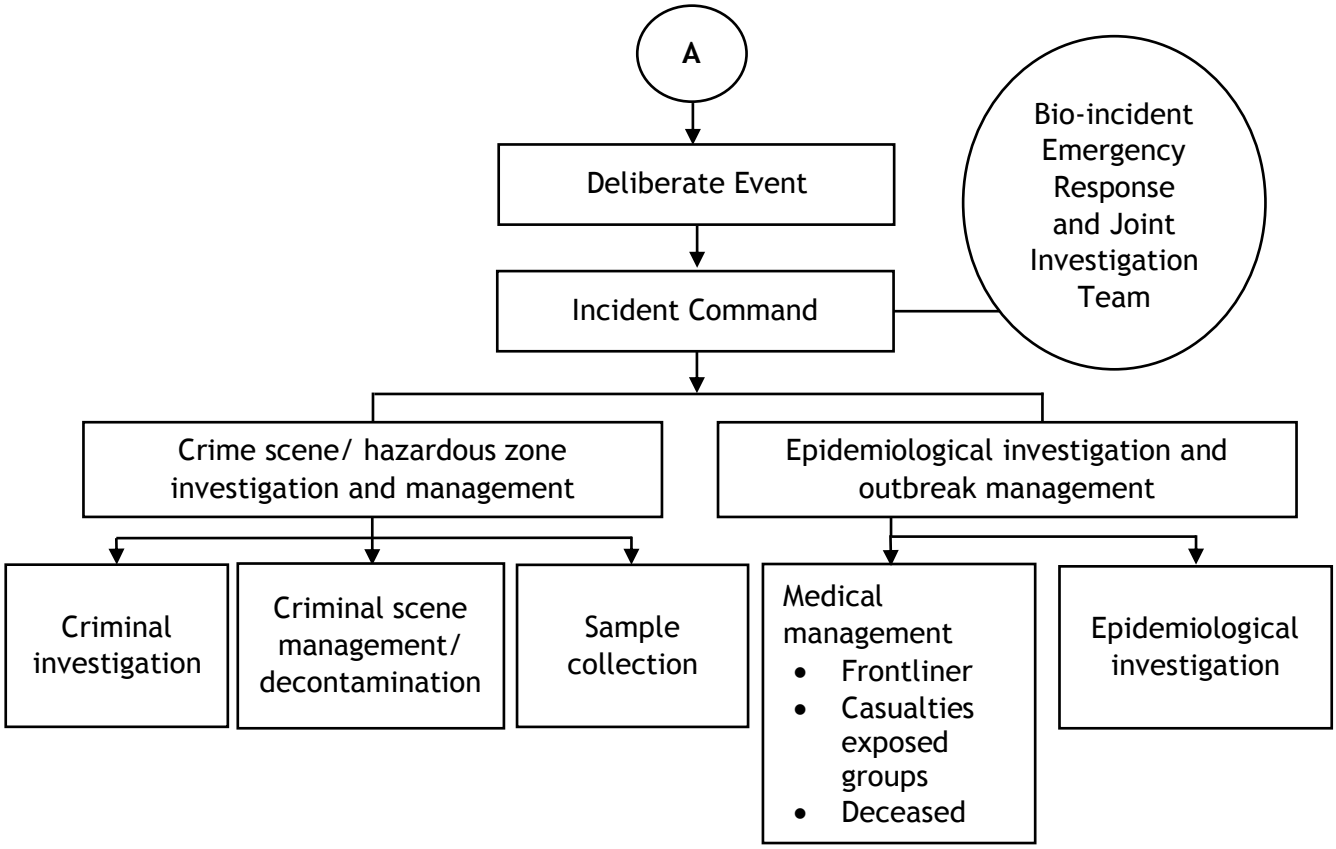


Figure 5.5 Further Steps in Managing Deliberate Biothreat Event

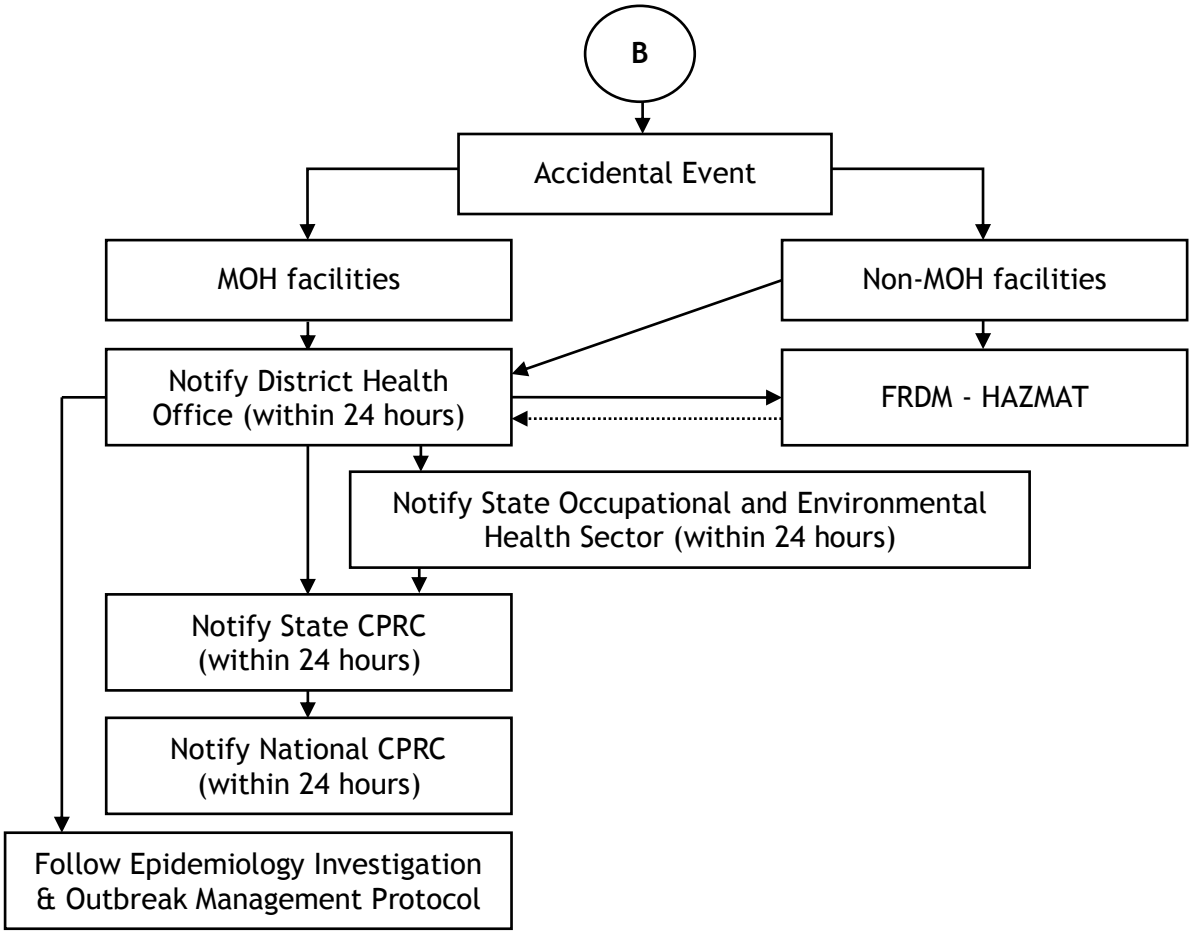


Figure 5.6 Further Steps in Managing Accidental Biothreat Event

5.5.2 The NADMA's and National Security Council's Directives

The NADMA Directive No. 1 is activated, if a biological event of a natural cause fulfils the disaster criteria. Thus, the MOH public health team will be deployed to conduct epidemiological investigation, collect samples, and conduct control measures.

However, if the biological event is of security concern thus the NSC Directive No. 18 will be activated by the NSC and the multiagency Bioincident Emergency Response and Joint Investigation Team, e.g., from Biological Response Investigation, Training, and Evaluation (BRITE) Team, will be deployed to the scene. The affected site becomes a biocrime scene of restricted security zone.

Threat and exposure credibility (Table 5.6), and Threat Credibility Evaluation (TCE) in Figure 5.7 will be assessed by law enforcement[11]. In bioterrorism, the Director of Internal Security of RMP will lead the Crisis Management Team (CMT) with NSC as the national secretariat.

Table 5.6 Assessment of Credible Threat versus Credible Exposure

Determined by Local Health Department in conjunction with Law Enforcement				
Determined by Law Enforcement	**Credible Threat**		**Credible Exposure**	
			Yes	**No**
		Yes	High priority Test immediately Chain of custody important Prophylaxis likely to be indicated	Medium priority Test the next business day Chain of custody important
		No	High priority Test immediately Need for chain of custody determined by law enforcement	No testing unless exceptional circumstances If tested, would be tested the next business day Prophylaxis not indicated unless exceptional circumstances

Note: Both a credible exposure and a credible threat analysis must be performed in order to make decisions regarding the safety of the people exposed, the necessity for prophylaxis and the appropriateness of laboratory testing.

Figure 5.7 Threat Credibility Evaluation (TCE)

Note:
- Technical Feasibility – Does the threat require technical expertise; if so, are those involved technically competent? (Will it work?)
- Operational Practicality – Does the operation that is used to carry out the threat seem practical? (Can it be done?)
- Adversarial Intent – Does the person display the behavioural resolve to carry out the operation? (Would the person do it?)

Source: *U.S. FBI and U.S. CDC. Joint Criminal and Epidemiological Investigations Handbook. International Edition, 2016*

5.5.3 Public Health Response

At the District Health Office level, RAT will be despatched to the scene to do risk assessment of all hazards. Risk assessment and field findings gathered by the RAT will be immediately analysed and discussed at the district level for further actions and measures to be taken by the RRT. The National CPRC will guide and give technical advice to RAT and RRT from the district/ state/ national level in dealing with biothreat event.

Three (3) main roles for RRT in biothreat response are:

a) Identify victims and manage those who have been exposed:

- Identify unaffected or well-ventilated area and stay upwind of contaminated areas or any potential source of agent release.
- Isolate victims with symptoms. Provide facemask and vomiting bag, remove contaminated clothes, and put in the biohazard bag.
- Assess those who have been exposed and treat accordingly. Refer to nearest health facility for further management.
- Always practices universal precautions and infection control measures.
- Discuss with Infectious Disease Consultant or Consultant Microbiologist.
- Immediately isolate patient and restrict entry to essential personnel only.
- Ensure contact details for relatives and friends obtained before they leave.
- Ensure ambulance used by the case is not used again until decontaminated or diagnosis excluded.
- Arrange clinical assessment by/ consultation with ID Specialist.
- Identify case contacts for follow up (+/- post exposure prophylaxis or vaccination).

b) Identify source of biological threat:

- Do a quick field screening. Identify possible source of biological threat in that area.
- Establish clean and dirty area. Always act together with a partner for sampling procedures.
- Always communicate with RAT and BRITE Subject Matter Expert (SME) for biological sampling. The use of GIRN and other means for real-team reporting are encourage.
- Label all specimen containers and all request forms high risk, and warn laboratory in advance.
- Transport clinical specimens to the laboratory according for high-risk specimens.

c) Execute Rapid Containment:

- Rapid containment operation involves a group of activity intended to stop a potential biothreat from developing further.
- Decision to launch containment operations should take into account all available information and numerous factors assessed by highly qualified SMEs with top management approval.

5.5.4 Bio-incident Emergency Response and Joint Investigation Team

A Bio-incident Emergency Response and Joint Investigation Team is a multiagency trained SMEs and personnel from:

a) FRDM/ HAZMAT.

b) RMP (Law Enforcement).

c) MOH (Public Health).

d) Department of Veterinary Services (DVS) for Animal Health.

e) Science and Technology Research Institute for Defence (STRIDE) from the Ministry of Defence (MINDEF).

f) Designated laboratories.

g) Other relevant agencies.

This team will respond, investigate, and collect biological as well as physical evidences at the bio crime scene. A joint investigation protocol is being developed by STRIDE. The protocol facilitates sharing of resources and maximise communication and coordination between responders from law enforcement, public health, animal health, and other relevant agencies. The aims are to identify the source of biothreat thus to contain and prevent it from spreading, and to identify, apprehend and prosecute the perpetrator (s) behind it.

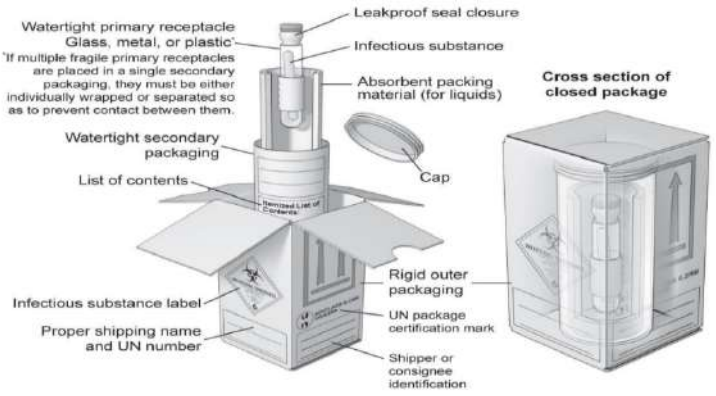
5.5.5 Biological Sampling and Evidence Collection

Biological sampling and evidence collection procedures are to be employed during field investigation at the bio crime scene. Biological sampling should be performed by specially trained MOH's (public health or laboratory) SMEs with RMP/ HAZMAT personnel (Table 5.7) in coordination and communication with the receiving analytical laboratory. Whereas, the evidence collection to be performed by specialised RMP officers.

Table 5.7 Procedures for Collecting Biological Samples and Evidence at Bio Crime Scene

No.	Procedure	Responsibility
1.	Request to Collect Biological Samples/ Evidence at the Scene ● On Scene Commander (OSC) from Royal Malaysia Police (RMP) may request SME from the MOH Malaysia who is trained to collect biological samples/ evidence at the biological crime scene. ● As a general rule, the crime scene sampling team should consist of at least three (3) operators: two (2) individuals for sample collection (a sampler or dirty person (from RMP) and an assistant or clean person (SME/ trained personnel), and one (1) as a note-taker/ photographer (from RMP).	SME/ Trained personnel
2.	Personal Protective Equipment (PPE) ● SME/ trained personnel should be equipped with at least Level C PPE (according to risk assessment).	HAZMAT/ MOH
3.	Reconnaissance ● SME/ trained personnel will join the Reconnaissance (Recon) Team consisting of RMP (Team Leader, photographer, and sketcher) and HAZMAT personnel to enter the Hot Zone (the centre of the Red Zone) of the biological crime scene to conduct survey for evidence/ sampling collection plan. ● HAZMAT personnel will lead the Recon Team as they will conduct CBRNe field screening (to detect presence of CBRNe hazards at the scene) throughout the reconnaissance process. ● SME/ trained personnel will observe potential biological samples/ evidence to be collected and the RMP personnel will mark sample areas or items to be collected with an indicator tag. ● The photographer will take pictures whereas the sketcher will make a sketch map of the biological crime scene. ● Reconnaissance is conducted for not more than 20 minutes. The Recon will exit the Hot Zone and to doff their PPE and undergo decontamination at the Warm Zone.	RMP/ HAZMAT/ SME/ Trained personnel
4.	Prepare Evidence Collection Plan ● SME/ trained personnel proceed to the Cool Zone to discuss and identify necessary equipment/ tools for collection and on what type and how many/ much of biological samples/ evidence to be collected.	SME/ Trained personnel

No.	Procedure	Responsibility
	● Prepare the appropriate collection equipment/ tools [containers, plastic packages (preferably of zip lock type), sampling mat, biohazard bag, parafilm tape, sufficient gloves, and others]. ● Separate equipment/ tools for each sampling task according to samples (eg. liquid, powder, documents, microslides, sharps, and others) into itemised packages/ kits. ● Label the containers/ packages for each of the collection item. ● Arrangements are to be made with the receiving designated laboratory and with RMP for chain of custody of samples/ evidence during transportation.	
5.	Re-entering the Hot Zone for Sample/ Evidence Collection ● The Sampling Team shall wear the appropriate Level of PPE (Level C or above). ● The sampler should wear multiple pairs of gloves, changing outer gloves between each sample. At no time should the innermost gloves be removed in the contaminated area. ● The Sampling Team will enter the Warm Zone then to the Hot Zone, bringing along the above gathered samples/ evidence collection apparatus, accompanied by the Team Leader and a HAZMAT personnel.	RMP/ HAZMAT/ Crime Scene Sampling Team
6.	Collection of Samples/ Evidence ● HAZMAT personnel will conduct screening on samples/ evidence prior to collection. Selection of samples to be taken shall be pre-determined during the reconnaissance process and identified by indicator tag. ● The assistant will open the sealed collection tool package/ kits and pass the necessary collection equipment/ tool and an appropriate container to the sampler. ● The sampler will collect the samples/ evidence (may be in the form of powder, jelly-like, fluid, or others) and transfer it into the container (the first layer). ● Sampling gloves and tools (such as pipettes) must be used only once for each sample or sampling area and then placed into the hazardous-waste bag or container. ● The sampler will place the first packaged sample/ evidence into a labelled plastic zip-lock bag or other protective bag (second layer) hold by the assistant, without touching the surface of the second layer, and move on to the next task. ● Air in the zip lock plastic bag shall be removed by the assistant using burping technique before the plastic bag is sealed. ● The above steps are repeated for the next sample collection with the sampler using a new pair of outer gloves between each sample.	RMP/ HAZMAT/ Crime Scene Sampling Team

No.	Procedure	Responsibility
7.	Exiting the Crime Scene (Hot Zone) ● Once all selected biological samples/ evidence have been collected, the crime scene sampling team will exit the crime scene (Hot Zone). ● The assistant will hand over all the packaged biological samples/ evidence to the HAZMAT personnel waiting at the Warm Zone to decontaminate their outer packaging. ● Each packaged samples/ evidence is to be put into another bag/ package (third layer) to be sealed and labelled, supervised by the RMP officer for chain of custody purposes. ● All individuals should doff their PPE at the Warm Zone and undergo decontamination. After signing off, individuals will be put under medical monitoring.	Crime Scene Sampling Team/ HAZMAT
8.	Sending Biological Samples to Designated Laboratories for Analyses ● The collected biological samples/ evidence shall be transported under chain of custody by RMP to the designated laboratories [e.g., National Public Health Laboratory (NPHL) in Sungai Buloh; Veterinary Research Institute (VRI) in Ipoh; Institute for Medical Research (IMR) in Kuala Lumpur] for analyses to confirm the presence of the agents/ toxins. ● Biological samples/ evidence transported must be appropriately preserved and packaged (as shown in the figure below) during transportation to maintain sample integrity, protect from destruction or degradation, ensure chain of custody, and free from cross contamination.  BASIC TRIPLE PACKAGING:	RMP/ Receiving Laboratories

Note: Biological sampling strategy at widespread area maintains the same principles with following additional steps:

a) Going from lowest to highest concentration of agent (reduce risk of cross contamination).
b) Obtain dual sets of any sample.
c) Obtain samples from the outside areas as predicted by the dispersal assessment (validation of area of contamination and persons exposed based on wind direction).
d) Take nasal swabs from contaminated persons.
e) Take surface swabs and air samples from building to confirm dispersal within a contaminated building through the ventilation system.
f) Obtain dry powder from delivery site to the source.

5.5.6 Accidental Detection of Biological Incident

During a routine response to an emergency call, the ART may detect a possible biological incident based on the situational assessment of the incident e.g., history from victims, presence of sick or dead animals on site. The team leader of ART has to relay the information back to their respective MECC and request for further orders.

In general, the ART members should:

a) Wear the appropriate PPE before managing the victims.

b) Direct the walking victims to an area and isolate them.

c) Prevent the bystanders from encroaching into the designated red zone.

d) Inform the RMP and other rescue agencies regarding the possibility of the biological incident.

5.5.7 Medical Response

The focus of medical response would be to manage the affected victims and prevent the contamination from spreading. There will be two (2) main activities to prepare for the management of victims:

a) Incident Site Management.

b) Hospital Management at Emergency and Trauma Department (ETD).

In preparation to receiving the affected victim (s), the nearest and appropriate hospital will be activated. The Hospital Director will be responsible for activating the hospital. The hospital will be activated once the information of the biological incident (confirmed or suspected) is received via an official communication i.e. from District Health Office, MECC, or other relevant authority or government agency.

5.5.7.1 Incident Site Management

a) Mobilisation of Emergency Medical Teams (EMTs)

The designated MECC of the affected area will coordinate the mobilisation of the Emergency Medical Teams (EMTs) from hospitals and health clinics to the incident area. The number of EMTs mobilised would depend on the number and severity of the affected victims. The hospital's EMT or MERT mainly come from the ETD consisting a minimum of an Assistant Medical Officer (AMO) and an ambulance driver. However, in anticipation of a large number of exposed and/ or contaminated victims, the team should include other additional staff (e.g., doctors and nurses). This team would be required to go to the site of the incident to manage the victim (s) together with other MOH teams. All the teams should bring the highest level of PPE available when the organism is unknown e.g., coveralls, N95 masks, or APRs.

Listed below are the suggested items to be brought along (if applicable):

- PPE:
  - Coveralls (e.g., Tyvek)/ disposable gowns
  - Disposable Masks-with filtration of < 5 microns if possible
  - Cap
  - Eye goggles
  - Gloves
  - Rubber Boots
- Chemoprophylaxis: e.g., ciprofloxacin, doxycycline, and amoxicillin for anthrax.
- Biohazard bags for the exposed persons contaminated clothes.
- Chlorohexidine wash for hand hygiene.
- Operating Theatre (OT) suit/ gowns (for exposed individual to change out of contaminated clothes).

b) Medical Management of Biological Incident Exposure/ Contamination at the Scene

On arrival at the scene of the incident, the team will communicate with the responsible agencies managing the incident e.g., RMP and FRDM/ HAZMAT to facilitate receipt of victims. The team would set-up a triage and treatment area at the most appropriate site available:

i) Set up MBS

Set up an appropriate area in the Yellow Zone (preferably with some privacy) to use as a treatment station/ bay to attend to those exposed or contaminated. Wear the appropriate PPE and standby at the Casualty Collection Point (CCP) to receive the affected victim(s).

ii) Triaging of Victims

Based on the initial assessment, victims may require life-saving intervention prior to decontamination (Figure 5.8). Otherwise, decontamination of victims (if required) will supersede medical management.

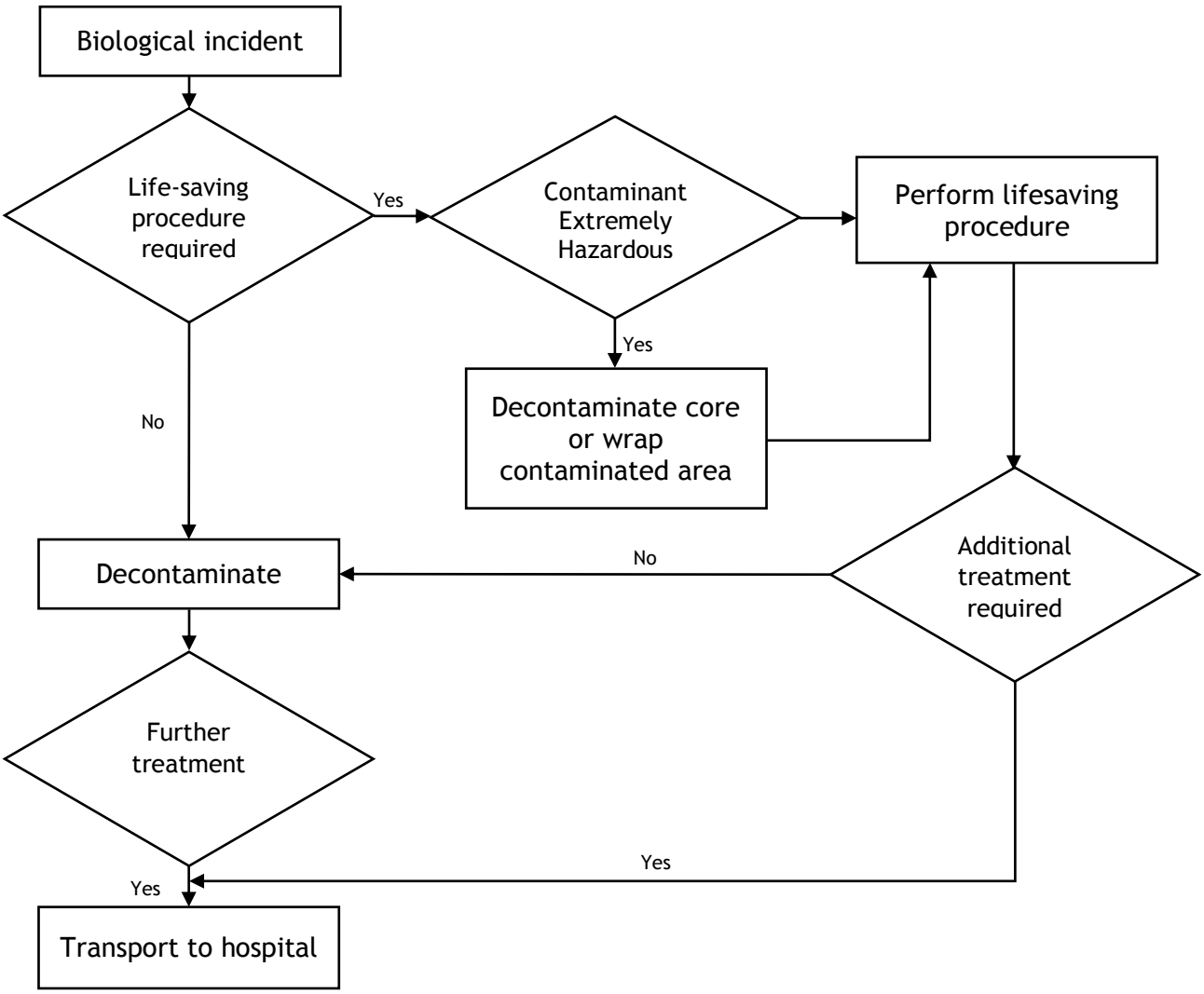


Figure 5.8 Triaging of Victims of Biological Incident at the Scene

iii) Decontamination by the HAZMAT

Decontamination of the exposed persons will be performed by the HAZMAT. The individual should remove his/ her contaminated clothing then wash his/ her hair and body using water and soap. He/ she should then change to fresh clothing of his/ her own, if available, or to the replacement clothing provided by the responsible agency. He/ she will then leave the warm zone into the cold zone to be attended to by the medical team.

iv) Handling of Contaminated Clothing

The individual's contaminated clothing should be double bagged and sealed by HAZMAT in biohazard bags (provided by the EMT). These bags are to be taken back to the hospital and given to the hospital's support services to treat as biohazardous waste. However, in a suspected deliberate event, all the victims' belongings will be handed over to RMP as evidence.

Medical Teams should also remove their hospital gowns or others and double seal these items in a biohazard bags to be treated as biohazardous waste, before leaving the site.

c) Patient Management at the Scene

i) Resuscitation and Stabilisation

Victims requiring emergency intervention and stabilisation would be managed accordingly before being sent to the hospital. The non-critical victims would be sent to the nearest health clinic or designated treatment centre for further management.

ii) Allay Anxiety and Counselling

Allay the anxiety of those with possible exposure. Counsel individuals exposed; on the suspected organism (if known), routes of possible exposure and infection, and the various clinical presentations of the disease; in particular, emphasise on the precautionary approach taken by the health authorities, clinical features, post-exposure chemoprophylaxis, and others.

iii) Post-exposure Chemoprophylaxis and Immunisation

All individuals in direct contact with the suspected substance (physical contact) should be offered prophylaxis or immunisation, whichever appropriate depending on the confirmed or suspected organism (**Annex 11**). Others in the vicinity but with no direct contact may also be given therapy, if the level of local contamination is high. Other important factors to be considered includes local conditions especially with regards to air movement e.g., nearby fans, wind, and enclosed spaces (e.g., in air-conditioned car, elevators). If doubt arises on commencing of therapy at the scene, the State ID Physician on-call/ in-charge at the hospital shall be consulted.

iv) Follow-up Details

All patients who are exposed should be provided medical follow-up to the nearest most appropriate clinic. It is suggested that this should be assigned to the Medical Department/ Infectious Disease Units until clearance is confirmed from the laboratories. The responsibility of providing follow-up treatment will come under the purview of the Head of Physician of the hospital. The patient should be given clear follow-up details e.g., date, place, and time as well as contact telephone numbers in case of emergencies. For patients on chemoprophylaxis, the frequency and duration of follow-up will be decided by the treating physician until laboratory confirmation is obtained. Patient is sent home once all the above has been done. Home visits (if needed) will be arranged by the respective District Health Office. Patients who are unwell, can be brought back to the hospital and referred to the Medical Unit, when necessary.

v) Documentation/ Record Keeping

The checklist which have the clinical notes should then be formally passed to the Hospital's Record Office for safekeeping, and a referral letter will be sent to the respective clinic to arrange for the clinic follow-up immediately (e.g., next working day). All records should be under proper and secure storage for easy retrieval and follow-up.

vi) Clinic Follow-up

Patients who are given chemoprophylaxis should be monitored for symptoms and adverse drug effects. The relevant investigations (laboratory or imaging) will be done accordingly. Patients should be encouraged to contact the clinic anytime, if they develop symptoms during the follow-up period.

vii) Home Isolation

Patients ordered for home isolation should be visited regularly by the health personnel to monitor patient's disease progression. Arrangements should also be in place to facilitate patient's daily needs e.g., food and drinks (if needed) during this period.

5.5.7.2 Hospital Management at ETD

The ETD must be prepared to receive victims to continue medical management. Victims may arrive to the hospital via a few options:

a) Arrive on their own or sent by bystanders (decontamination not done).
b) Sent by the EMT (decontamination done at the scene).

Decontamination/ Isolation Area

The receiving hospital has to designate a decontamination/ isolation area to manage the affected victims. The designated area should fulfil certain criteria such as:

- Away from crowded areas in ETD.
- Dedicated route of passage for the person suspected of exposure to this area.
- Available shower near/ within the area.
- Negative pressure capability with separate ventilation ducts from the main hospital's ventilation.

Management of Patients/ Suspected Persons Exposed to Biological Agent and Seen at the ETD (Figure 5.9)

There might be instances whereby contaminated individuals or exposed persons to a biological agent come directly to the hospital with the suspicious package. Should this occur, the persons should be:

- Brought to the decontamination/ isolation area identified at ETD immediately. There should be no/ minimum contact with other patients and staff. The package is double bagged by the patient and kept secured in the decontamination area until HAZMAT team arrives.
- The ETD will contact the RMP who in turn will contact the FRDM/ HAZMAT.
- The District Health Office will also be notified and public health personnel will come to the hospital to carry out their duties.
- Life-saving procedures will be performed first for the affected victims, if required. Otherwise, the affected persons should be decontaminated based on the decontamination triage.
- After decontamination, the exposed individuals should be given a fresh change of hospital's clothing and brought out into the clean area where they will be attended to by the designated doctor (following procedures listed in the Management at the Scene Protocol).

- The victims would then be referred to the designated primary team for further management in the hospital.
- Contaminated clothes should be double sealed in a biohazard bag and handed over to the RMP, if a deliberate incident is suspected. Otherwise, it will be treated as biohazardous waste and managed accordingly by the hospital's concessionaires/ contractors.
- The decontamination zone/ area will be decontaminated in accordance to standard decontamination protocol for premises.
- The package concerned will be retrieved by HAZMAT, decontaminated, and sealed before it is passed over to the RMP for delivery to the designated laboratory for analysis.
- If the person had left the package at the different place, the RMP will liaise with the FRDM to retrieve it.

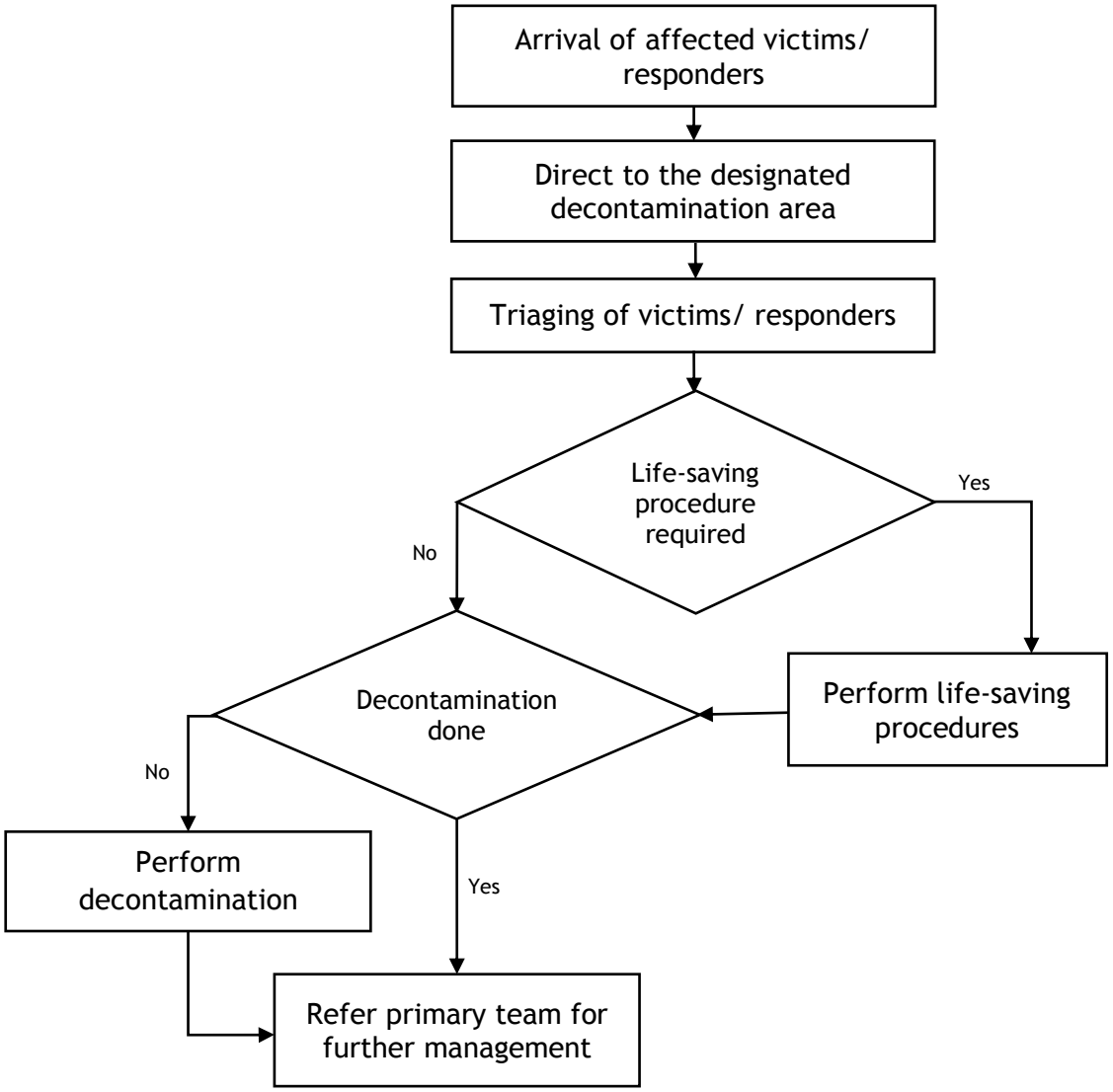


Figure 5.9 Management of Patients/ Suspected Persons Exposed to Biological Agent at the ETD

5.6 Laboratory Response

5.6.1 Sample Requirement

a) Non-Clinical Sample Collection at Biological Incident Site

Minimum sample size requirements for biological analysis:
If there is bulk liquid or solid, collect at least 1 ml of liquid or a swab of solid material. Acceptable sample types for biological testing include swab, wipe, liquid, powder, and HEPA filters. First responders (RMP/ MOH) should consult and notify the Designated Reference Laboratory to determine additional acceptable sample types, to verify testing capability and sample size requirements.

b) Clinical Sample Collection from Casualties (Field/ Hospital)

Refer to **Annex 10** for the type of clinical samples to collect from casualties at the field or hospital. Responders should consult and notify the Designated Reference Laboratory to determine additional acceptable sample types, to verify testing capability and sample size requirement.

Note: Every sample (non-clinical and clinical) shall be collected in duplicate and sent to the Designated Reference Laboratories where testing will be conducted. In the event that only ONE sample is received by the Designated Reference Laboratory, the laboratory shall split the sample into the necessary numbers needed for further testing at other Designated Reference Laboratory while maintaining chain of custody at all times.

5.6.2 Steps Upon Arrival of Samples at the Designated Reference Laboratory

A focal point for biological agent investigation shall be appointed and be notified immediately that a suspected biological agent specimen is in the laboratory. Laboratory workers are to be informed promptly of the name and medical record number of the person (s) with the suspected infection and, if appropriate, to treat other specimens from the patient (s) appropriately.

Prior to accepting the sample, the receiving laboratory must check the incoming sample to ensure that proper packaging is complied, that all accompanying documentation is included and correct, and that it comprises any field screening results to ensure that explosive, radiological, and Volatile Organic Compound (VOC) field screening was performed, at the biological incident site.

Sample preservation photos of the materials should be taken; minimise handling of evidence (e.g., envelopes), and store some of the original sample. Remove materials from the outside packaging, such as an envelope, and store the contents in the appropriate conditions according to laboratory protocol. The outside packaging should be minimally handled and stored in the best possible conditions to preserve traditional forensic evidence.

Complete records shall be kept and specimen identification shall be used, to maintain chain-of-custody. Each time any portion of the sample changes hands or is transferred, chain of custody must be completed and maintained. An example of documentation is to note that 10 plates, such as 5 chocolate agar and 5 sheep blood agar, were created from sample 1 and were delivered by Person A and received by Person B at X time. Derivative or secondary evidence can often be properly decontaminated and destroyed after testing is completed. It is critical to maintain the chain of custody of each sample. If the chain of custody is not maintained, this may severely jeopardise law enforcement prosecution of suspected perpetrators.

Secondary evidence such as growth plates can be destroyed after final testing conclusions have been made in compliance to laboratory protocols. The important material to save is the primary evidence, which is the original sample, so that further testing can occur, if requested. The general rule of thumb is to preserve the original sample until all legal matters have been resolved.

All suspected biological agent specimens are to be processed in the biological safety cabinet located in a room that is under negative pressure (BSL-3). Laboratory workers must wear appropriate PPE such as gown, gloves, and mask.

Each of the plates, tubes, and blood culture bottles for which this applies must be labelled clearly as it may contain highly infectious agent.

Any growth from specimens is to be manipulated in the biological safety cabinet, in a BSL-3, while wearing appropriate PPE.

As the culture is being worked up, the scientist/ technologist working on the culture (s) must be in close touch with the microbiology supervisor and the medical director.

An identification of the organism is not the role of the peripheral microbiology laboratory. An organism that is identified as a biological agent will be forwarded to a Designated Reference Laboratory for definitive identification. Do not perform any more manipulation of the cultures other than absolutely essential.

5.6.3 Handling of Samples

In general, powder samples received by the Designated Reference Laboratory are tested first for the presence for *Bacillus anthracis* before they can be tested for other biological agents.

Perform testing of biological agents microorganisms according to the Designated Reference Laboratory protocols.

5.6.4 Preliminary Positive Laboratory Result

Notify/ report preliminary positive results to the National CPRC.

5.6.5 Biological Agent Specific Confirmatory Testing

Perform biological agent specific confirmatory testing per existing protocols.

5.6.6 Reporting of Confirmatory Test Results

Report positive and negative results to the National and State CPRCs, and the requester.

5.6.7 Preliminary and Confirmed Negative Laboratory Results

Report preliminary and confirmed negative results to the National and State CPRCs, and the requester.

5.6.8 Biological Sample Disposal

Upon completion of all tests and depending on the needs of the requestor, sample may be returned to RMP, referred to another laboratory, or destroyed using an autoclave. All sample disposal procedures should comply with MOH guidelines and the Designated Reference Laboratories biological/ biohazardous waste disposal SOPs.

Note: The original sample shall be kept for evidence.

5.6.9 Laboratory Decontamination

Commercially available household bleach solutions contain 5.25% hypochlorite and, when diluted 1: 10, are effective in routine decontamination of surfaces and instruments after working with *B. anthracis*.

Contaminated items such as pipettes, needles, loops, and microscope slides should be immersed in decontamination solution until autoclaving.

Work surfaces, such as a Biological Safety Cabinet (BSC), should be wiped down before and after use with decontamination solution.

The method of decontamination of a spillage depends upon the nature of the spillage. Spills involving fresh cultures or samples known to have low concentrations of spores should be flooded with decontamination solution and soaked for 5 minutes before cleaning up. Spills that involve samples with high concentrations of spores, involve organic matter, or occur in areas of lower than room temperature (refrigerators, freezers) should be exposed to decontamination solution for at least one hour before cleaning up.

Personnel involved in the cleanup of any spillage to wear gloves, safety glasses, and a laboratory coat or gown during the cleanup process.

Respiratory protection should be considered for spills in which a substantial aerosolisation is suspected. Sporicidal disinfectant such as 0.5% sodium hypochlorite or 0.5% calcium hypochlorite can be used.

All materials used in the cleanup and decontamination should be placed in an autoclave bin or bag for autoclaving or incineration.

5.7 Recovery Phase

The recovery phase begins immediately after the threat to human life has subsided. The goal of the recovery phase is to bring the affected area back to some degree of normalcy.

5.7.1 Definition of Recovery

Defined as the process of rebuilding, restoring, and rehabilitating. The aim is to support a prompt return to normality and it is therefore important that the remediation strategy, where possible, contributes to the swift restoration of normal living. Recovery consists of those activities that continue beyond the emergency period to restore critical community functions and begin to manage stabilisation efforts.

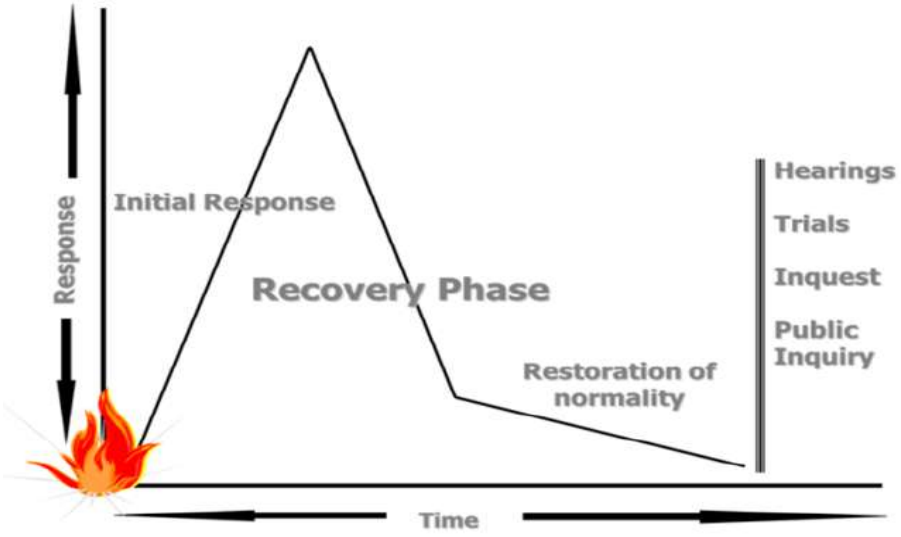


Figure 5.10 Response during Initial, Recovery Phase, and Restoration of Normality over Time

Response level (number of agencies/ responders involved) to an incident increases rapidly during the initial response but declines over time during the recovery phase (Figure 5.10). After the recovery phase, the environment is returned to normal and public access may be restored. After the incident is over, it is usually followed by a series of inquests or AARs which serve to evaluate why the incident happened and the subsequent recovery of the incident.

5.7.2 Factors for Recovery Effectiveness

Factors that influence the effectiveness of recovery are:

a) Technical Factors

- Availability of staff, equipment, methodology, transport, resources, and access to the incident.
- Duration of the recovery strategy to facilitate return to normal (i.e., treatment and application).
- Characteristics of the biological agent (s) involved in the incident.
- Surface type (e.g., robust or sensitive), land use (e.g., agriculture, livestock, and domestic use such as allotments) and water use (e.g., drinking water or recreational waters).

b) Social Factors

- Timescale for decision making and implementation of recovery options.
- Acceptability and compliance with procedures (implementers).
- Expertise and training in new technology.
- Acceptability to general public, consumers, and environmentalists.

c) Ethical Factors

- Members of the public or a workforce in the contaminated environment.
- Animal welfare is concerned with the amount of suffering the recovery option may inflict on animals such as pets, zoo animals, and farm or wild animals.

5.7.3 Different Phases in Recovery

a) Short-Term Phase

The short-term recovery phase involves assessment of the nature and the scope of the incident, concerning the potential number of people at risk, the affected area, and other consequences. A first estimate will be made of required response resources. Restoration of basic infrastructure and the mobilisation of recovery organisations and resources may be necessary in order to provide emergency personnel access to the scene.

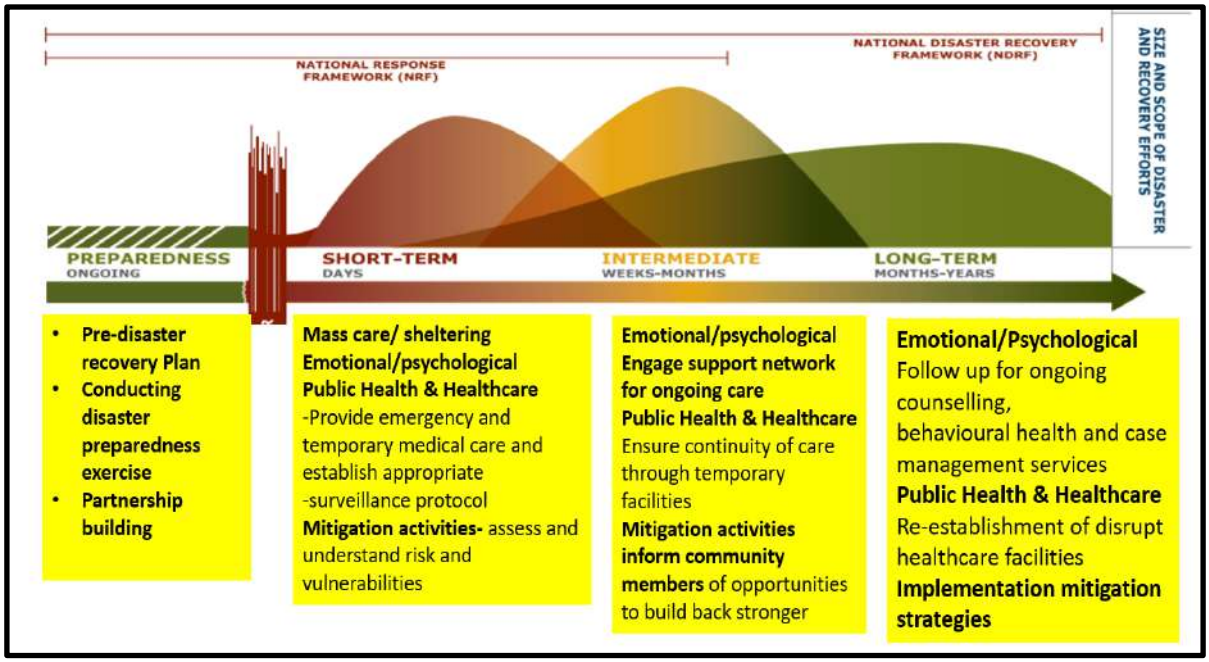


Figure 5.11 Different Phase in Recovery: Short-Term, Intermediate, and Long-Term Phases in Recovery

b) Intermediate Phase

As the incident is stabilised, it will enter the intermediate phase, which typically occurs in the days-to-weeks range, but it can follow the early-phase response within as little as a few hours. In the intermediate-term phase, site-specific remediation and restoration begins.

c) Long-Term Phase

The long-term phase of recovery could continue for months or years as complete redevelopment and revitalisation of the impacted area may be needed. However, restoration and re-occupancy may also occur after a few hours or days.

CHAPTER 6

RADIOLOGICAL AND NUCLEAR EMERGENCIES

CHAPTER 6: RADIOLOGICAL AND NUCLEAR EMERGENCIES

6.1 Background

6.1.1 Definition of Radiological and Nuclear Emergency

A non-routine situation that requires prompt action, primarily to mitigate a hazard or adverse consequences for human life and health, property and the environment 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. It includes situation for which prompt action is warranted to mitigate the effects of perceived hazard.

Radiological emergencies are those emergencies involving radioactive material that can occur anywhere that include:

a) Unauthorised (abandoned, lost, stolen, malicious threats/ acts or found) dangerous sources;

b) Misuse of dangerous industrial and medical sources (e.g., those used in radiography);

c) Public exposures and contamination from unknown origins;

d) Serious overexposures; and

e) Transport emergencies.

Whereas, nuclear emergencies are categorised into three (3) categories, I, II, or III, depending on their on-site and off-site threats. Nuclear emergencies may occur at:

a) Nuclear reactors (research reactors, ship reactors and power reactors);

b) Storage facilities for large quantities of spent fuel or liquid or gaseous radioactive material;

c) Fuel cycle facilities (e.g., fuel processing plants); and

d) Accident involving the detonation with partial nuclear yield of a nuclear weapon.

6.1.2 Types of Radiological Exposure causing Health Consequences

Radiation is energy that is transported through space and emitted in waves or particles (Figure 6.1). Some radiation is particularly rich in energy and interacts destructively with matter (ionising radiation) causing health consequences (**Annex 12**).

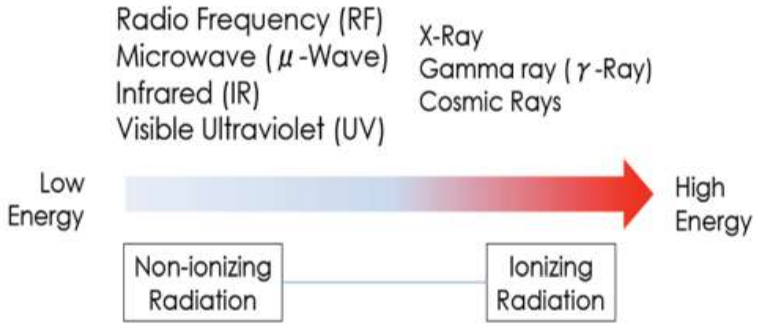


Figure 6.1 Types of Radiation

6.1.3 Health Effects from Radiological Exposure

Acute radiation syndrome (ARS) (or radiation sickness or radiation toxicity) is a constellation of health effects which present within 24 hours of exposure to high amounts of ionizing radiation either from a bomb or radiological source.

The initial symptoms such as nausea, vomiting, loss of appetite, and malaise occurs between half an hour and six hours after exposure. There is a symptom free period which occurs from 12-48 hours after exposure and can last up to three weeks (Figure 6.2).

The second phase symptoms were noticeable after a few days up to a few weeks which include initial symptoms with diarrhoea, haemorrhage, fever, and if not recover, will end up with death.

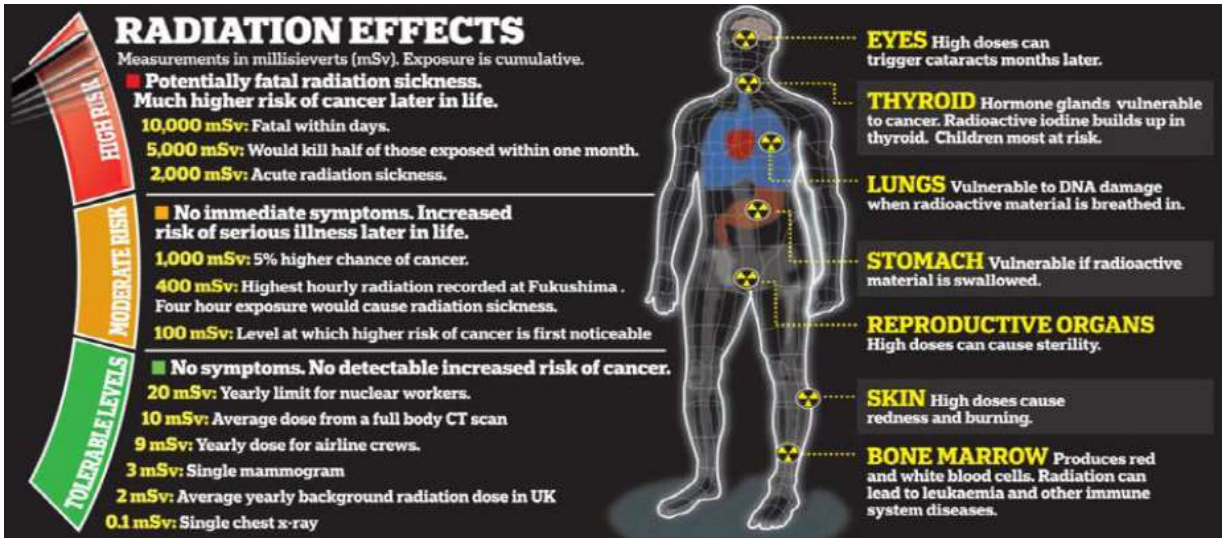


Figure 6.2 Spectrum of Health Effects in Human by Magnitude of Radiation Exposure
Source: https://healthphysics.georgetown.edu/sites/healthphysics/files/files/upload/Radiation-effects.jpg)

6.2 Preparedness Phase

This phase encompasses early warning and preparation for intervention and control measures in order to ensure the safety of the community as well as the responders whenever a radiological incidence occurs.

6.2.1 Risk Assessment

During preparedness phase, risk assessment must be conducted and continuously reviewed so that the appropriate risk and resource mapping for defense capabilities and protective measures are selected and adjusted as required. It shall be done by Occupational and Environmental Health (OEH) Officer or trained personnel at national, state, district, and hospital level.

The most common method for prioritising threat (s) and hazard (s) is to measure each one based on likelihood of occurrence and potential impact which will determine level of overall risk. The Nuclear and Radiological Emergency Preparedness Categories (**Annex 13**) used by Department of Atomic Energy (Atom Malaysia) can be used as a measurement for the likelihood of occurrence. Consequences or impact of disaster can be measured through:

a) Case fatality rate.

b) Case morbidity rate.

c) Property damages.

d) Working days loss.

An example of risk assessment based on missing gamma projector device containing radioactive isotope Ir-192 is shown in **Annex 14**.

6.2.2 Risk Mapping

All states shall identify and prepare risk mapping regarding radioactive material handling. This information can be obtained from Department of Atomic Energy (Atom Malaysia) and MOH Medical Radiation Surveillance Division (MRSD). MRSD will coordinate and distribute regularly the information on level of risk to the respective state and district.

6.2.3 Resource Mapping

Based on information on risk mapping, all states and districts shall prepare their resources as in Table 6.1 below:

Table 6.1 Resource Mapping by Level of Risk

No.	Item	Level of Risk		
		Red (high risk) Category I, II, III	**Yellow (moderate risk) Category IV**	**Green (low risk) Category V**
1.	Definition	Immediate response required even if the event is reported out of normal working hours. Immediate senior management attention needed (e.g., the command and control structure should be established within hours).	Roles and responsibility for the response must be specified. Specific monitoring or control measures required (e.g., enhanced surveillance).	Managed according to standard response protocol, routine control programmes, and regulation (e.g., monitoring through outline surveillance system).
2.	Infrastructure	Risk hospital shall equipped with decontamination room with nett in flow with HEPA filter.	Risk hospital shall equipped with decontamination room with nett in flow with HEPA filter.	N/A
3.	Equipment	1. Survey meter. 2. Contamination survey meter. 3. Personal dosimeter. 4. Personal protective equipment type C package. 5. Plastic bag. 6. Contamination signage. 7. Mobile decontamination.		
4.	Human Resource	MERT, RAT, RRT, SME, MHPSS, All Responding Teams (**Annex 15**)		
5.	Laboratory	1. List of tests for blood sampling and send to (chromosome aberration) Bio-dosimetry Laboratory Services at Malaysian Nuclear Agency, Bangi. (refer to Section 6.3.10). 2. Thyroid uptake system/ counter – Hospital Canselor Tuanku Muhriz, National Cancer Institute, Kuala Lumpur Hospital, Penang Hospital, Likas Hospital, Malaysian Nuclear Agency. 3. Whole body counter – Malaysian Nuclear Agency. 4. Internal dosimetry – Malaysian Nuclear Agency. 5. External dosimetry – Malaysian Nuclear Agency/ Sinaran Utama Technology Sdn Bhd/ ALYPZ (M) Sdn Bhd.		
6.	Others	Decorporating Agents and Antidotes for Radiological Internal Continuation (**Annex 16**).		

Note: Equipment and human resource for each risk are the same except the number of equipment and human resource depending on risk severity

6.2.4 Critical Information Requirement (CIR)

CIR is a high priority of information received that triggers immediate action for response involving nuclear or radiological material with high exposure and/ or contamination to human which include:

a) Transportation accident involving nuclear or radiological material.

b) Missing of nuclear or radiological material with shield damage.

c) Explosion inside nuclear reactor containment.

d) Person (s) with highly suspicious of radiological exposure and/ or contamination who attends to hospital or clinic.

e) Fire at irradiation room.

f) Abnormal radiological level with activation from Department of Atomic Energy (Atom Malaysia).

g) Person (s) presented with signs and symptoms of radiation sickness/ ARS.

h) Any death due to radiation injury.

i) Incident notification of Radiological Dispersal Devices (RDD)/ Radiological Exposure Devices (RED)/ Improvised Nuclear Devices (IND) by RMP.

6.2.5 Alert Notification

Alert notification will be received either through Department of Atomic Energy (Atom Malaysia) i.e. from owner, operator or related agency (Figure 6.3), or MERS 999 (Figure 6.4). Subsequently, the National CPRC will prepare spot report (SPOTREP) and situation report (SITREP), and shall inform all relevant states CPRC of possible radiological emergency via official letter, e-mail, or any other methods that may expedite the process. The information that must be conveyed to the SHDs shall include the details of incidence, radiological situation during the incidence, current radiological situation, and possible adverse health effects to human.

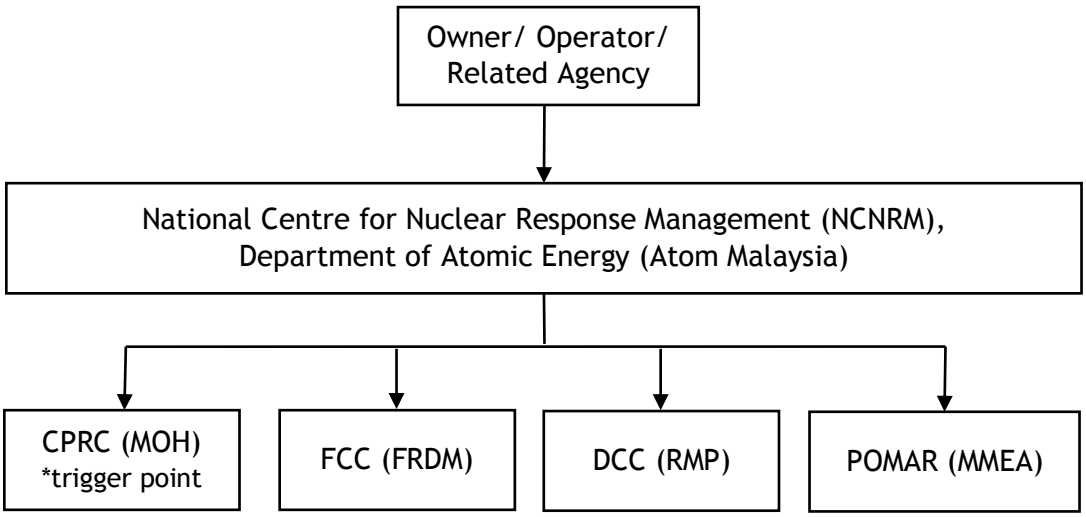


Figure 6.3 Flow of Notification of Radiological or Nuclear Emergencies through Department of Atomic Energy (Atom Malaysia)

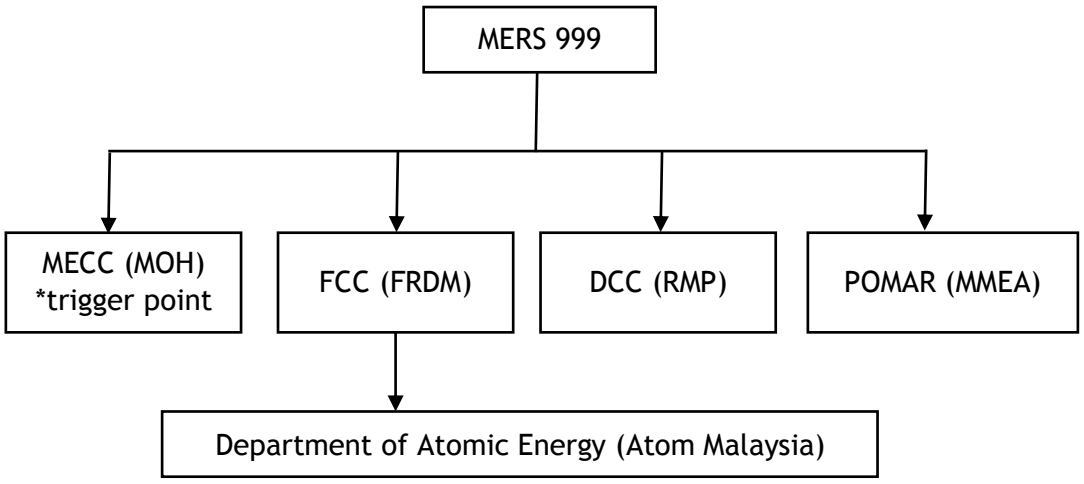


Figure 6.4 Flow of Notification of Radiological or Nuclear Emergencies through Department of Atomic Energy (Atom Malaysia)

6.3 Response Phase

This phase begins as soon as the radiological event occurs which activates the ICS and IMS. Response action is to save lives and minimise the impact of the crisis/ disaster on human, property, and environment.

6.3.1 The NADMA's and National Security Council's Directives

NADMA will activate the NADMA Directive No. 1 if a radiological event of a natural cause fulfils the disaster criteria. Together, NADMA's SOP on Radiological and Nuclear Disaster Management will be implemented using colour coded disaster demarcation zoning approach.

However, if the radiological event is of security concern thus the NSC Directive No. 18 will be activated by the NSC and the affected radiological site will becoming a crime scene or restricted security zone. For any radiological and nuclear events, the lead agency is the Department of Atomic Energy (Atom Malaysia); the OSC is the Police Chief; and the Forward Field Commander is the FRDM Chief.

The MOH is responsible to lead and provide emergency and health services during crisis and disaster. Private healthcare providers and Non-Governmental Organisations (NGOs) providing medical aid and health support shall report to the MOH health authority and given approval before delivering their services at the crisis/ disaster zone.

6.3.2 Public Health Response

At the District Health Office level, the RAT will be despatched to the scene to do risk assessment of all hazards. Risk assessment and field findings gathered by the RAT will be immediately analysed and discussed at the district level for further actions and measures to be taken by the RRT. The National CPRC will lead within MOH and interagency coordination for medical and health needs at the national level.

6.3.3 Medical Response

MERT from the responding hospital will be despatched to the scene. Hospital Director and the Radiation Protection Officer (RPO) will be alerted on the event by the EP in-charge. The RPO must have available the necessary radiation detection equipment and dosimeters. Suitable generic precautions must be adopted by the RPO to protect MERT and other people present at the event from radiological hazards. The RPO should be able to assess the level of the radiation emergency and assist with the radiological aspects of the response[12]. Also, the RPO will inform the State Radiation Safety Unit and MRSD. Hospital shall notify the District Health Office and the State CPRC. Hospital Director shall inform the State Director of Health. At the radiological scene, MERT team leader shall ensure safe distance of MERT from radiation contamination and exposure. Safe distance from an exposed radioactive source is at least 30 meters whereas safe distance for RDD is at least 400 meters away (Table 6.2)[13].

Table 6.2 Safety Perimeter from a Radiological Source

Situation	Initial inner cordoned area (safety perimeter)
Initial determination - outside	
Unshielded or damaged potentially dangerous source	30 m around
Major spill from a potentially dangerous source	100 m around
Fire, explosion or fumes involving a potentially dangerous source	300 m radius
Suspected bomb (Potential RDD), exploded or unexploded	400 m radius or more to protect against an explosion
Initial determination – inside a building	
Damage, loss of shielding or spill involving a potentially dangerous source	Affected and adjacent areas (including floors above and below)
Fire or other event involving a potentially dangerous source that can spread materials throughout the building (e.g., through the ventilation system)	Entire building and appropriate outside distance as indicated above
Expansion based on radiological monitoring	
Ambient dose rate of 100 μSv/h	Wherever these levels are measured

6.3.4 Alert Notification from MOH Facilities and other Agencies

Notification and communication flow from MOH facilities and other agencies to CPRC at national, state and district levels is shown in Figure 6.5 below.

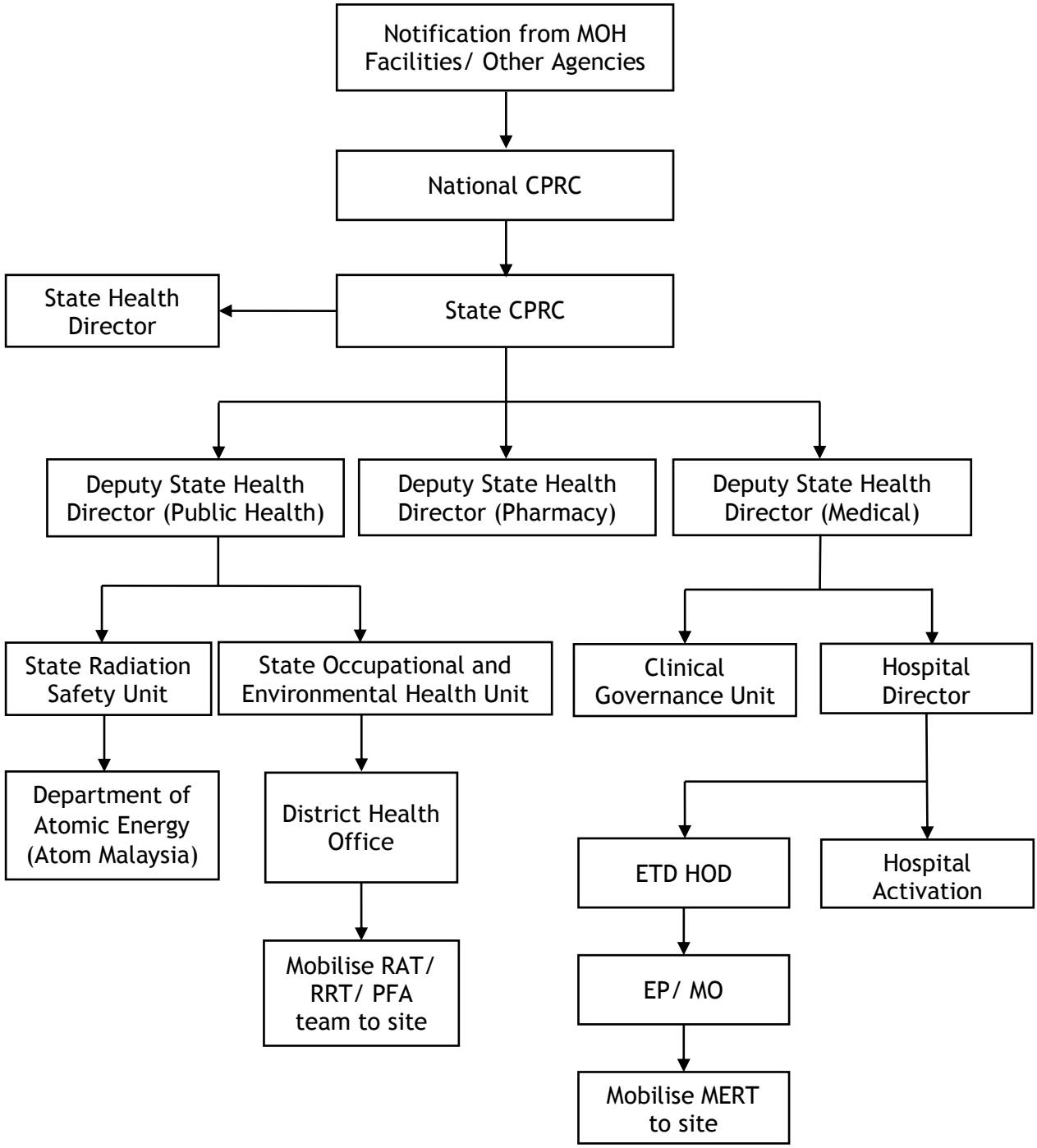


Figure 6.5 Communication Flow from MOH Facilities and Other Agencies to CPRC at National, State, and District Level

Source: Adapted from Selangor State Health Department. Pelan Tindakan Kecemasan Radiologikal dan Nuklear, 2018

6.3.5 Alert Notification from the Public through MERS 999

Whereas, notification and communication flow from the public through MERS 999 is shown in Figure 6.6 below.

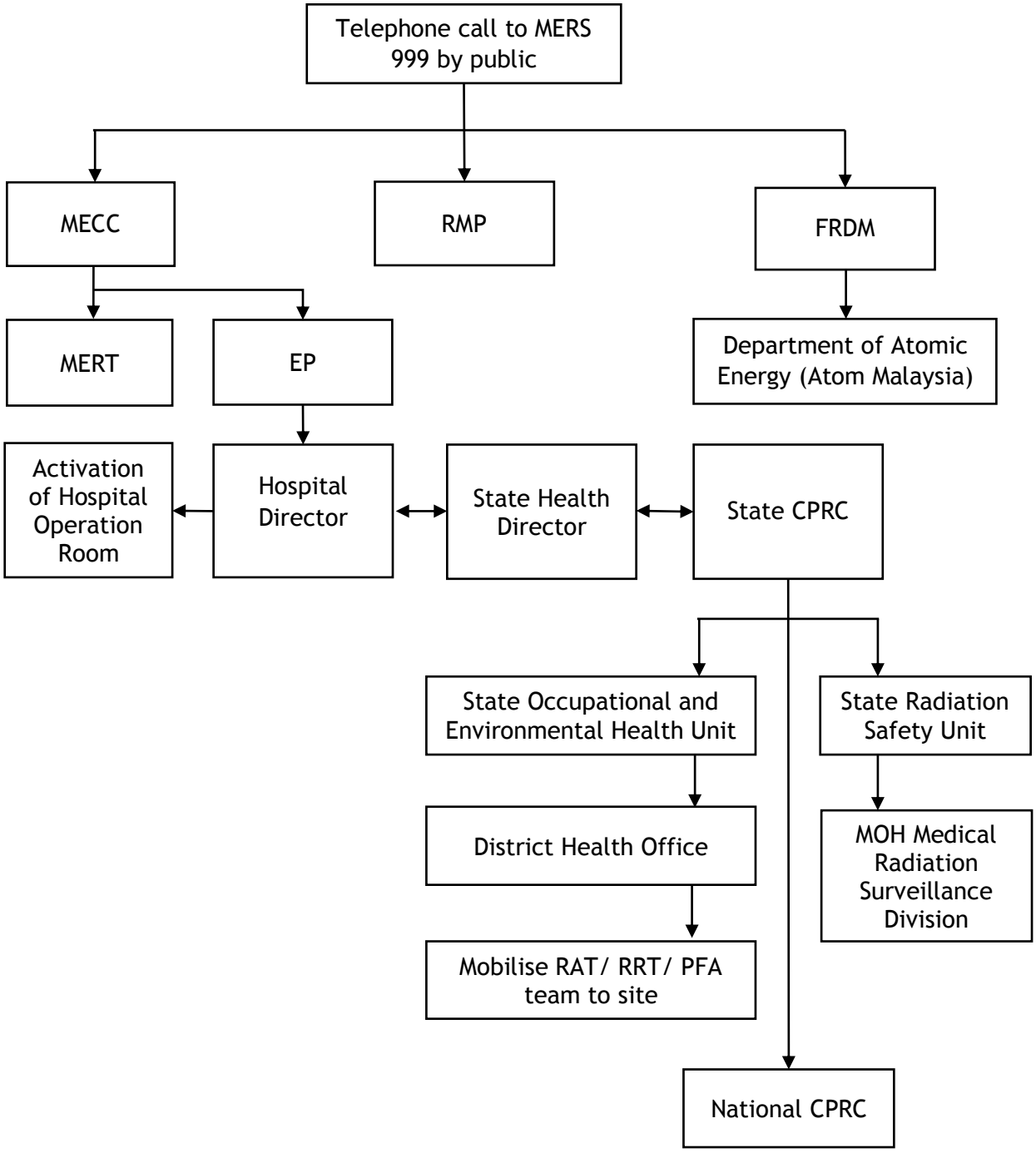


Figure 6.6 Communication Flow from MERS 999 to Responding Agencies and MOH Malaysia at Local, State, and National Level

Source: Adapted from Selangor State Health Department. Pelan Tindakan Kecemasan Radiologikal dan Nuklear, 2018

6.3.6 Hospital Activation

Steps taken during Hospital Activation Phase is shown in the following Figure 6.7.

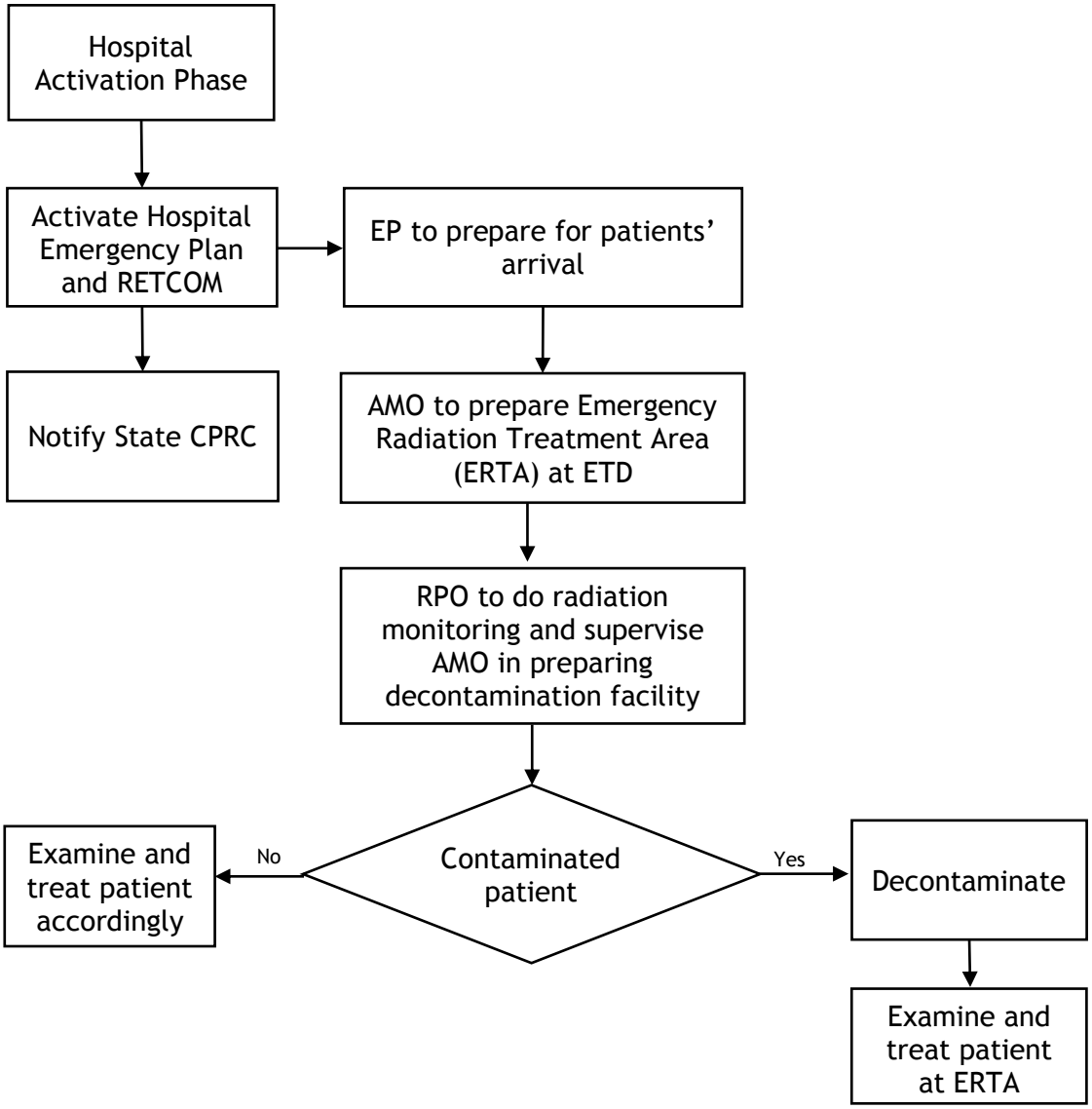


Figure 6.7 Hospital Activation and its Communication Flow with State CPRC

Source: Adapted from Selangor State Health Department. Pelan Tindakan Kecemasan Radiologikal dan Nuklear, 2018

6.3.7 Management of Radiological Victims at the Scene

a) Zoning Areas

Management at red zone which is further subdivided into three (3) sub-zone i.e.; hot, warm, and cold zones which will be determined by HAZMAT. These zones will be controlled by Safety Officer (appointed by OSC) including exit and entry points. These zones will only be allowed to competent and designated SAR agencies fully equipped with relevant PPE.

Hot zone is a contaminated area where operations on search and rescue of victims and recovery of the area from radiological material source will take place. Decontamination process for victims, responders, all equipments and vehicles used in the operation, will take place in warm zone. All logistics and resources support for Hazard Control Zone operations will be placed at forward operations post in cold zone. All radiological victims will be treated at the MBS in yellow zone (Figure 6.8).

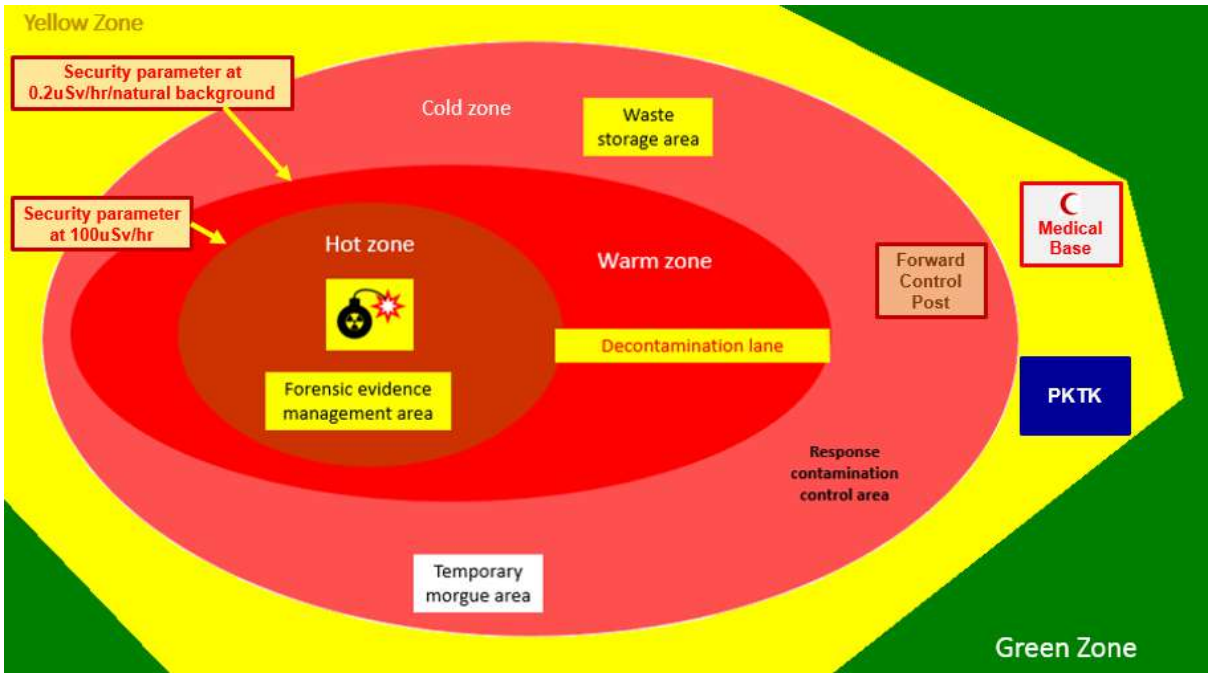


Figure 6.8: Generic Layout of Response Facilities and Locations within Areas Established in A Radiological Emergency

b) Field Triage

The field triage will be managed by first responder as below:

- Injured patients without exposure and/ or contamination or with exposure only (green and yellow tag cases) will be sent and treated at the MBS in yellow zone after undergo screening process by HAZMAT.
- All life-threatening patients (red tag cases) may need resuscitation at the cold zone then to be sent straight to the hospital using a designated ambulance with minimal equipment which are covered with protective layer (for easy disposal of the cover during decontamination process of the ambulance).
- Contaminated area (s) on the patient's body must be securely concealed and clearly marked so that the contaminated area (s) can be decontaminated later at the hospital (Figure 6.9).

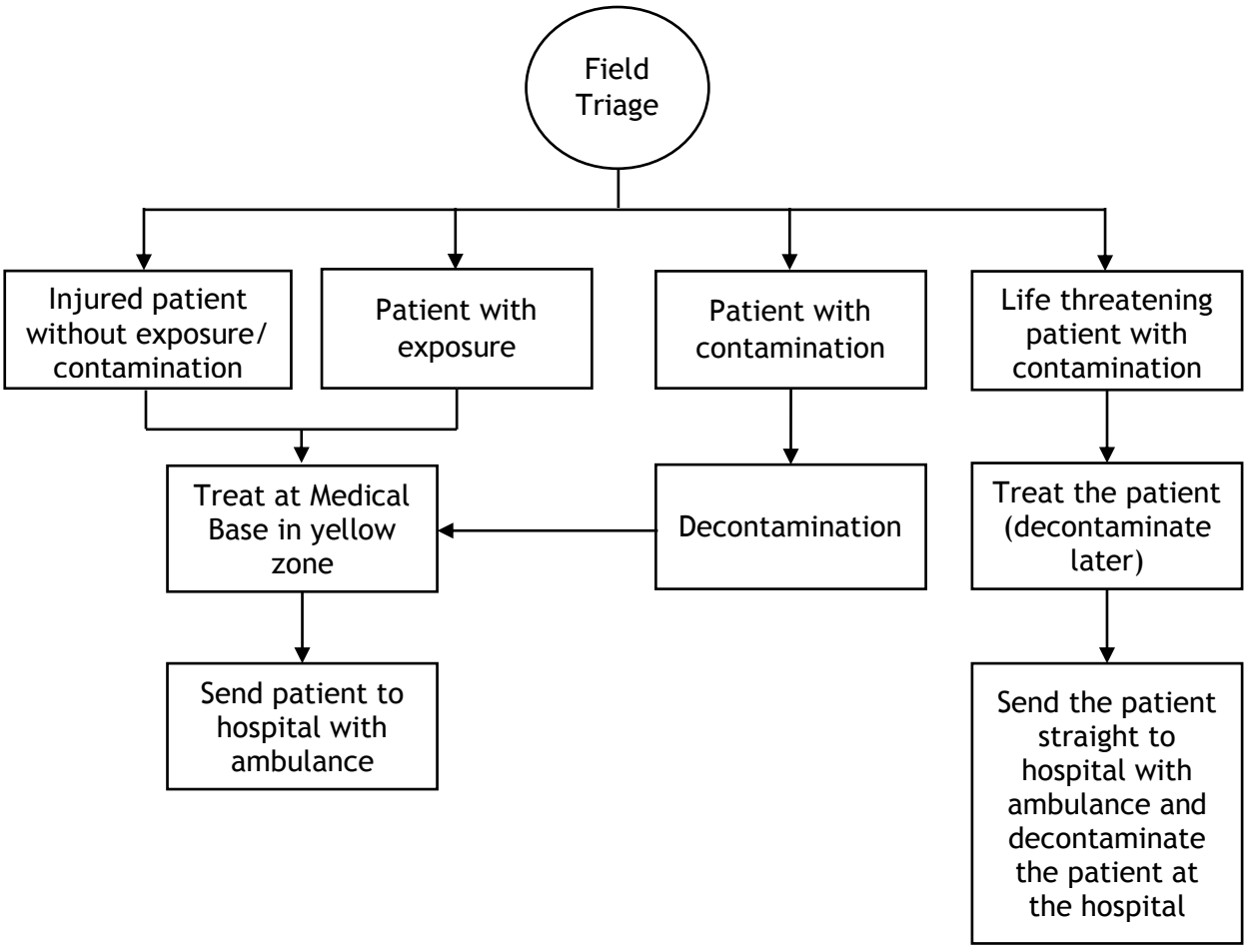


Figure 6.9 Field Triage and Patient Management at the Radiological Scene

6.3.8 Management of Announced and Unannounced Cases

During and after disaster, there is a possibility that victims and public who are exposed to radiation have escaped from cordoned area. The management of these cases will be divided into two (2) categories:

a) Management of Announced and Unannounced Cases at ETD Hospital.

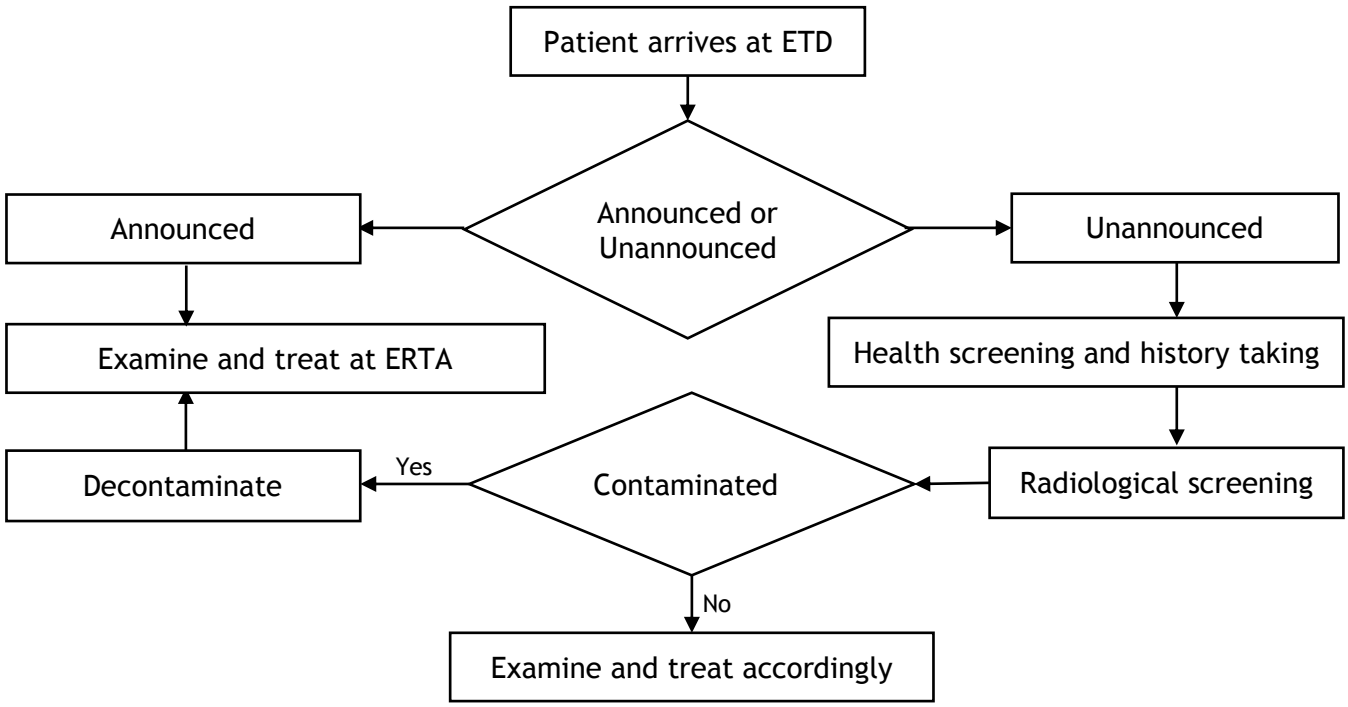


Figure 6.10 Flow Chart in Managing Announced and Unannounced Cases at Hospital ETD

b) Management of Unannounced Cases at Health Clinic:

- If unannounced radiological case (s) presented and identified at the Health Clinic, the case (s) need to be separated from other patients.
- HCWs must wear full PPE when managing contaminated patient (s) but sufficient to wear universal precautions on examining patient (s) with exposure only (Figure 6.11).
- The doctor in-charge to call HAZMAT to do radiation screening and decontamination process.
- Contaminated wastes including used PPE will be handled by HAZMAT.
- Contaminated clothes on patient (s) need to be replaced with new ones.
- Those HCWs who have been exposed to contaminated patient (s) will be put under medical monitoring.

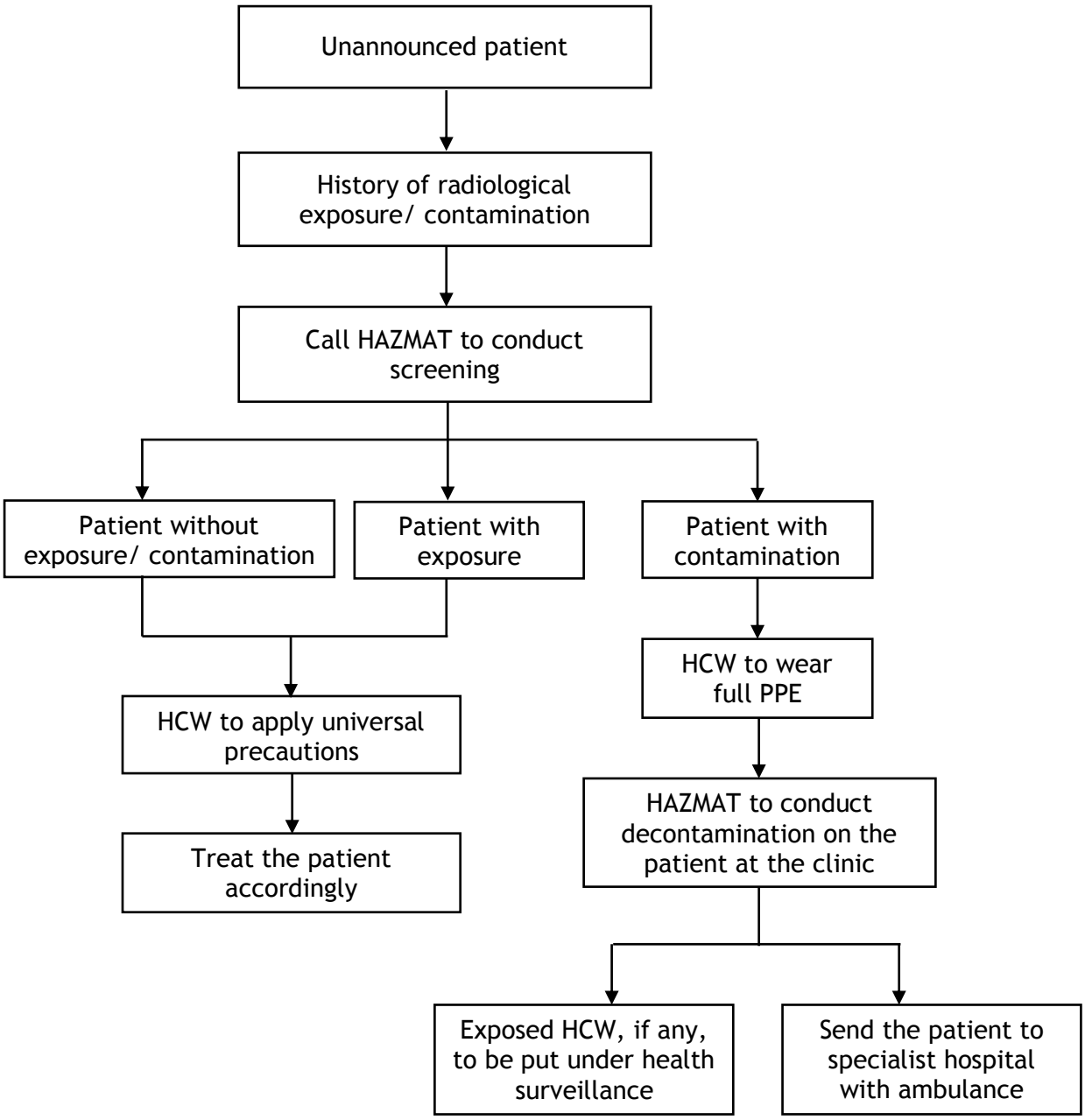


Figure 6.11 Flow Chart in Managing Unannounced Radiological Case Presenting at Health Clinic

6.3.9 Decontamination

Decontamination is a process used to reduce, remove, or neutralise radiological contamination to reduce the risk of exposure. Decontamination may be accomplished by cleaning or treating surfaces to reduce or remove the contamination; filtering contaminated air or water; subjecting contamination to evaporation and precipitation; or covering the contamination to shield or absorb the radiation.

a) All victims shall undergo the decontamination process at warm zone within the red zone area by HAZMAT. Some of the victims may need to be decontaminated in the hospital such as:

   - In life threatening condition.
   - Walk-in exposed victims.
   - Unannounced victims.

   The process should not be delayed as the priority is to save life.

b) HCWs shall perform the following to victims to prevent the spread of contamination:

   - Remove their outer clothing.
   - Wrap them in a blanket and tag as possibly contaminated.

c) To protect emergency medical personnel:

   - Wear Level C PPE i.e., disposable coverall, N95 mask, goggles, shoe cover, surgical glove (double layer).

d) Types of decontamination:

   - Dry decontamination
     - Undressed.
     - Wipe with wet tissue until back to background radiation/ less than 2 times background/ less than 300 cpm than background radiation.
     - Cover the victims.

   - Wet decontamination
     - Undressed.
     - Shower until back to background radiation/ less than 2 times background/ less than 300 cpm than background radiation.
     - Redressed with issued clothing.

6.3.10 Laboratory Services

In the event of radiological emergencies incident, exposed individuals will require clinical specimens to confirm potential exposures to radiation. The specimen collection, packaging and transportation are outlined below.

a) Biodosimetry (blood specimen)

- Criteria for blood sample:
  - If there is strong indication of exposure of 100 mSv or more (by calculation or external dosimeter).
  - Patients with signs and symptoms of ARS.
- Test request from hospital:
  - They are required to contact Malaysian Nuclear Agency and inform the requirement to perform the blood analysis test.
  - Fill up Test Request Form: BIODOS 1-00 and BIODOS -2-00.
- Specimen requirement, collection, and transportation:
  - Blood sample must be put inside lithium heparin tube (green cap). Any other type of anti-coagulant tube used will be rejected.
  - Volume of sample required is 5-6 ml.
  - Avoid exposure to any radiation source and extreme heat.
  - Sample must be stored inside a suitable container such as polystyrene box stuffed with sufficient ice packs to maintain cool environment between 18 to 24 degrees Celsius or lower.
  - Sample must reach BIODOS Lab within 24 hours after blood sampling.
  - Confirmation letter from MO who has taken the sample must be attached together.
- Test method:
  - Test will be done using Dicentric Assay Technique.
  - Incubation of sample until slide preparation will take approximately 1 week (working days).
  - Analysis of samples will take 1-2 weeks.
- Test results:
  - Results will be informed via fax and/ or courier to hospital.

b) Bioassay (urine specimen)

- Test request from hospital:
  - They are required to contact Malaysian Nuclear Agency and inform the requirement to perform the urine analysis test.
  - Currently there are no specific form available.

- Specimen requirement, collection and transportation:

  - Urine sample to be collected in polyethylene bottle.
  - 1000 ml urine sample to be collected over 24-hour period.
  - Bottle with urine sample must be placed inside a clear plastic and tied.
  - Specimen placed inside the transfer box and kept at room temperature.
  - Sample must reach laboratory within 24 hours after urine collection.

- Test method:

  - Test will be done using α dan ß counter.
  - Analysis of sample will take 1-2 days.

- Test results:

  - Results will be informed via fax and/ or courier to hospital.

c) Whole Body and Thyroid Monitoring

- Criteria for whole body and thyroid monitoring:

  - If there is suspected intake of radionuclide in the victim body via inhalation or ingestion.

- Test request from hospital:

  - They are required to contact Malaysian Nuclear Agency and inform the requirement to perform the whole body and/ or thyroid monitoring.
  - Fill up Form: BKS/IM//F/04 REQUEST FORM FOR WHOLE BODY AND THYROID MONITORING SERVICE.

- Subject requirement, registration and transportation:

  - If possible, subject should be free from any external surface contamination.
  - Subject should bring ona (1) set clothing.
  - Subject must registered at the whole body laboratory on the date and time as scheduled.
  - Subject's transportation to be managed by the hospital.

- Method:

  - Whole body monitoring will be done using ORTEC Whole Body Counter Model GEM-FX8530P for 40 minutes.
  - Thyroid monitoring will be done using ORTEC Thyroid Counter System for 15 minutes.
  - Internal dose calculation will be based on the Basic Safety Radiation Protection 2010 and using MONDAL3 software.

- Test results:

  - Results will be informed via fax and/ or courier to hospital.

d) External Dosimetry

Radiation dosimetry is widely used in the fields of health physics. It serves as occupational radiation protection by continuous measurement, calculation, and assessment of the ionising radiation dose absorbed by the human body. In the event occupational accident and radiation exposure occurs, the external dosimeter will be sent to Malaysian Nuclear Agency for analysis to determine the effective dose received by the personnel. The reference laboratory for biodosimetry (blood specimen), bioassay (urine specimen), whole body and thyroid, and external monitoring is Malaysian Nuclear Agency at the following address:

Emergency Laboratory, Block 13
Malaysian Nuclear Agency,
Ministry of Energy, Science, Technology, Environment and Climate Change,
Bangi, 43000 Kajang
Selangor Darul Ehsan, Malaysia
(Attn.: Director of Emergency, Malaysian Nuclear Agency)
All specimens sent to the reference laboratory must have the following information clearly stated:

1. Name
2. Age
3. Gender
4. Identity Card No.
5. Occupation
6. Date involved with radiological incident
7. Time initiate sample collection
8. Time conclude sample collection

6.3.11 Waste Management

Radiological or nuclear emergency incident will produce a number of radioactive wastes. These radioactive wastes must be appropriately and cautiously managed with minimal impact to the environment, public health and safety to the next generation. Clothing and accessories; water; and clinical waste can be contaminated as result of radiological or nuclear incident.

a) Waste Separation Methods

Residual separation measures are foremost process in waste management procedure. The aim is to reduce the amount of radioactive waste generated and to optimise the treatment and disposal. During emergency situation, waste separation is done according to the following categories:

i) Non-radioactive waste:

Any materials and articles that do not contain radioactive material or contaminated with radioactive material e.g., food waste and domestic waste.

ii) Solid radioactive waste:

Examples of this category of waste are gloves, papers, clothes, face-mask, and other articles contaminated with radioactive material.

iii) Liquid radioactive waste:

Examples are waste water and solvents contaminated with radioactive material.

iv) Contaminated clinical waste:

Examples are clinical wastes, such as body fluids, organs, contaminated with radioactive material.

v) Cleanup waste:

Waste generated from cleanup process of contaminated surfaces and areas e.g., soils, materials used for decontamination procedure. The cleanup waste has low radioactivity levels but is generated in large volumes during a radiological or nuclear incident.

b) Waste Disposal

i) Separated wastes requires disposal in accordance to the specific method determined for the residual type.

ii) At the healthcare facilities, the emphasis is on management of radioactive waste and contaminated clinical waste as follows:

- Radioactive waste management must be performed in accordance to Radioactive Waste Management Regulations by Department of Atomic Energy (Atom Malaysia).
- The wastes must be placed in suitable and appropriate containers and labelled with radioactive emblem.
- These containers are kept temporarily in an approved storage area before being disposed of by Malaysian Nuclear Agency after obtaining permission from local authorities.
- The following information must be clearly documented on the waste package/ containers:
  - Type of radionuclide.
  - Surface dose reading.
  - Radioactive labelling, transportation labelling.
  - Name of liaison officer.
  - Site details.

6.3.12 Data Management

In the event of radiological or nuclear incident, there is likely to leave a sizeable group of individuals impacted by radiation exposure and/ or contamination. Hence, it is important to quickly collect basic information as below.

a) Demographics:

- Name
- Age
- Gender (if female, pregnancy status)
- Ethnicity
- Home address
- Status and place of employment.
- Home and mobile phone number.

b) Health information:

- Co-morbidities.
- Health clinic/ hospital follow up.
- Past medical history, including cancer.

c) Exposure information:

- Location at incident time and thereafter (i.e., within evacuation or hazard zone area).
- Length of time within evacuation or hazard zone.
- Shielded or sheltered while in evacuation or hazard zone.
- Presence at incident site as first responder.

d) Contamination assessment:

- Contamination level detected on person.
- Contamination detected in the breathing zone (face and neck).
- Decontamination performed.
- Contamination detected on the body after decontamination.
- Any open wounds or embedded pieces of material.

e) Exposure-related medical and health effects:

- Signs and symptoms consistent with ARS.
- Immediate health and safety needs.
- Psychological First Aid (PFA).
- Health education and awareness.

Above data shall be put in line-listing daily. Analysis shall be done by Epidemiological Officer at state and district level, and put into graphs and charts. Daily and weekly reports based on collected data to be disseminated to stakeholders at the District Disaster Operations Control Centre, State, and National CPRCs in a timely manner.

6.4 Recovery Phase

Recovery and reconstruction operations should be carried out once emergency situations have stabilised and immediate action to safeguard public safety and health and property has been implemented. Cancellation of restriction or termination of a reaction emergency operations will only be issued by Department of Atomic Energy (Atom Malaysia).

6.4.1 Remedial Actions

Remedial actions shall be taken as follows:

a) Ensure and report long-term monitoring of victims exposed to radiation through medical surveillance.

b) Conduct control over food, agricultural products, and dairy products that may have been contaminated.

c) Ensure medical monitoring with psychosocial support to victims, responders, and affected communities.

6.4.2 Planning for Management of Psychosocial Impact to Victims

a) Psychosocial support is an approach to victims to foster endurance for both communities and individuals. It aims to address public concerns, revitalise the situation, as well as prevent the effects of conditions that have caused destruction and trauma.

b) Healthcare and psychosocial elements are important component of psychosocial support services:

- Psychosocial support is one of the important factors in the radiological and nuclear emergency response.
- The actual risk of exposure to radiation is low, but fears among the public can lead to anxiety and panic.
- Some residents may react differently after discovering the release of radioactive material to the environment despite evidence showing no health risks to the public.
- It is envisaged that the probability that the number of civilians who have the potential to have psychological effects as a result of the incident is far beyond the number of people physically affected.

c) Psychosocial impact management from a health perspective covers the following three (3) functions:

- Provide accurate and up to date information on health risks related to the incident.
- Provide a way to convince people who perceived that they may have been exposed or contaminated.
- Coordinate with other agencies to ensure that the message communicated to the public is consistent and accurate.

d) Healthcare Workers (HCWs) must ensure that the above functions are included when providing psychological support and counseling services to patients.

6.4.3 Planning for Management of Psychosocial Impact to HCWs

a) All employees involved directly or indirectly in the event of radiological or nuclear emergency may experience various levels of psychological stress as they work with depressed and worried victims.

b) This pressure may be experienced at any time during or after the incident leading to post-traumatic stress reaction (PTSR) or post-traumatic stress disorder (PTSD). Sufficient psychosocial support is important and should be given to all HCWs.

c) Health authority involved in radiological emergencies should be prepared to arrange provision of support services to assist HCWs to cope with the stresses and concerns caused by the work environment with radiological hazards. In certain circumstances, additional monitoring may be necessary to ensure the level of ionising radiation is safe for HCWs, responders and volunteers.

6.4.4 Criteria for De-escalation and Deactivation

Criteria for de-escalation and deactivation are when:

a) There is no longer threat or risk of radiation from the incident to human health.

b) The missing nuclear or radiological materials are found and secured by the authorities.

c) There is no nuclear material release from inside nuclear reactor containment.

d) There is no radiological material release or radiation exposure to the public from irradiation room.

e) The radiological material from RDD/ RED/ IND has been neutralised and decontaminated by the relevant authorities.

f) There are no more cases with highly suspicious of radiological exposure or contamination or presented with signs and symptoms of radiation sickness/ ARS/ death due to radiation injury attending to hospital or clinic within past three (3) weeks.

g) Notified by NADMA or Department of Atomic Energy (Atom Malaysia) or relevant authority that a radiological or nuclear incident is no longer an emergency.

CHAPTER 7

EXPLOSIVES

CHAPTER 7: EXPLOSIVES

7.1 A Growing Threat

Improvised Explosive Devices (IEDs) are among the world's oldest types of weapons. Unlawful use of IEDs, particularly by non-state actors, is spreading quickly. Such IED attacks deliberately target concentrations of civilians to achieve a maximum effect of lethality, terror, and societal disruption. A review of selected international media reports from 2011 to 2015 revealed more than 6,300 recorded IED explosions, resulting in over 105,000 casualties. In 2015 alone, suicide attacks involving IEDs occurred in over 10% of Member States, a greater proportion than any recorded ever before[14].

IEDs can be simple to design, and components remain cheap and easily accessible, including through criminal networks and porous borders. The spread of communications technology has greatly abetted IED knowledge-sharing. Online, groups share instructional videos or materials, both on IED construction and on execution of attacks. Moreover, foreign fighters have been returning to their home countries or have crossed borders into third countries, bringing the skills learned in conflict zones with them. These returnees have formed cells and networks providing access to weapons and materials for IED construction, while capitalising on acquired battlefield skills and explosives-related training. They must be stopped from getting access to CBRNe materials.

7.2 Scene Safety

There is an increasing frequency that terrorists are targeting responders using IEDs. This tactic may range from placing a secondary device in close proximity to a primary device that can be detonated after security and rescue personnel have arrived and initiated incident response, or a primary device can be intended for detonation after these same public safety personnel respond to a seemingly unrelated event[15]. Therefore, rescue personnel should maintain a high level of suspicion when approaching the scene of any explosion.

7.3 Mass Casualty Incident following Explosion

Explosions can create MCI and present prehospital responders with a wide range of injuries requiring simultaneous attention[16]. There is a difference between blast injuries and those that result from the dynamics of an explosion. Blast injuries are related to the physics properties that produce rapid pressure changes which may cause tissue damage in the body locations where air is found, such as the ears (e.g., tympanic membrane rupture), lungs and gastrointestinal tract (e.g., perforation)[17,18]. Additionally, a common technique that increases lethality is packing or wrapping the explosive device with nails, bolts or other small items that will increase projectile injuries. Combining IEDs with CBRNe materials will further complicate patient's management.

CHAPTER 8

RISK COMMUNICATION

CHAPTER 8: RISK COMMUNICATION

8.1 Background

Risk communication (RC) currently has been widely accepted internationally and nationally as a key strategy for the management of risks of public health concerns or security be it natural or man-made disasters, emerging and re-emerging diseases, mass casualty's incidents, all hazards as well as CBRNe. Locally, risk communication has played vital roles in disseminating risk related health messages during the outbreaks such as H1N1, MERS-CoV, malaria, rabies and lately CBRNe threat. In addition, it is also being applied during crises such as major floods, tsunami, volcano tremors, and public demonstrations. Effective risk communication confers confidence and builds trust towards the authorities. It improves the willingness of populations to take actions based on informed decision and comply with recommended measures. Furthermore, it hastens the return to normalisation after a crisis peak. A favourable public attitude allows those engaged in the technical response to concentrate on rapid containment of the incident.

The concept and practice of risk communication has been evolving worldwide since 1980s. This is due to the complexity and diversity of risks, the development in the arts of communication, and the complex nature of stakeholders, media and the well-informed community (Figure 8.1). Failure to communicate on the risk may mitigate control measures for the management of all hazards crises and emergencies of which it may affect the credibility and image of the health authority. In addition, it is important that one is aware of the legal and ethical implications inherent to public health in handling risk communication in a health crisis situation. The key personnel trained need to have a good understanding of the various elements discussed so that the rights, dignity, and honour of the target group is not compromised.

Figure 8.1 Audience Relationship to Incident

8.1.1 Acknowledging Barriers and Limitations

Risk communication which is based on comprehensive risk assessment is necessary in order to spread information on the risk of a disastrous situation in a timely, accurate, and transparent manner. This is important so as to prevent citizens from becoming overly confused to the level of the actual risk. For the period of disaster there are differences in perceptions in term of hazard and public outrage. For this, it is aimed to ensure risk communication activities of public health authorities upon occurrence of critical situations by maintaining public trust, press, and relevant organizations.

In high risk situation, public expectation will focus on empathy from authorities. However, in low risk situation the focus is more on competency of the spokesperson. The credible spokesperson will deliver a trustworthy information. Limited access to information will hamper good risk communication. Many obstacles that may affect good risk communication include political situation, socio-culture background, and socio-economy.

Media plays major role in risk communication in creation of awareness and influence public perception. Therefore, authorities need to provide a timely and accurate information from credible source. Despite of all these, it is important that one is aware of the legal and ethical implications inherent to public health in handling risk communication in crisis. Hence, risk communication work best when there is cooperation from governmental, non-governmental agencies, and stake holders to elicit advocacy, networking, and community participation.

8.1.2 Risk Communication Approach during Crisis

Risk communication is applied during all four (4) stages of a crisis namely preparedness, initial response, maintenance, and recovery (Figure 8.2).

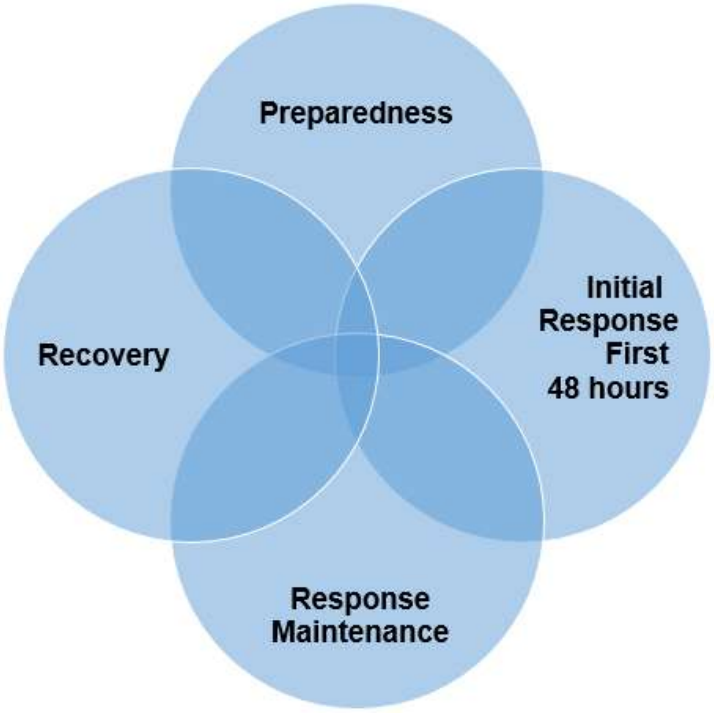


Figure 8.2 Approach during the Four Stages of Crisis
Source: U.S. CDC Crisis and Emergency Risk Communication (CERC)

8.2 Preparedness Phase

Risk communication during preparedness phase focuses on awareness among various audience including public, responders, staff, and special target group depending on the hazard (s). The objective of risk communication during preparedness phase is to build the capacity and capability of all relevant stakeholders in managing crisis/ disaster. Operational risk communication in preparedness phase is very crucial and any organisations need to have the followings:

a) Establishment of the communication plan:

- Prepare risk communication manual by focusing on checklist, procedures, response messages, and reports for operations to be carried out directly in the event of risk occurrence[3,19].

b) Simulation exercise to be conducted to test the plan.

c) AAR with input from supplement manual and expert consultation to ensure improvement of risk communication activities.

d) Organise official and informal meetings is needed to establish or enhance networking with relevant agencies.

e) Risk communication training to empower knowledge and competency:

- All communication staff must acquire basic information on risk communication on a regular basis.
- Other categories of staff and responders need to be trained regularly.

f) Establishment of network to prepare for risk:

- Regular meetings with other government agencies, NGOs, and relevant private sectors.
- Regular meetings with media personnel or editors.

g) Securing experts and encouraging their participation:

- Secure a list of experts in risk communication.
- Establish MOH RC Technical Working Group.

8.3 Initial Response

Once an emergency or a crisis is declared, the operations room is activated, and the incident should be notified to the relevant personnel in the specified line of communication as stated in Director General of Health's Circular No. 1, 2005.

Response phase of the risk communication is divided into two (2) categories which are initial response i.e. response within 48 hours, and response maintenance phase. The objective of response phase within 48 hours is to manage an incident quickly in order to address its needs as well as to allay anxiety especially among affected population. Whereas, the objective of the maintenance phase of risk communication is to continue assisting the public to understand the risk, and to empower the public to act on informed decision.

8.3.1 Activities at MOH Level

a) Monitor and analyse public opinions daily through:

- Phone lines and Hotlines – within working hours:
  - Public Information Officer (PIO) and Joint Information Centre (JIC)'s team will go through all the issues received from various channels daily.
  - The issues will be analysed, categorised, and resolved by building up new or improving existing messages and channels.
- Activation of social media and messenger.
- Emails.
- Newspapers.
- Rumours surveillance.

b) Share the results with:

- The public using facts sheet, press release through social media, press conference, town hall sessions, interpersonal communication e.g., face to face, focal group discussion, talks, and announcement.
- Internal and external stakeholders locally at all levels through specific committees, written document (e.g., alert letters), teleconference (TC) and video conference (VC).
- International bodies through IHR focal point, if indicated.

8.3.2 Activities at State or District Level

a) Monitor and analyse public opinions daily through:

- Phone lines and Hotlines – within working hours.
- Activation of social media and messenger.
- Emails.
- Newspapers.
- Rumours surveillance.

b) Share the results with:

- The public using flyers, pamphlets, media, town hall sessions, interpersonal communication e.g., face to face, focal group discussion, talks, and announcement.
- Internal and external stakeholders locally at all levels through specific committees, written document (e.g., alert letters).

8.4 Maintenance Phase

The activities done within 48 hours are continued but some of the activities will be lesser in frequency, e.g., press release from daily to weekly, depending on several factors including severity, complexity of the hazards, mode of transmission, or others.

8.5 Recovery Phase

Following tasks to be conducted during recovery phase:

a) AAR by evaluating and analysing risk communication in terms of:

- Message content.
- Channels of delivery.
- Public perception through survey, hotlines, social media or others.

b) Documentation of risk communication during the event.

An example of risk communication messages during all the four stages of a crisis is given in **Annex 17**.

CHAPTER 9

MENTAL HEALTH AND PSYCHOSOCIAL SUPPORT

CHAPTER 9: MENTAL HEALTH AND PSYCHOSOCIAL SUPPORT

9.1 Mental Health and Psychosocial Support (MHPSS) in Crisis

Any type of crisis will have mental health and psychosocial effects on those affected either on a short or long term basis. As such, MHPSS and management are equally important in response coordination for MOH, NGOs, or any other agencies involving in the operationalisation of the Crisis Management Plan.

There is a need to provide MHPSS and intervention for those affected in crisis for the following reasons:

a) All crisis-stricken individuals will experience emotional and psychosocial effects which may vary from one individual to another.

b) Many of the victims are not severely affected by emotional and psychosocial effects and can resume to normal function. Nevertheless, the effects of the crisis can add stress to their daily life.

c) Vulnerable or individual at risk such as children, women, disabled people, the elderly will be psychosocially affected.

9.1.1 Definition of MHPSS

The composite term MHPSS refers to any type of local or outside support that aims to protect or promote psychosocial well-being or prevent or treat mental disorders[20]. Support may include interventions in health, education, or interventions that are community-based. The term MHPSS problems covers social problems, emotional distress, common mental disorders (such as depression and posttraumatic stress disorder), severe mental disorders (such as psychosis), alcohol and substance abuse, and intellectual disability.

9.1.2 Objectives of MHPSS

Objectives of MHPSS are:

a) To eliminate or reduce the risk of psychosocial trauma.

b) To reduce distress among the population.

c) To identify early persons at risk of developing long-term psychological effects.

d) To prevent, treat, and rehabilitate the mental disorders occurring as a direct or indirect consequence of the disaster or crisis.

e) To provide support and psychosocial care for the members of the response teams.

9.1.3 Target Group for MHPSS

The MHPSS services is targeted at the following groups:

a) Crisis victims, families, and community.

b) Rescue personnel – HCWs, RMP, FRDM, Civil Defence, and other responders.

c) Existing and new psychiatric patients.

9.2 Psychosocial Impact due to CBRNe Hazards

Mental health and psychosocial problems in emergencies encompass far more than the experience of PTSD or disaster-induced depression. Depending on the type and extent of hazard exposures, individuals can experience a variety of psychological symptoms and emotional reactions during and/ or post-disaster. Fear is common in any disaster, it is even more common in cases when biological, chemical, and radiological materials are present.

Psychological impact can occur due to various factors such as:

a) Trauma/ Stress.

b) Loss/ Death.

c) Loss of property and possessions.

9.2.1 Types of Psychological Impact

There are two types of psychological impact which are:

a) Acute: Acute stress reaction, panic attack, fear, hyperventilation.

b) Chronic: PTSD, Major Depressive Disorder (MDD), Anxiety Disorders.

Signs and symptoms of psychological impact can be presented as headache, giddiness, vomiting, muscle tension, hyperventilation, difficulty in breathing, sweating, tremors, and sense of foreboding.

In CBRNe emergencies, individuals affected may experience above physical signs and symptoms during acute phase which may be confused with the emotional and psychological effects. These signs and symptoms can be normal reactions to abnormal situation. Nonetheless, it is utmost importance to treat these individuals appropriately.

There are factors that may aggravate emotional and psychological symptoms which are:

a) The invisibility of the agent.

b) The risk of spread.

c) Uncertainty about the level of risk.

d) Lack of information and clarity.

e) Use of protective clothing.

f) Existing co-morbidity.

9.3 Action Plan for MHPSS Services

9.3.1 Objectives of the Plan

Objectives of the Action Plan for MHPSS services are:

a) To coordinate MHPSS services in disaster.

b) To enhance collaboration between agencies in terms of MHPSS services.

c) To develop a system that enables the distribution of MHPSS resources.

When crisis occurs, the MHPSS team is activated based on needs assessment of the incident. This action plan can be implemented at all levels which are district, state, and national levels[21].

9.3.2 Functions of MHPSS Provider

Functions of MHPSS provider are:

a) To provide PFA for victims, health workers, and response workers from other agencies.

b) To perform continuous psychological risk assessment during the crisis.

c) To make referral to psychiatrist, if necessary.

d) To establish a good rapport with other agencies in the field during the incident while providing the best psychosocial support services.

MHPSS team members consist of psychiatrist, public health physician, FMS, MO, nurse, AMO, psychology officer, counsellor, social worker, and volunteer (e.g., from NGO).

Action of MHPSS services in district level and intervention of MHPSS services are shown in following Figure 9.1 and Figure 9.2, respectively.

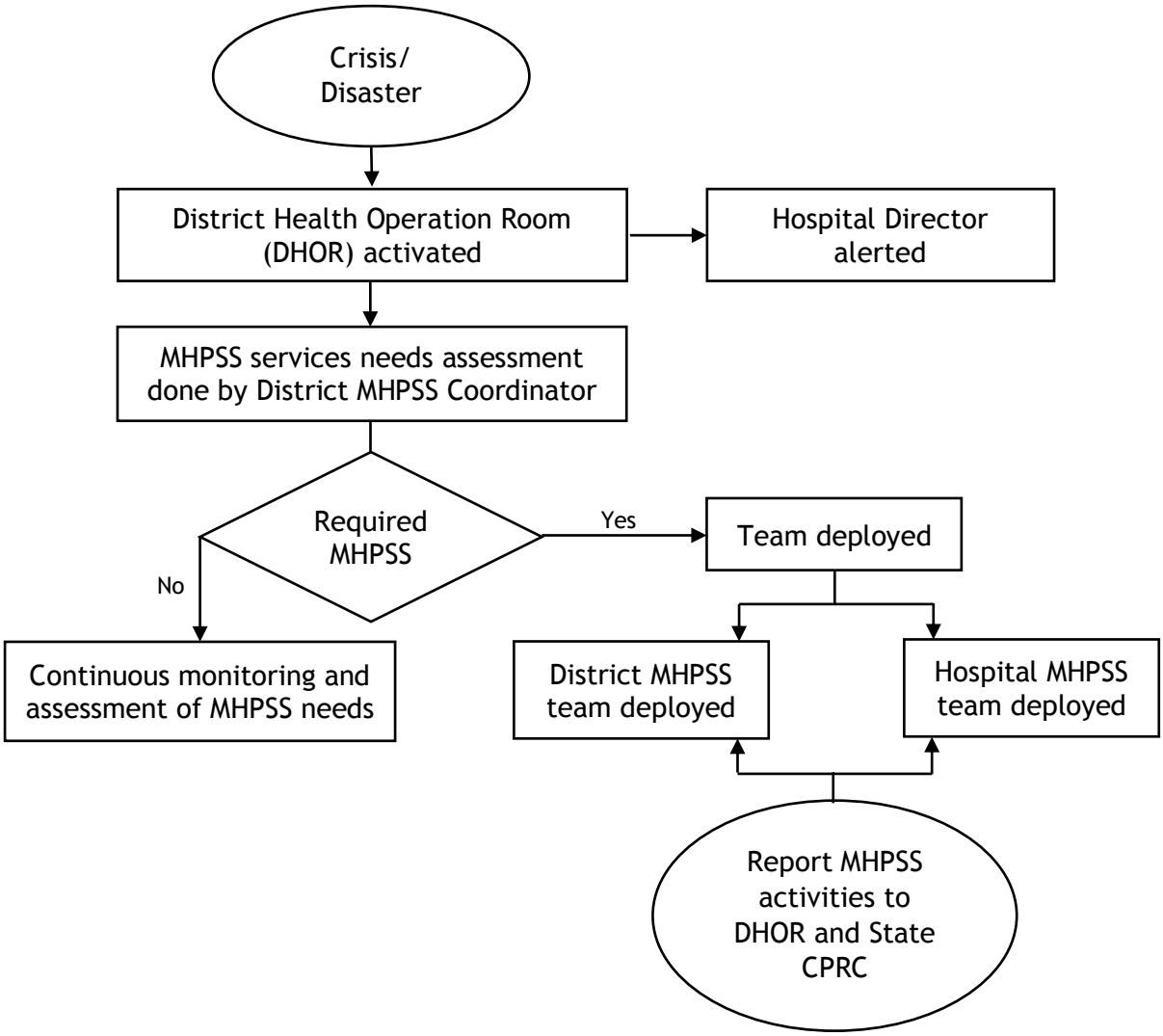


Figure 9.1 Action of MHPSS Services at District Level

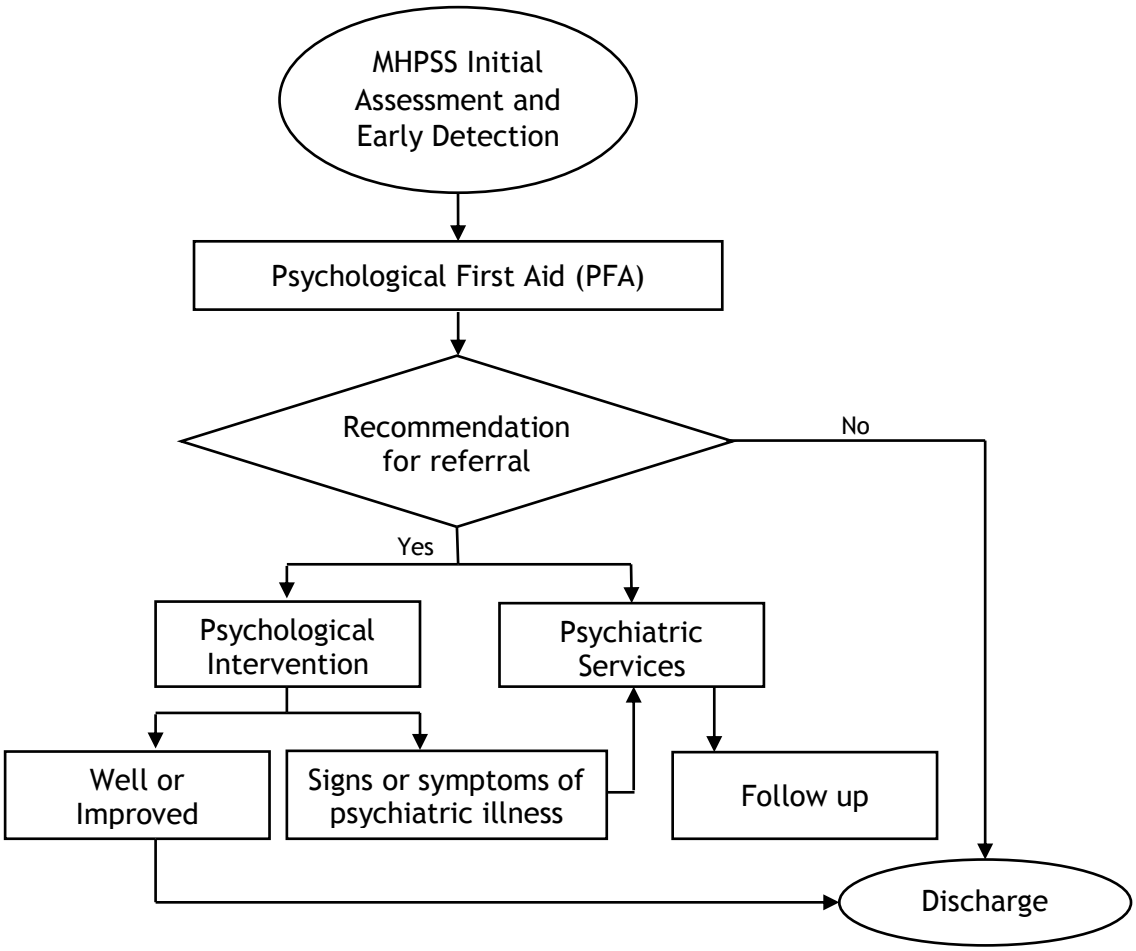


Figure 9.2 MHPSS Services Intervention

9.4 Preparedness Phase

9.4.1 Training

The mental health impact on the disaster response workers can be reduced through comprehensive and regular pre-disaster training. Training helps both workers and volunteers to better deal with the possible emotional consequences of a disaster. Resources and budget need to be allocated for training, exercises, tools, and materials used during intervention.

All disaster responders should have a minimum training on the followings:

a) Psychological First Aid.

b) Basic helping skills.

c) Mental health care of disaster response workers.

9.4.2 Pre-Deployment Requirement

Prior to mobilisation of responders to the crisis/ disaster site, the following responders' health status parameters needs to be assessed:

a) Physical health.

b) Emotional wellbeing.

c) Immunisation status.

Pre-deployment briefing is vital to ensure preparedness of the responders or volunteers. Information on what to expect upon arrival is provided to alert them on the crisis/ disaster situation. Pre-deployment briefing should consist the following:

a) Information on incident/ crisis/ disaster (site/ location, time, number of victims).

b) Type of incident.

c) Type of hazard expected.

d) Safety and security concerns.

e) PPE.

f) Mental health preparedness.

g) Logistical needs.

h) Available resources.

i) Deployment schedule.

j) Information on volunteers.

*The pre-deployment briefing for mental health needs shall be conducted together with the overall briefing by team leader or field commander (Figure 9.3).

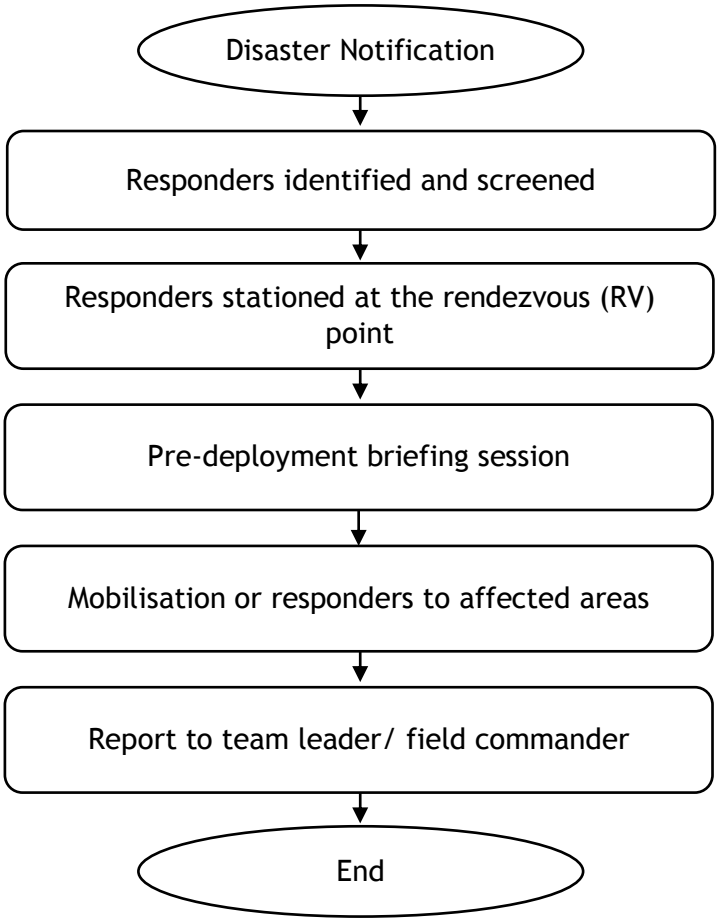


Figure 9.3 Pre-Deployment Screening, Briefing, and Mobilisation

9.5 Response Phase

9.5.1 Psychological First Aid

During crisis/ disaster, MHPSS services will be provided to those in need based on the eight (8) core action principles of PFA (**Annex 19**) and three (3) action principles of PFA by the World Health Organisation (WHO) which is look, listen, and link.

9.5.2 Psychoeducation

Psychological awareness to be provided through the dissemination of information via pamphlets, radio, TV, and social media or any suitable media.

9.5.3 Psychosocial Support for Disaster Responders

Regular ventilation, relaxation, and sharing session are important to ensure that responders are not exhausted or burnt out. Working schedule to have protected time for rest and spiritual activities (daily working time for not more than 8 hours).

For disaster responders with psychological distress, they will be assessed and given psychological intervention. However, if they are deemed unfit by the clinician to continue his or her duty, they will be relieved from duty. This will be documented in the Psychological Assessment Form.

9.6 Recovery Phase

Post disaster aims with a purpose to achieve early recovery and rehabilitation of victims and responders in helping them return to their daily routine. The purpose of this phase is to inform victims and responders on the signs and symptoms they may experience in the first few weeks after returning from the crisis/ disaster area (**Annex 20**). The responders and victims will be advised on things and matters need to be taken care of which may include the following:

a) Maintaining a healthy diet, routine exercise, adequate rest, and sleep.

b) Spending time with family and friends.

c) Paying attention to health matters.

d) Fulfilling neglected daily personal tasks (e.g., paying bills, mow loan, shop for groceries).

e) Reflecting upon what the experience has meant personally and professionally.

f) Getting involved in personal and family preparedness.

9.6.1 Post-Deployment

Upon completion of deployment, Mental Health Alert card (**Annex 21**) will be given to all responders involved (Figure 9.4). Mental health assessment will be conducted after a month upon returning from deployment site using screening tools (e.g., K10, DASS) in making sure that the responders are mentally and physically stable.

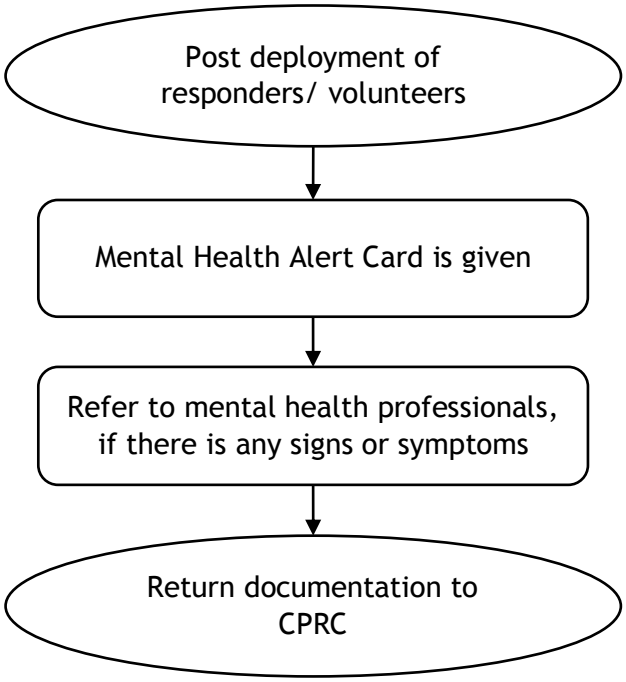


Figure 9.4 Post-Deployment Session

CHAPTER 10

DEAD BODY MANAGEMENT IN CBRNe DISASTERS

CHAPTER 10: DEAD BODY MANAGEMENT IN CBRNe DISASTERS

Dead body management begins after survivors and injured persons have been evacuated. There is no hurry whereby responders may take their time to properly identify the CBRNe materials involved[22]. Human remain management will then require that bodies be handled or moved. These procedures will expose the responders to hazardous agents, which may be disseminated into the population and environment when the bodies are moved. Where possible, it is preferable that deceased bodies be decontaminated before they are handled or moved.

10.1 Chemical Risk

For the purposes of deceased body management, only chemicals that are persistent in the environment (e.g., vesicants or nerve agents) pose a risk to the responders, thus the body need to be decontaminated. After a few hours, gases (e.g., phosgene or hydrogen cyanide) are no longer present on a dead body. Therefore, other than proper ventilation, no specific precautions are necessary. Detectors with at least two (2) different technologies are used for chemical screening at the scene.

10.2 Biological Risk

There are two (2) levels of risk with respect to deceased body management. The highest risk involves handling human remains contaminated and infected with highly contagious agents (e.g., smallpox). These agents can be easily spread among the population beyond the primary contacts. The second, lower risk involves handling bodies contaminated or infected with non-contagious (e.g., anthrax) or non-toxic (e.g., ricin, saxitoxin or botulinum toxin) agents. It is vital that responders eliminate the risk of contaminant transfer (e.g., agent in powder form) and protect themselves against the risk of accidental blood exposure. The primary concern with biological risks among the responders is contracting bacterial or viral infection from the deceased. Decontamination is rarely conducted in death cases following infection with a biological agent. Therefore, use of appropriate PPE with proper donning and doffing procedures is crucial when handling dead body with biological risk.

10.3 Radiological and Nuclear Risk

A nuclear disaster would cause mass casualties in which most victims would be killed by the explosion itself through blast or heat. Some would be irradiated, not contaminated, and others would be irradiated and contaminated by radioactive materials via dust or aerosol. For detonation of a RDD or a dirty bomb, it could require responders to deal with dead bodies with external/ internal radioactive contamination and with radioactive shrapnel. Although many radiation protection procedures are very similar to protective measures against chemical and biological agents, there are some important conceptual and practical differences that need to be addressed[23].

Procedures concerning dead bodies that were exclusively exposed externally to ionising radiation entail no radiological risks to the responders and will follow the conventional biosafety rules. However, when handling a deceased who presents internal contamination with radionuclides, as during an autopsy, the responders could be exposed to ionising radiation from the radioactive material located in the body and could also be contaminated especially when the body is improperly manipulated.

In general, autopsies ought not to be performed on internally contaminated bodies unless absolutely necessary (e.g., for medico-legal reasons). When an autopsy needs to be performed on a contaminated body, the proper planning for the procedure is essential. For this purpose, the participation of a RPO is required to assist and advise on screening and safety aspects encompassing limiting external exposure; avoiding radioactive contamination; protecting the premises; disposing biological samples, clothes and materials; and monitoring the dosimeter reading on the responders throughout the autopsy procedure. If a victim is pronounced dead at the scene of an emergency, the body will not be transported to a hospital.

On the scene of the emergency, deceased casualties may require basic preliminary decontamination before they are moved to the morgue or are ready for release to a designated place. After the authority authorises removal of bodies, each body will be surveyed. For MCI causing many deaths and bodies contaminated with radionuclides, it would probably be necessary to establish a field morgue near the scene (Figure 6.9), but in an area where dose rates are low. The morgue will need to set up a clean processing line, a contaminated processing line and a refrigeration facility at least 10 metres from the clean and contaminated areas.

After bodies have been released by the morgue team, they can be moved to a decontamination area and washed. Collection of runoff water is not necessary for uncontaminated bodies. The runoff water from contaminated bodies could be collected for later disposal. After washing a deceased and removing any radioactive shrapnel, a last survey will be performed. To release the body for burial without restrictions, RPO will be consulted. A tag can be attached to the body indicating the date, dose rate and distance at which this dose rate was measured, the results of any measurements of external and internal contamination, as well as type of the equipment used to perform the measurements.

A body with internal contamination with radionuclides has to be embalmed under the close orientation and supervision of the RPO. Internally contaminated bodies are only to be cremated when adequate measurements and, as necessary, procedures can be taken for preventing radioactive contamination of the facility and the surrounding environment. Cremation of dead bodies contaminated with long lived radionuclides could cause sufficient contamination to require extensive decontamination efforts. Shrapnel or brachytherapy seeds will not be destroyed in the process of cremation. If cremation is desired, shrapnel, brachytherapy seeds or any other discrete sources have to be removed and dealt with in accordance with the local requirement. Burial of a body that has internal contamination usually constitutes minimal health risk to human or the environment.

ANNEXES

Annex 1 Basic Emergency Care – List of Medical Equipment and Medications

1. Airway Management

- Oro-pharyngeal Airway (various sizes)
- Nasopharyngeal Airway (various sizes)
- Bag-Valve and Mask
- Advance Airway Adjunct (Laryngeal Tube/ Laryngeal Mask)
- Laryngoscope
- Endo-tracheal Tube (various sizes)
- Endo-tracheal Tube Introducer
- Adhesive Tapes
- Syringes (20cc, 10cc) and Needles (sizes 18G, 20G, 22G, 24G)
- Lubrication Gel

2. Breathing and Ventilators Support

- Oxygen Supply or Oxygen Tank with oxygen regulator
- High Flow Mask
- Nebulizer Mask
- Suction Outlet or Portable Suction Machine
- Portable Resuscitator
- Portable Ventilator

3. Circulation and Haemorrhage Control

- Automated External Defibrillator (AED)/ Defibrillator with TCP Capability
- Intravenous Cannula (Sizes 16G, 18G, 20G, 22G, 24G)
- Intravenous Fluids (Normal Saline/ Hartman's Solution)
- Water for Irrigation
- Compression Bandages
- Triangular Bandages
- Sutures
- Chest Tube Set with under water seal
- ECG Machine

4. Skeletal Immobilization

- Cervical Collar (adjustable)
- Head Immobilizer (various sizes)
- Upper Limb Immobilizer (various sizes)
- Lower Limb Immobilizer (various sizes)
- Traction Immobilizer

5. Monitoring Equipment

- Non Invasive Blood Pressure with Oxygen Saturation
- Capillary Blood Sugar Machine
- Vital Signs Monitor (BP/ PR/ RR/ SpO/ ECG)

6. Personal Protective Equipment (Disposable)

- Gloves
- Apron
- Surgical Face Mask

7. Emergency Medications (Drugs)

- Adrenaline
- Adenosine
- Frusemide
- Flumazenil
- Opioids
- Atropine
- Calcium Gluconate
- Sodium Bicarbonate
- Amiodarone
- Lignocaine
- Dextrose 50%
- Naloxone
- Magnesium Sulphate
- Beta 2-Agonist for Asthma/ COPD
- Benzodiazepines
- Aspirin
- Glyceryl Trinitrate
- Hydrocortisone/ Prednisolone
- 0.9% Saline

Annex 2 Checklists for Chemical Event

Table A: Checklists and Capability of Chemical Risk Assessment

Capability Target	Hazard	Threat	Incident
Context	Refer Table A	Refer Table A and B	Refer Table A, B, C and D
Resources			
• Availability	Existing resources such as: • Communication tool. • Human resource. • PPE.	• Inter- agency collaboration. • Communication tools. • Remedial control measures are usually in placed to address certain threats.	• Principles of control measures and decontamination can be fulfilled. • Availability of SME.
• Gap	• Information. • Skills, training and experience. • Viability of interoperability communication. • Tendency to underestimate the actual risk.	• Variation of SOPs and terminology • With poor communication and assessment, delay in response from external stakeholders are common. • Unmet needs in addressing or responding to threats.	• Lack of urgency as encouraged.
Surveillance			
• Responder		Preparedness	Sickness/ casualty among responders.
• Population		Preparedness	Casualties outside of red zone.
• Environment		Preparedness	Chemical effects around the crisis zone.
Act of deliberate/ terror?	Yes/ No/ Unsure	Yes/ No /Unsure	Yes/ No/ Unsure

Table B: Basic Required Chemical Data

General checklist					
Name of chemical	Trade mark name:	Chemical name:		CAS number:	□ Unknown
Amount/ Size of container					
What phase are you in?	□ Hazard		□ Threat		□ Incident
Sort/ type/ risk of incident	□ Traffic	□ Fire	□ Industry release	□ Terroristic release	□ Others
Physical properties	□ Gas/ vapour		□ Liquid		□ Solid
No of victim	Adults :		Children:		□ No data
Sign/ symptoms/ experience by victims	□ No	□ Yes	If yes, please list:		□ No data
Conventional injuries present	□ No	□ Yes	If yes, please list:		□ No data
Availability of clinical/ state toxicologists	□ No	□ Yes	□ Other state, please list:		
Type of industry involved	□ Agricultural	□ Manufacturer	□ Oil and gas	□ Others	□ Unknown
Availability of HAZMAT team?	□ No	□ Yes	□ Other state, please list:		
Required PPE and availability	□ No	□ Yes	If yes, please list:	Type:	Estimated Number:
Availability of known antidote	□ No		□ Yes		
Remarks (If any):					

Table C: Checklist of Communication with Clinical Toxicologist

Toxicology data for toxic trauma treatment in a chemical incident				
Name of chemical	Trademark name:	Chemical name:		CAS number:
Relevant route of exposure	□ Inhalation	□ Skin/ mucous membrane		□ Ingestion
Expected sign/ symptom/ exposure				
Secondary contamination risk	□ No	□ Yes	Details:	
Decontamination necessary	□ No	□ Yes	Details:	
Prioritization by triage				
Required PPE	□ No	□ Yes, please list	Details:	
Required antidote	□ No	□ Yes, please list	Name:	
			Indication:	
			Dosage:	
			Cautions:	
Symptomatic treatment/ recommendation				
Biological samples for toxicology analysis	□ None	□ Blood	□ Urine	□ Vomit
	□ Others, please list:			
Observation/ admission/ discharge criteria				
Possibility of environmental contamination	□ No	□ Yes	Details:	
Remarks (If any):				

Table D: Chemical Incident Report

Data on the victim/ institution				
Institution/ Location			Date of arrival:	Time:
Address				
Department				
No of victims				
Male:	Toddler:	Child:	Adult:	Elderly:
Female:	Toddler:	Child:	Adult:	Elderly:
Exposure and decontamination				
Location of exposure			Date:	Time:
Route of exposure	No of victims in inhalation:	No of victims in dermal exposure:	No of victims in ingestion:	□ No data
Chemical name and form	□ Solid	□ Liquid	□ Vapour/ gas	□ No data
Decontaminated at the incident site	□ No	□ Yes, partly	□ Yes, completely	□ No data
Has the victim been decontaminated in the Emergency Department (ED)	□ No	□ Yes	If yes, please list: Date: Time:	
Did the victim showed any signs/ symptoms?	□ No	□ Yes	□ No data	
Lists of signs/ symptoms				
Time of onset of signs of symptoms	Date:		Time:	
Triage category at incident site	□ Green	□ Yellow	□ Red	□ White
Triage category in ED	□ Green	□ Yellow	□ Red	□ White

Treatment				
No. of victim receive antidote?	Not receive antidote:	Receive antidote:	□ No data	
Name of antidote				
Treatment	Oxygen:	IV fluid:	Hemodialysis:	Intubation:
	□ No	□ No	□ No	□ No
	□ Yes	□ Yes	□ Yes	□ Yes
Sample for toxicology analysis	□ Blood/ Serum/ Plasma	□ Urine	□ Vomit	□ Organs
	□ Clothes	□ Skin swab	□ Environment samples	
Possibility of environmental contamination	□ No		□ Yes	
Outcome				
No. victim admitted to hospital				
No. victim discharged				
No. victim scheduled for follow-up				
No. of patients transferred				
No. of patient died in hospital				
No. of responders became casualties				
No. of casualties outside red zone				
No. of deaths if any				
Remarks (If any):				

Annex 3 Tasks by Relevant Agencies in Responding to Chemical Incident/ Disaster

Task	Relevant Agencies
Command and control	• RMP (at site i.e. OSCP) • Disaster Management Committee (at District/ State/ National DOCC)
Zoning and determination of medical base location	• FRDM/ HAZMAT
Identification of offending chemical on field	• FRDM/ HAZMAT (for TICs) • MAF/ RMP (for CWAs)
Sampling of offending chemical	• DOE/ Department of Chemistry Malaysia (for TICs) • NACWC/ Department of Chemistry Malaysia (for CWAs)
Responders' safety	• FRDM/ HAZMAT • DOSH • MOH (Occupational and Environmental Health Sector)
Antidote procurement	• MOH (Pharmacy Practice and Development Division)
Determination of suitable PPE to be used by medical personnel	• FRDM/ HAZMAT • DOSH
Decontamination of victims, personnel and equipment	• FRDM/ HAZMAT (at site) • ETD for MOH hospitals* • District Health Office for MOH health clinics* *with advice and assistance from FRDM/ HAZMAT
Evacuation of population	To be determined by Disaster Management Committee

Annex 4 List of Drugs and Antidotes Available in Ministry of Health (MOH) Facilities according to Procurement, MOH Malaysia Drug Formulary Category, and Stock Location

No.	Antidote	Indication	Procurement Methods	MOH Drug Formulary Category	Stock Type	Location
1	Activated Charcoal 50 g Granules	Gastrointestinal decontamination	Local Purchase (LP)	A	Buffer stock	All hospitals
2	Atropine Sulphate 1 mg/ml Injection	Organophosphate poisoning	Approved Products Purchase List (APPL)	B	Buffer stock	All hospitals and concession companies
3	Pralidoxime Chloride 25 mg/ml in 20 ml Injection		APPL	B	Buffer stock	All hospitals and concession companies
4	Diazepam 5 mg/ml Injection		APPL	B	Buffer stock	All hospitals and concession companies
5	Calcium Gluconate 10% Injection	Hydrofluoric acid poisoning	LP	B	Buffer stock	All hospitals
6	Dimercaprol (BAL) 50 mg/ml Injection	Heavy metal poisoning	LP	B (Import Permit)	Stockpile	Tengku Ampuan Rahimah Hospital, Klang
7	Dimercaptopropane Sulphonate (DMPS) 250 mg/5 ml Injection	Heavy metal or tetramine poisoning	LP	Import Permit	Stockpile	Tengku Ampuan Rahimah Hospital, Klang

No.	Antidote	Indication	Procurement Methods	MOH Drug Formulary Category	Stock Type	Location
8	Succimer (DMSA) 200 mg Capsule	Heavy metal poisoning (lead, mercury, arsenic, zinc)	LP	Import Permit	Stockpile	1. Tengku Ampuan Rahimah Hospital, Klang
9	Hydroxocobalamin 5 g Injection	Cyanide poisoning	LP	Import Permit	Stockpile	1. Kuala Lumpur Hospital 2. Tengku Ampuan Afzan Hospital, Pahang 3. Raja Perempuan Zainab II Hospital, Kelantan
10	Prussian Blue 500 mg Capsule	Thallium poisoning	LP	Import Permit	Stockpile	1. National Cancer Institute 2. Penang General Hospital 3. Sultanah Aminah Hospital, Johor Bharu 4. Sarawak General Hospital, Kuching 5. Likas Women and Children's Hospital, Sabah 6. Kuala Lumpur Hospital
11	Filgrastim (G-CSF) 30 mU/ml Injection (Asymptomatic treatment for anemia due to Thallium)		APPL	A*	Buffer stock	
12	Potassium Iodide Mixture/ Solution	Thallium/ radiation poisoning	LP (Permit Import)	B	Buffer stock	

Note: The chain of command for drug management during crisis is depending on the crisis level – refer to *Pelan Pengurusan Krisis Bencana Bagi Perkhidmatan Farmasi*, 1st Edition October 2016 *Sources: Pelan Pengurusan Krisis Bencana Bagi Perkhidmatan Farmasi, October 2016*

Annex 5 Recommended Antidotes for Chemical Warfare Agents (CWAs)

Type of CWA	Antidote	Recommended Dosage	Frequency	Notes
Nerve agents/ Organophosphate (OP)	Atropine	IV/IM 0.5-1 mg	Repeated every 5 minutes until secretions are dried and/ or resolution of bradycardia.	Dose can be doubled each time until drying of secretions and/ or resolution of bradycardia achieved.
Nerve agents/ OP	Diazepam	IV 5-10 mg	Can be repeated with careful consideration to airway management.	Anti-convulsant.
Nerve agents/ OP	Midazolam	IV/IM 5-10 mg	Can be repeated with careful consideration to airway management.	Anti-convulsant.
Nerve agents/ OP	220 mg Obidoxime/ 2 mg Atropine - autoinjector	Up to IM 650 mg over 30 minutes (total of three injections via auto-injector)	-	Can be used in the field by first responders.
Nerve agents/ OP	Pralidoxime	IV 0.5-1 g infusion over 1 hour	Repeated every 8 hours OR as continuous infusion.	Poor efficacy for Tabun and Soman.
Lewisite (Vesicant)	BAL (British Anti Lewisite)	IM 3 to 5 mg/kg	Every 4 to 6 hours for 48 hours	-
HCN (blood agent)	Hydroxy-cobalamin	IV 5-10 mg	Once	Subsequent dosing may be required in severe toxicity.
Sulfur Mustard (blister agent)	Sodium thiosulfate	IV 250 to 500 mg/kg slow infusion over 10 minutes	-	For systemic toxicity.
Nitrogen Mustard (blister agent)	None recommended	-	-	Symptomatic treatment
BZ (3-Quinuclidinyl benzilate) (incapacitating)	None recommended	-	-	Symptomatic treatment
Fentanyl	Naloxone	IM/ IV/ Intranasal 0.4 mg	Can be repeated every 2-3 minutes until respiratory depression is reversed. Not to exceed a total dose of 10 mg	For chronic opioid abusers starting dose should be 0.1 mg
Tear gas CS/ CN	None recommended	-	-	Symptomatic treatment

Annex 6 Category of Biological Agents

Category A Agents					
Agents Name	Incubation Period	Mode of Transmission, Communicability	Symptoms, Duration of illness, Fatality Rate	Treatment, Vaccine Efficacy, Antitoxin	Potential as Biological Agent
Anthrax *(Bacillus anthracis)*	1 to 7 days, although there are rare cases of 60 days.	Dissemination through: 1. Spores in aerosol 2. Sabotage (food) 3. Cutaneous - contact with contaminated animal product Person-to-person contact is very rare.	3 kind of illness: cutaneous (blisters/ bumps), inhalation (fever, SOB, cough and others) and gastrointestinal (fever, chills, diarrhea, swelling of abdomen). Duration of illness: 3 days to 5 days Inhalation anthrax: after symptoms appear, almost always fatal, regardless of treatment. Intestinal: 25 % to 60 % fatality rate Contact or cutaneous anthrax: 5% to 20% fatality rate.	IV antibiotics (ciprofloxacin, tetracyclines including doxycycline, penicillins) and antitoxins. Timing and treatment are crucial for survival of inhalation. 60 days treatment with one of the antibiotics is given to reduce the risk or progression of disease due to inhaled anthrax.	High, Iraqi and USSR biological programs worked to develop anthrax as a bioweapon.
Botulism *(Clostridium botulinum)*	12 to 36 hours.	Consumption of food that contains toxin (common outbreaks associated with improperly canned food). No person-to-person transmission.	4 kinds : foodborne, contaminated wound, infant (colonization of intestines in an infant), and adult intestinal urnetii. Symptoms : blurred vision, drooping eyes, muscle weakness, muscle paralysis, and others. 70% fatality if untreated and <5% if treated. Death in 24-72 hours; last for months if not lethal.	Heptavalent equine antitoxin (A to G), older version antitoxin – trivalent.	Not very toxic via aerosol route; extremely lethal if delivered orally.

Category A Agents					
Agents Name	Incubation Period	Mode of Transmission, Communicability	Symptoms, Duration of illness, Fatality Rate	Treatment, Vaccine Efficacy, Antitoxin	Potential as Biological Agent
Plague *(Yersinia pestis)*	1 to 7 days.	Flea bites (infected fleas), contact with contaminated fluid or tissue, and infectious droplets (cough via pneumonic cases). Person-to-person transmission high (pneumonic).	3 kinds: bubonic (fever, chills, weakness, and swollen lymph nodes), septicaemic (fever, chills, shock, bleeding into skin and organs), and pneumonic plague (fever, rapid pneumonia, cough, and others). 1 to 6 days (usually fatal).	Doxycycline, ciprofloxacin, and gentamicin (common antibiotics). Vaccine not available.	High-highly infectious, particularly pneumonic (aerosol) form; lack of stability and loss of virulence complicate its use.
Smallpox *(Variola major)*	7 to 19 days.	Droplets spread via saliva droplets. Person-to-person transmission high.	Prodormal rash, high fever, headache, malaise, and others. Duration of illness is 4 weeks. 20-40% fatality (Variola major) and <1% (Variola minor).	No known treatment, but vaccination within 3-4 days of exposure can reduce severity of illness. Vaccinia immune globulin (VIG) and supportive treatment.	Possible, especially since routine smallpox vaccination program has been eliminated worldwide; weaponised by former Soviet Union.
Tularemia *(Francisella tularensis)*	3 to 5 days with a range of 1-14 days.	Arthropod bites (infected ticks), contact of infected tissue with mucous membrane, ingestion of infected meat or aerosolization. No person-to-person transmission.	Depends on exposure route, but general symptoms are fever, swollen lymph nodes, difficulty breathing, chest pain. Duration of illness more than 2 weeks.	Aminoglycosides 10 – 21 days; preferably parenteral Streptomycin or Gentamicin Alternatives: Doxycycline, Chloramphenicol, Ciprofloxacin. No vaccine.	High, if delivered via aerosol form (highly infectious, 90-100%).
Viral Hemorrhagic Fever Zoonotic viruses from 4 families (arenavirus, filoviruses, bunyaviruses,	2 to 21 days.	Where animal or insects are natural reservoirs. Person-to-person transmission through close contact with infected persons noted in Ebola, Marburg, Lassa,	Fever, dizziness, muscle aches, exhaustion, bleeding under the skin and in internal organs or from orifices and eyes, shock, nervous system malfunction,	No established treatments. Ribavirin has been shown to be beneficial for Lassa fever, but supportive care is standard practice. Vaccine available for Flavivirus.	High: Filovirus (weaponised by former Soviet Union biological program); Yellow fever virus (if efficient

Category A Agents					
Agents Name	Incubation Period	Mode of Transmission, Communicability	Symptoms, Duration of illness, Fatality Rate	Treatment, Vaccine Efficacy, Antitoxin	Potential as Biological Agent
and flaviviruses)		and Crimean-Congo hemorrhagic fever.	delirium, and seizures. Duration of illness between 2-16 days. Fatality rate: Arenavirus:18% Filovirus:23-90% Flavivirus: 10-20% in severe case.		dissemination device is employed).

Category B Agents					
Agents Name	Incubation Period	Communicability	Symptoms	Treatment	Potential as Biological Agent
Brucellosis *(Brucella* species*)*	Commonly 1-2 months but range from 5 days to 60 days.	Person-to-person spread is extremely rare. Ingestion of raw or undercooked meat or dairy products, inhalation, contaminated wounds or water supply.	Initial symptoms include fever, sweats, malaise, anorexia, headache, pain in muscles, joint, and/or back, fatigue. Fatality rate is low. Duration of illness unknown.	Generally, the antibiotics doxycycline and rifampin are recommended in combination for a minimum of 6-8 weeks.	Unknown.
Epsilon toxin *(Clostridium perfringens)*	10 – 12 hours with a range of 6 – 24 hours.	Not communicable.	Usually begins suddenly – diarrhoea and abdominal cramps, usually no fever or vomiting.	Supportive care. Antibiotics not recommended.	
Food safety threat *(Salmonella* species, *Escherichia coli O157:H7, Shigella)*	Usually 3-4 days but may be as short as 1 day or as long as 10 days.	Ingestion of contaminated water supplies by faecal matter and contaminated food such as raw or undercooked ground meat products, raw milk, raw vegetables, raw sprouts. Person-to-person transmission high.	Sudden onset of diarrhoea (which may be bloody), abdominal cramps, fever (almost always present), nausea, vomiting, and headache.	Supportive care. Antibiotics for severe cases. Oral vaccine (Vivotif) and single dose injectable vaccine (capsular polysaccharide antigen). Amoxiciilin or cotrimixazole.	Not likely to be deployed via aerosol; more likely for covert contamination of water or food.

Category B Agents					
Agents Name	Incubation Period	Communicability	Symptoms	Treatment	Potential as Biological Agent
Glanders *(Burkholderia mallei)*	Typically 2 – 6 weeks.	Human cases are rare. Human-to-human transmission have not been reported. Contact with infected tissues or body fluids, inhalation.	4 kinds: localised (via open wound, could cause enlarged lymph nodes), pulmonary (pneumonia or lung abscess), bloodstream (disseminated – fatal), chronic (multiple abscess over skin, muscle or organs). Duration of illness unknown. Fatality rate 50-70%.	Sulfadiazine. Usually susceptible to tetracyclines, ciprofloxacin, streptomycin, novobiocin, gentamicin, urnetii, ceftazidime, sulfonamides. No vaccine.	Unknown.
Melioidosis *(Burkholderia pseudomallei)*	Generally 2-4 weeks but could range from 1 day to many years.	Inhalation, droplets, ingestion of contaminated water or soil. No person-to-person transmission.	Localised (fever, abscess or ulceration), pulmonary (high fever, cough, chest pain, headache), bloodstream (fever, respiratory distress, stomach or chest pain, disorientation). Duration of illness 4-20 days. Fatal if bloodstream infection.	IV Ceftazidime every 6-8 hours or Meropenem every 8 hours for 10-14 days followed by 3-6 months of oral Bactrim every 12 hours or Doxycycline 12 hours. No vaccine.	Moderate-no vaccine available.
Psittacosis *(Chlamydia psittaci)*	5-14 days.	Rare human-to-human transmission. Inhalation of dust containing dried urine, feces, and respiratory secretions of infected birds.	Abrupt onset of fever and chills, headache, muscle aches, urnetiidtive cough.	Tetracyclines are the drugs of choice. But also sensitive to macrolides.	
Q fever disease *(Coxiella urnetiid)*	Typically 2-3 weeks, may range from 3 to 30 days.	Inhalation of dust contaminated by infected animal feces, urine, milk, and birth products. Rare person-to-person transmission.	Flu-like symptoms including fever, chills, fatigue, and muscle pain. Duration of illness weeks. Fatality rate very low.	2 weeks of doxycycline.	Highly infectious if delivered in aerosol form; dried agent is very stable; aerosol form is stable.

Category B Agents					
Agents Name	Incubation Period	Communicability	Symptoms	Treatment	Potential as Biological Agent
Ricin toxin *(Ricinus communis* – castor beans)		Type of poisoning, not contagious, in the form of inhalation, ingestion of contaminated food or beverages, injection. No person-to-person transmission.	Inhalation: respiratory distress within few hours, ingestion: vomiting and diarrhea, seizures, fatal in few days, skin and eye exposure: redness and pain. fatality rate 100% without treatment. Duration of illness: days-death within 10-12 days for ingestion.	No available antidotes or vaccines.	High potential use in aerosol form; has been used in 1978 Markov murder included on prohibited schedule 1 chemical list for Chemical Weapon Convention.
Staphylococcal enterotoxin B	4-6 hours.	Contaminated food or water, inhalation. No person-to-person transmission.	Nausea, vomiting, stomach cramps and diarrhoea. Duration of illness in hours.	Pain relievers and cough suppressants for mild cases; for severe cases may need mechanical breathing and fluid replenishment.	Moderate-could be used in food and limited amount of water.
Typhus fever *(Rickettsia prowazekii)*	8-16 days.	Primary vector is the human body louse. No person-to-person transmission.	Flu-like symptoms, fever, headaches, and sometimes rash. Duration of illness unknown. 10-40% fatality if untreated, increases with age.	Doxycycline for 7-10 days.	Uncertain-broad range of incubation (6-14 days) period could cause infection of force deploying biological agent.
Viral encephalitis *(alphaviruses)*	4-10 days.	Bite of an infected mosquito.	Abrupt fever, chills, malaise, arthralgia, myalgia, headache.	No human vaccine or specific antiviral treatment.	
Water safety threats *(Vibrio cholerae, Cryptosporidium parvum)*	A few hours to 5 days, usually 2 to 10 days.	Contaminated water supply. Rare person-to-person transmission.	Profuse watery diarrhoea, vomiting, muscle cramps, dehydration symptoms. Duration of illness >1 week. Fatality rate low with fluid replacement.	Supportive care. Antibiotics for severe cases.	Not appropriate for aerosol delivery.

Annex 7 Hazard Assessment Form for Biothreat

Hazard Assessment for Biothreat	Yes	No
Does the suspected hazard (pathogen, toxin, contaminant and others) cause the clinical signs and symptoms observed?		
Is the suspected hazard known to cause disease in humans or animals?		
Are the age group(s), sex or occupational group (s) affected typical for exposure to any hazards?		
Is the time from presumed exposure to the onset of clinical signs and symptoms typical of a particular hazard or type of hazard?		
Is the severity of disease typical of a particular hazard or type of hazard?		
Does the disease respond to particular treatments (e.g., antibiotics)?		
Has the suspected hazard been diagnosed previously as the cause of disease at the same time of year, place or population?		
Have there been any associated or preceding events (e.g., disease or deaths in animals, food or product recalls, known accidental or deliberate releases of biological or similar events in neighbouring countries, and others)?		
Do laboratory test results confirm a specific cause or are they consistent with a particular type of hazard?		

Annex 8 Biosafety Level for Laboratory

BSL	Agents	Practices	Primary Barriers and Safety Equipment	Facility (Secondary barriers)
1	Not known consistently to cause disease in healthy adults.	Standard microbiological procedures.	No Primary barriers required. PPE: Laboratory coats and gloves, eye, face protection, as needed.	Laboratory bench and sink required.
2	Associated with human disease. Routes of transmission include percutaneous injury, ingestion, mucous membrane exposure.	BSL-1 practice plus limited access, biohazard warning signs, sharps precautions, and a biosafety manual defining any needed waste decontamination or medical surveillance policies.	Primary barriers: Biosafety cabinet (BSC) or other physical containment devices used for all manipulations of agents that cause splashes or aerosols of infectious materials. PPE = Laboratory coats, gloves, and face and eye protection, as needed.	BSL-1 plus autoclave available.
3	Indigenous or exotic agents that may cause serious or potentially lethal disease through the inhalation route of exposure.	BSL-2 practice plus controlled access, decontamination of all waste, decontamination of laboratory clothing before laundering.	Primary barriers: BSC or other physical containment devices used for all manipulations of agents. PPE = Protective laboratory clothing, gloves, and face. Eye and respiratory protection, as needed.	BSL-2 plus physical separation from access corridors, self-closing double-door access, exhausted air not recirculated, negative airflow into the laboratory, hand washing sink near laboratory exit.
4	Dangerous/ exotic agents which pose high individual risk of aerosol-transmitted laboratory infections that are frequently fatal, for which there are no vaccines of treatments. Agents with a close or identical antigenic relationship to an agent requiring BSL-4 until data are available to redesignate the level. Related agents with unknown risk of transmission.	BSL-3 practices plus clothing change before entering, shower on exit, all materials decontaminated on exit from facility.	Primary barriers: All procedures conducted in Class III BSC or Class I or II BSC in combination with full-body, air-supplied, positive-pressure personnel suit.	BSL-3 plus separate building or isolated zone, dedicated supply/ exhaust, vacuum and decontamination systems. Other requirements outlined in the text.

Annex 9 Specimen Selection, Transportation, and Handling for High Priority Biological Agents

Disease/ Agent	Specimen Selection					Transport and Storage	Specimen Handling
Botulism (botulinum toxin)	Specimen type	Clinical syndrome				Specimen(s) of choice for confirming botulism: 1. Serum. 2. Wound/ tissue. 3. Stool. 4. Incriminated food.	
		Food borne	Infant	Wound	Intentional release (airborne)		
	Enema fluid – 20 ml	X	X		X	4°C	Contact LRN Reference level laboratory for instructions before collecting specimens.
	Food sample – 10 - 50 g	X	X		X	4°C	Foods that support C. botulinum growth will have a pH of 3.5-7.0; most common pH is 5.5-6.5. Submit food in original container, placing individually in leakproof sealed transport devices.
	Gastric fluid – 20 ml	X, A				4°C	Collect up to 20 ml.
	Intestinal fluid – 20 ml	A	A			4°C	Autopsy: Intestinal contents from various areas of the small and large intestines should be provided.
	Nasal swab (anaerobic swab)				X	RT	For aerosolized botulinum toxin exposure, obtain nasal cultures for *C. botulinum* and serum for mouse toxicity testing.
	Serum – 15-20 mls	X, A		X	X	4°C	Serum should be obtained immediately after the onset of symptoms and before antitoxin is given. Whole blood (30 ml [3 red-top or gold-top tubes]) is required for mouse toxicity testing. In infants, serum is generally not useful, since the toxin is quickly absorbed before serum can be obtained.
	Stool > 25g	X	X	X	X	4°C	Botulism has been confirmed in infants with only "pea-size" stools. Please note: Anticholinesterase given orally, as in patients with myasthenia gravis, has been shown to interfere with toxin testing.

Disease/ Agent	Specimen Selection					Transport and Storage	Specimen Handling
	Vomitus – 20 ml	X				4°C	Collect up to 20 ml.
	Wound, tissue – anaerobic swab or transport system.					Anaerobic swab or transport system. Transport at RT.	Exudate, tissue, or swabs must be collected and transported in an anaerobic transport system. Samples from an enema or faeces should also be submitted, since the wound may not be the source of botulinum toxin.

Disease/ Agent	Specimen Selection		Transport and Storage	Specimen Handling				
				SBA	CA	MAC	Stain	Other
	Possible *Y. pestis* exposure in asympto-matic patient.	No cultures or serology indicated.						Follow public health instructions if advised to collect specimens.
Plague *(Yersinia pestis)*	Bubonic.	Blood cultures: Collect 2 sets (1 set is 2 bottles) per institutional procedure for blood routine.	Transport at RT. Incubate at 35-37°C per blood culture protocol.	Blood culture bottles.			Gram stain of positive cultures.	If suspicion of plague is high, obtain an additional set for incubation at RT (22-28°C) without shaking.
		Red-top for serology; EDTA, heparin, and citrate are all acceptable for PCR.	≤24h, 4°C	No			No	Patients with negative cultures having a single titer, ≥1:10, specific to F1 antigen by agglutination would meet presumptive criteria.
		Lymph node (bubo) aspirate: Flushing.	Transport at RT or 4°C if transport is delayed. Stored at ≤24h, 4°C.	X	X	X	Gram stain, Giemsa Wright's stain.	Contact LRN Reference lab before preparing smears for DFA.

Annex 10 List of Designated Reference Laboratories

1. Infectious Diseases Research Centre (IDRC)
   Bacteriology/ Virology Unit,
   Institute for Medical Research,
   Jalan Pahang,
   50588 Kuala Lumpur,
   Malaysia.
   Tel: 603-2616 2666
   Fax: 603-2693 9335
   Email: portal@imr.gov.my

2. National Public Health Laboratory (NPHL)
   Bacteriology/ Virology Unit,
   Lot 1853, Kampung Melayu Batu 13,
   47000 Sungai Buloh, Selangor,
   Malaysia.
   Tel: +60 (3) 6126 1200
   Fax: +60 (3) 6140 2249
   Email: mkak_careline@moh.gov.my

3. Veterinary Research Institute (VRI)
   59, Jalan Sultan Azlan Shah,
   31400 Ipoh, Perak,
   Malaysia.
   Tel: 05-545 7166
   Fax: 605-5463368

4. Department of Chemistry
   Jalan Sultan,
   46661 Petaling Jaya, Selangor,
   Malaysia.
   Tel: (603) -7985 3000
   Fax: (603) -7985 3092
   Email: projkm@kimia.gov.my

Annex 11 List of Antibiotics, Antitoxin, Immunoglobulin, and Vaccines

No.	Communicable Disease	Prophlaxis/ Treatment	Procurement Methods	FUKKM Category	Stock Type	Location
1.	Cholera	Ciprofloxacin 200 mg/ 100 ml Injection	Central Contract	A	Buffer stock	All hospitals
2.	Brucellosis, Q fever, Plague, Tularemia	Doxycycline 100 mg Capsule/tablet	APPL	B	Buffer stock	All hospitals and concession companies
3.	Plague, Tularemia	Gentamicin Sulphate 40 mg/ml Injection	APPL	B	Buffer stock	All hospitals and concession companies
4.	Plague	Streptomycin Sulphate 1 g Injection	APPL	B	Buffer stock	All hospitals and concession companies
5.	Brucellosis	Rifampicin 150 mg/300mg Capsules	APPL	B	Buffer stock	All hospitals and concession companies
6.	Botulism poisoning	Botulism antitoxin type A, B and E	LP	Import Permit (handled by MOH)	Stockpile	Kuala Lumpur Hospital
7.	Smallpox	Smallpox Immunoglobulins	–	–	–	Coordinated at MOH level
		Smallpox vaccine	LP	Import Permit	–	Coordinated at MOH level
8.	Ebola	Ribavirin 200 mg Capsule	LP	A*	Buffer stock	All hospitals
9.	Anthrax	Anthrax vaccine	LP	–		Coordinated at MOH level
		Ciprofloxacin 200 mg/ 100 ml Injection	Central Contract	A	Buffer stock	All hospitals

Annex 12 The Danger of Nuclear, Radiological Devices, and Materials

Improvised Nuclear Device (IND)

What is an Improvised Nuclear Device (IND)?

- A nuclear emergency involves the explosion of a nuclear weapon or IND.
- The explosion produces an intense pulse of heat, light, air pressure, and radiation.
- Nuclear explosions produce fallout (radioactive materials that can be carried long distances by the wind).

What are the main dangers of an IND?

An IND would cause great destruction, death and injury, and have a wide area of impact. People close to the blast site could experience:

- Injury or death (as a result of the blast).
- Moderate to severe burns.
- Flash blindness.
- Radiation Sickness (also called ARS).
- Contaminated food and water sources.

Dirty Bomb or Radiological Dispersal Device (RDD)

What is a dirty bomb?

- A dirty bomb is a mix of explosives, such as dynamite, with radioactive powder or pellets. It is also known as a RDD.
- A dirty bomb cannot create an atomic blast like an IND or nuclear weapon.
- When the dirty bomb explodes, the blast carries radioactive material into the surrounding area.

What is the main danger of a dirty bomb?

- The main danger from a dirty bomb comes from the explosion, not the radiation.
- The explosion from a dirty bomb can cause serious injuries and property damage.
- Only people who are very close to the blast site would be exposed to enough radiation to cause immediate serious illness. However, the radioactive dust and smoke can spread farther away and could be dangerous to health if people breathe in the dust, eat contaminated food, or drink contaminated water.

Radiological Exposure Device (RED)

What is a Radiological Exposure Device (RED)?

- Radioactive material could be hidden from sight to expose people to radiation without their knowledge. These devices are called RED, or hidden sealed sources.
- REDs could be hidden from sight in a public place (e.g., under a subway seat, in a food court, or in a busy hallway). People who sit or pass close to the site of a RED could be exposed to radiation.

What are the main dangers of an RED?

- The dangers of a RED depend on:
  - The type and amount of radioactive material.
  - How long people were near the device.
  - What parts of their bodies were exposed.
- People exposed to high levels of radiation could develop symptoms of ARS, or could develop radiation burns.

- Health effects may take hours, days, or weeks to appear. These effects range from mild to severe effects, such as death or cancer. Some people may not experience any health effects.
  Report a suspected Radiological Exposure Device to law enforcement officials immediately. Stay as far away from the suspected RED as possible. If a RED is identified, and you believe you have been exposed, listen for instructions from emergency officials and contact your doctor.

Nuclear Power Plant Accident

Nuclear power plants have safety and security procedures in place and are closely monitored by the Nuclear Regulatory Commission (NRC) External. An accident at a nuclear power plant could release dangerous levels of radiation over an area (called a plume).

What are the main dangers of a nuclear power plant accident?

- Radioactive materials in the plume from the nuclear power plant can settle and contaminate people who are outdoors, buildings, food, water, and livestock.
- Radioactive materials can also get inside the body if people breathe it in, or eat or drink something that is contaminated.
- People living close to the nuclear power plant who are exposed to radiation could experience long-term health effects such as cancer.

What should I do to protect myself?

- If you live near a nuclear power plant, you can get emergency information materials from the power company that operates your local nuclear power plant or your local emergency services office. If a nuclear power plant accident happens, the best thing to do is to Get Inside, Stay Inside, and Stay Tuned for instructions from emergency officials.

Transportation Accidents

How is radioactive material transported?

- Radioactive material is transported by trucks, rail, and other shipping methods.
- Shipments involving significant amounts of radioactive material are required to have documentation, labels, and placards identifying the cargo as radioactive.

What are the main dangers of a transportation accident involving radiation?

- The main dangers of transportation accidents involving radiation are contact with and exposure to radioactive material.
- It is very unlikely that accidents involving transport of radioactive material will cause any radiation-related injuries or illnesses. Emergency officials have plans in place to safely respond to transportation accidents involving radioactive material.

What should I do to protect myself?

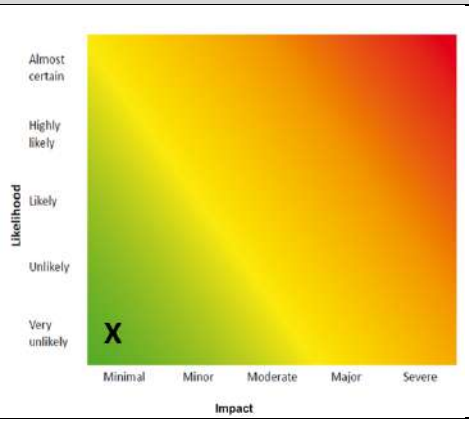
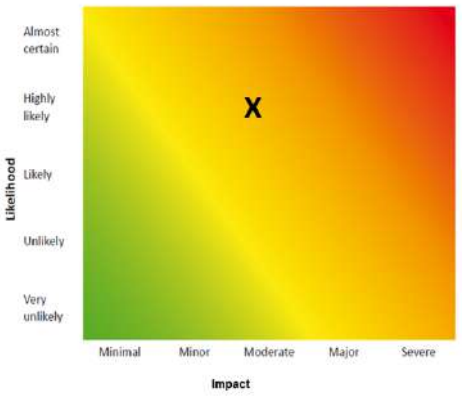
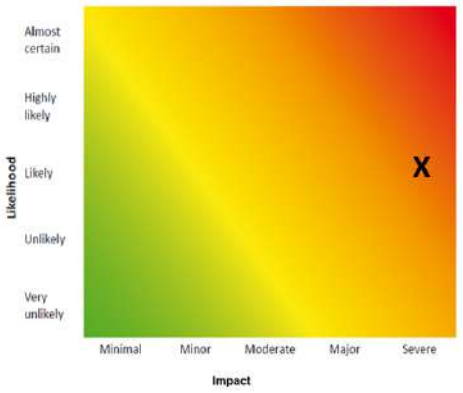
- Report any transportation accidents involving radiation to emergency responders immediately. Stay as far away from the site of the accident as possible. Do not touch any cargo from the transport container.
- If you believe you have been exposed, listen for instructions from emergency officials and contact your doctor.

Annex 13 Nuclear or Radiological Emergency Preparedness Categories

Category	Discription
I	Facilities, such as nuclear power plants, for which on-site events (including those not considered in the design) are postulated that could give rise to severe deterministic effects off the site that would warrant precautionary urgent protective actions, urgent protective actions or early protective actions, and other response actions to achieve the goals of emergency response in accordance with international standards, or for which such events have occurred in similar facilities.
II	Facilities, such as some types of research reactor and nuclear reactors used to provide power for the propulsion of vessels (e.g., ships and submarines), for which on-site events are postulated that could give rise to doses to people off the site that would warrant urgent protective actions or early protective actions and other response actions to achieve the goals of emergency response in accordance with international standards, or for which such events have occurred in similar facilities. Category II (as opposed to category I) does not include facilities for which on-site events (including those not considered in the design) are postulated that could give rise to severe deterministic effects off the site, or for which such events have occurred in similar facilities.
III	Facilities, such as industrial irradiation facilities or some hospitals, for which on-site events are postulated that could warrant protective actions and other response actions on the site to achieve the goals of emergency response in accordance with international standards, or for which such events have occurred in similar facilities. Category III (as opposed to category II) does not include facilities for which events are postulated that could warrant urgent protective actions or early protective actions off the site, or for which such events have occurred in similar facilities.
IV	Activities and acts that could give rise to a nuclear or radiological emergency that could warrant protective actions and other response actions to achieve the goals of emergency response in accordance with international standards in an unforeseen location. These activities and acts include: a) Transport of nuclear or radioactive material and other authorized activities involving mobile dangerous sources such as industrial radiography sources, nuclear powered satellites or radioisotope thermoelectric generators; and b) Theft of a dangerous source and use of a radiological dispersal device or radiological exposure device. This category also includes: • Detection of elevated radiation levels of unknown origin or of commodities with contamination; • Identification of clinical symptoms due to exposure to radiation; and • A transnational emergency that is not in category V arising from a nuclear or radiological emergency in another State. Category IV represents a level of hazard that applies for all States and jurisdictions.
V	Areas within emergency planning zones and emergency planning distances in a State for a facility in category I or II located in another State.

Source: IAEA Safety Standards: General Safety Requirements, GSR Part 7 on Preparednessand Response for a Nuclear or Radiological Emergency

Annex 14 An Example of Risk Assessment For Missing Gamma Projector Device Containing Radioactive Isotope Ir-192

Threat/ Hazard of Radioactive Isotope Ir-192	
Description	Risk Matrix with Level of Overall Risk
Description 1: The radioactive isotope Ir-192 remains intact inside the projector. Likelihood of exposure/ contamination: Very unlikely in the concealed projector. Impact: Minimal/ None Level of Overall Risk = **Very Low**	
Description 2: The radioactive isotope Ir-192 directly exposed to the environment/ people. Likelihood of exposure/ contamination: Highly likely if the projector was stolen and forcefully opened to sell the components as scrap metal. Impact: Moderate as unprotected person(s) who opened the projected will suffer from radiation sickness/ ARS with expected number of exposed persons are low (<10 people). Level of Overall Risk = **Moderate**	
Description 3: The radioactive isotope Ir-192 is used in dirty bomb. Likelihood of exposure/ contamination: Likely if the Ir-192 fall into wrong hands/ terrorists. Impact: Quantity of Ir-192 is very small hence dirty bomb will cause mostly blast injury and psychological effect rather than radiation contaminated injury. However, affected persons are expected to be many (up to hundreds). Level of Overall Risk = **High**	

Annex 15 List of Radiological and Nuclear Response Team

LIST OF MEDICAL RADIATION RESPONSE TEAMS FROM THE MEDICAL RADIATION SURVEILLANCE DIVISION, MINISTRY OF HEALTH MALAYSIA

NAME	DESIGNATION	E-MAIL	TELEPHONE. NO
Mr. Zunaide bin Kayun @ Hj Farni	Director	zunaide@moh.gov.my	011-2110 1622 03-8892 4970
Mr. Bazli bin Sapiin	Deputy Director	bazli@moh.gov.my	013-221 4949 03-8892 4968

TEAM 1 (OPERATIONAL)

NAME	DESIGNATION	E-MAIL	TELEPHONE. NO
Mr. Mohd Khairudin bin Mohamed Samsi	Senior Principal Assistant Director	mohd.khairudin@moh.gov.my	013-355 7062 03-8892 4971
Mr. Yusri bin Yusuf	Senior Principal Assistant Director	yusriyusuf@moh.gov.my	013-622 3344 03-8892 4678
Mr. Mohd Nasrul Azizi bin Mohd Shukry	Senior Principal Assistant Director	nasrulazizi@moh.gov.my	017-917 9885 03-8892 4575
Mr. Firdaus bin Mohd Idris	Principal Assistant Director	scfirdaus@moh.gov.my	012-522 7796
Ms. Martha James Jimponey	Principal Assistant Director	martha@moh.gov.my	016-831 3038 03-8892 4441
Mr. Mohd Nathir bin Mohd Kamari	Senior Assistant Director	nathir.mkamari@moh.gov.my	019-286 1985 03-8892 4721
Mr. Nursharul Aman bin Johari	Senior Assistant Director	nursharul_aman@moh.gov.my	014-573 7283 03-8892 4861
Ms. Norsuraya binti Abdul Jabbar	Senior Assistant Director	norsuraya@moh.gov.my	017-633 5730 03-8892 4710
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Mr. Muhammad Dzulkhairi bin Zulkifly	Assistant Director	mdzulkhairi@moh.gov.my	017-260 1378 03-8892 4714
Mr. Zul Iskandar bin Johari	Senior Radiotherapy	zuliskandar@moh.gov.my	010-464 6576
Mr. Shahrul Afandy bin Ramli	Senior Radiographer	shahrulafandy@moh.gov.my	013-338 3891 03-8892 4738

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NAME	DESIGNATION	E-MAIL	TELEPHONE. NO
Ms. Nurmazaina binti Md Ariffin	Senior Principal Assistant Director	nurmazaina@moh.gov.my	019-678 7892 03-8892 4676
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Mr. Mohd Reduan bin Abd Razak	Senior Principal Assistant Director	mreduan@moh.gov.my	019-279 0822 03-8892 4576
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Mr. Arif Hafizi bin Ramli	Senior Assistant Director	arif.hafizi@moh.gov.my	019-446 0065 03-8892 4716
Ms. Nur Ashmira binti Aznan	Senior Assistant Director	ashmira.aznan@moh.gov.my	013-308 1372 03-8892 4750
Ms. Najibah binti Abdul Rahman	Assistant Director	najibah.ar@moh.gov.my	017-570 0950 03-8892 4732
Mr. Nor Hisam bin Muhamad	Senior Radiographer	hisam@moh.gov.my	019-706 3774 03-8892 4736

LIST OF MEDICAL RADIATION RESPONSE TEAMS FROM THE STATE HEALTH DEPARTMENT, MINISTRY OF HEALTH MALAYSIA

STATE HEALTH DEPARTMENT	NAME	DESIGNATION	OFFICE NO.	TELEPHONE NO.
Kuala Lumpur & Putrajaya	Ms. Adzlin Hana binti Mohd Sari	Senior Principal Assistant Director	03-2268 7357	012-309 6758
Selangor	Mr. Izham bin Muhammad	Senior Principal Assistant Director	03-5522 4613	019-399 7165
Sarawak	Mr. Harun Chan Sze Pheng	Senior Principal Assistant Director	082-473 200 ext 291	012-885 8584
Perak	Mr. Mohd Amin bin Yaakob	Senior Principal Assistant Director	05-245 6000	017-292 2329
Sabah	Mr. Wilfred Intang	Senior Principal Assistant Director	088-261 426	019-881 7308
Terengganu	Mr. Azman bin Ibrahim	Principal Assistant Director	09-621 3624	012-905 7740
Pulau Pinang	Mr. Zainudin bin Yasak @ Yusof	Principal Assistant Director	04-201 7204	019-450 6765
Kelantan	Mr. Hendra Pawitra bin Jajat Sudrajat	Principal Assistant Director	09-741 3386	012-929 5497
Pahang	Mr. Mohd Azamnie bin Ab Kader	Principal Assistant Director	09-570 7940	019-910 2658
Johor	Mr. Azlan bin Safian	Principal Assistant Director	07-236 2254	019-912 0129
Negeri Sembilan	Ms. Nurul Faiezin binti Mohd Yusuf	Principal Assistant Director	06-766 4800	016-206 8594
Kedah/Perlis	Mr. Mohd Amir bin Abdul Wahab	Principal Assistant Director	04-744 1151	012-417 0535
Melaka	Mr. Mohd. Fairoz bin Mohd Yusoff	Senior Assistant Director	06-234 6893	019-635 6773

LIST OF HOSPITAL WITH RADIATION PROTECTION OFFICER IN MINISTRY OF HEALTH MALAYSIA

STATE	HOSPITAL NAME	NAME OF RPO	OFFICE NO.	TELEPHONE NO.
Kuala Lumpur & Putrajaya	Kuala Lumpur Hospital	Nik Mohamed Hazmi bin Nik Hussain	03-2165 5555 ext 5821	019-212 6107
		Mohd Azhar Musa	03-2165 5555 ext 7075	019-670 4258
		Mohammad Azwin bin Abdul Karim	03-2615 5555 ext 7112	012-541 2107
	Tunku Azizah Hospital	Leong Swee Shing	03-2165 5555 ext 7075	012-230 2225
	Putrajaya Hospital	Nur Umira binti Razali	03-8312 4265	018-357 1933
	National Cancer Institute	Mohamad Aminudin bin Said	03-8892 5474	012-587 6923
Selangor	Ampang Hospital	Sharmila binti Mohd Imran	03-4289 6114	012-633 6205
	Selayang Hospital	Suratey binti Sulaiman	03-6137 0857	017-3720507
	Serdang Hospital	Siti Normasitah binti Masduki	03-8947 5555 ext 1344	012-400 7849
	Sungai Buloh Hospital	Wan Nur Ain binti Wan Ghazali	03-5522 4612	019-734 0549
	Tengku Ampuan Rahimah Hospital	Surani binti Ibrahim	03-3375 7000 ext 6229	016-211 5941

STATE	HOSPITAL NAME	NAME OF RPO	OFFICE NO.	TELEPHONE NO.
Selangor	Shah Alam Hospital	Nafizatul Khairiah binti Mohd Shamsuri	03-5526 3000 ext 3818	013-339 8879
	Kajang Hospital	Nurul Aida Nusairah binti Mohd Yusri	03-8913 3346	013-226 7535
Sarawak	Sarawak General Hospital	Voon Siaw Chien	082-276 666 ext 6014	013-821 6369
		Charlene Wong Muh Yiing	082-276 666 ext 6046	016-668 7284
		Jessica Edward Ngayong	082-276 666	016-691 9091
	Sibu Hospital	Norliziana binti Abdur Rahman	084-342 203	011-3333 0468
Perak	Raja Permaisuri Bainun Hospital	Roslina binti Ismail	05-208 5253	019-519 4979
	Teluk Intan Hospital	Nur Ain Amira binti Mat Salim	05-629 8794	012-948 6078
Sabah	Sabah Women and Children Hospital	Ronald Jerneh	082-276 666	016-829 2033
		Irene Anak Danik	088-522 600	013-880 1711
	Queen Elizabeth Hospital	Nurul Syakira binti Mat Bakri	088-517 555	011-2568 8314

STATE	HOSPITAL NAME	NAME OF RPO	OFFICE NO.	TELEPHONE NO.
Sabah	Queen Elizabeth II Hospital	Juslia Apau	088-324 600	016-834 5359
Terengganu	Sultanah Nur Zahirah Hospital	Wan Nurul Aini binti Wan Ibrahim	09-621 2121 ext. 2151	011-255 59982
Pulau Pinang	Penang General Hospital	Mohd Hizwan bin Mohd Yahya	04-222 5520	012-509 4179
	Sebarang Jaya Hospital	Masitah binti Othman	04-382 7447	017-753 1589
Kelantan	Raja Perempuan Zainab II Hospital	Noraini binti Abdul Razak	09-745 2745	012-980 2118
Pahang	Tengku Ampuan Afzan Hospital	Aimi Firdhaus bin Shafie	09- 557 2642	013-594 4819
	Sultan Haji Ahmad Shah Hospital	Nor Hayati binti Muhd Shamshudin	09-295 5333	011-2648 0594
Johor	Sultanah Aminah Hospital	Fatan Hamimah binti Jamal	07-223 1666 ext 2060	011-2781 8298
		Rosdiana binti Wahab	07-225 7200	019-607 6228
	Sultan Ismail Hospital	Halimaton Saadiah binti Paiman	07-356 5000 ext 1117	013-386 6366
		Emma Idayu binti Mohamed Kamal Ariffin	07-356 5000 ext 2608	016-739 2292

STATE	HOSPITAL NAME	NAME OF RPO	OFFICE NO.	TELEPHONE NO.
Johor	Enche' Besar Hajjah Khalsom Hospital	Juarieyah binti Mat Arifin	07-778 7000 ext 2382	019-626 1200
Negeri Sembilan	Tuanku Ja'afar Hospital	Siti Sarah binti Yusof	06-768 4000 ext 4129	013-794 8204
	Tuanku Ampuan Najihah Hospital	Nur Shahidatul Akma binti Mohd Yusoff	06-481 8002	017-503 2745
Kedah/ Perlis	Sultanah Bahiyah Hospital	Noorhidayah binti Che Mat	04-740 7297	013-430 3681
	Sultan Abdul Halim Hospital	Hafizah binti Mislam	04-740 7297	013-446 1560
Melaka	Melaka Hospital	Puteri Afini binti Mohd Razak	06-289 2555	017-212 6660

DEPARTMENT OF ATOMIC ENERGY MALAYSIA (ATOM MALAYSIA) DIRECTORY

Jabatan Tenaga Atom (Atom Malaysia)
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Emergency Hotline: 1 800 88 7999
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Mrs. Noraishah binti Pungut
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Kementerian Sains, Teknologi dan Inovasi
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97000 Bintulu, Sarawak.
Tel. No. : 086-330469, 086-315469, 086-339469 (Direct Line)
Fax No. : 086-332469

Source: radia.mog.gov

Annex 16 List of Decorporating Agents and Antidotes for Radiological Internal Continuation

Radionuclides	Decorporating Agents and Antidotes	Dose	Route
Radioiodine (I-131)	Potassium Iodide Mixture 65mg/ 15mL	<u>Adult</u> 130mg p.o OD. ASAP, repeat dose daily as long as the contamination lingers in the environment. <u>Children</u> 4 to 18y, 65mg p.o. 1 mth to 3y, 32.5mg p.o. <1 mth, 16.25 mg mixed with a liquid such as low fat milk.	Oral
Radioactive phosphate	Potassium Phosphate	<u>Adult</u> 250-500mg p.o. QID, with full glass of water each time, with meals and at bedtime. <u>Children</u> 250mg QID.	Oral
Plutonium (Pu) Americium (Am) Curium (Cm) Californium (Cf) Neptunium (Np) Lanthanum (La) Cobalt 60	Calcium DTPA Zinc DTPA	<u>Intravenous</u> 1 gm in 250 ml normal saline or 5% dextrose in water, IV over 1 hour OD for several days to a week in most cases without toxic effects. <u>Nabulise</u> Inhaled plutonium will need nebuliser DTPA 1 gm over 1530 mins daily and lung lavage.	Intravenous or nebulise
Strontium (Sr-90) Radium	Sodium Alginate Powder	10gm powder add water to 30ml and drink.	Oral
	Calcium Gluconate Injection	3gm in 500ml D5% over 4 hours.	Intravenous
Cesium, Thallium, Rubidium	Prussian Blue	1g p.o. TDS for up to 3/52 or longer as required. Doses up to 10-12 g/day for significantly contaminated adults may be used.	Oral
Uranium	Sodium Bicarbonate 1.4% IV (available as 8.4% 10ml injection)	Slow IV infusion 250ml.	Intravenous

Annex 17 An Example of Risk Communication for Unsealed Iodine-131

Iodine-131 (I-131) is a water soluble liquid radioisotope. It has half-life of eight (8) days. I-131 will accumulate in thyroid if enter human body and may cause damage to thyroid. It may cause thyroid cancer in long term. Any spill of I-131 may enter the drain and later the rivers, contaminating aquatic organisms and may enter the food chain via grass, subsequently cattle, and dairy products.

Risk Communication Elements	Messages	Healthcare Workers (HCWs)
Preparedness	Information of I-131 to be disseminated to HCWs and the public.	HCWs should prepare PPE appropriately: Coverall Type C, goggles, N95 respirator, shoe cover, radioactive waste bag.
Initial 48 hours Response	Advice the public and HCWs to avoid consuming the contaminated water, avoid eating fishes, and may extend to avoid dairy products from nearby area.	HCWs responding to the radiological emergency must wear full PPE, including attending contaminated patients. Avoidance of contaminated fishes, water, and dairy products must be adhered to.
Maintenance	The avoidance should be continued for ten times the half-life of I-131, specifically 80 days.	Continuing response elements.
Recovery	Consumption of the previously contaminated water, fish products, and dairy product can be resumed, unless stated otherwise by the authorities.	Full gear PPE need not to be worn. Consumption of previously restricted water, marine, and dairy products can be resumed.

Annex 18 Core Action Principles of Psychological First Aid (PFA)

Eight (8) core action principles of PFA are:

1. **Contact and Engagement**
   The goal is to respond to survivors and to engage in a non-intrusive and supportive manner.

2. **Safety and Comfort**
   The goal is to help meet immediate safety needs and to provide emotional comfort.

3. **Stabilisation**
   The goal is to reduce stress caused by a traumatic event.

4. **Information Gathering**
   The goal is to assess the immediate where the survivors.

5. **Practical Assistance**
   The goal is to create an environment where the survivor can begin to solve problem.

6. **Connection with Social Support**
   The goal is to assist survivors to connect or re connect with primary support systems.

7. **Coping Information**
   The goal is to offer verbal and written information on coping skills and the concept of resilience in the face of disaster.

8. **Linkage with Collaborative Services**
   The goal is to inform survivors of services that are available to them as well as the list of referral agencies.

Annex 19 Stressors Associated with Disaster Response

- Fatigue.
- Experiencing stress related physical symptoms such as headaches, upset stomach, poor concentration, and others.
- Exposure to toxic agents.
- Physically unfit.
- Unfamiliar with surrounding and working environment.
- Exposure to dead bodies.
- Feeling of tired of the disaster and prefer not to talk, think or associated to the disaster during time off, burnt out.
- Feeling of frustration or guilt for not be able to meet the families and are unavailable to them physically and emotionally.
- Feeling of frustration with family and friends when contacted them because they may not be able to understand the disaster experience especially if the family members or friends become irritated.
- Group stressors.
- Loss of loved ones.

Annex 20 Mental Health Alert Card

MENTAL HEALTH ALERT CARD

To the traveller/ volunteer coming back as a disaster responder,
If you have any of the following symptoms:

- ❑ Easily anxious
- ❑ Feeling extremely sad/ hopeless/ helpless
- ❑ Feeling guilt
- ❑ Easily irritated/ angry
- ❑ Flashbacks/ nightmares of the disaster
- ❑ Difficulty in sleeping
- ❑ Crying without any specific reasons

Seek professional help from nearest clinic/ hospital and present this card for further assessment.

To the Doctor

The person presenting this mental health alert card has been deployed as a disaster responder. The disaster was …….
If the person presents with symptoms related to mental health problems, kindly perform further assessment and appropriate intervention for him/ her.

TIPS ON MANAGING YOUR MENTAL HEALTH
UPON RETURNING FROM MISSION

- Do not be alone.
- Talk to someone that you trust or share your feelings about the events that you have experience.
- Try to eat even if you do not have the appetite.
- Pay extra attention to rekindling your interpersonal relationships with your family members and friends, continue to communicate.
- Try to get back to your normal routines.
- Manage your stress by relaxation techniques, enough sleep, balance diet, and exercises.
- Practice deep breathing exercises or other forms of relaxation techniques.
- Anticipate that you will experience recurring thoughts or dreams and they will decrease over time.
- Give yourself time and chance to recover from the memories of events.

THANK YOU FOR YOUR CONTRIBUTION

Annex 21 Evaluation Checklist

LOCATION: EVENT SITE

Name of Controller:		**Name of Rapporteur:**	
Name of Evaluators:		**Names of Observers:**	

NO.	PROCEDURES/ ACTIVITIES	CHECKLIST		COMMENTS
		YES	NO	
1.	**SAFETY AND SECURITY**			
	Approach within the safety limit			
	Have situational awareness of the event site			
	Recognize ongoing hazards			
	Identify limits of the event Red Zone area and stays at the Yellow Zone (Tactical) area			
	Wear appropriate PPE			
	Report to On Scene Command Post (OSCP)			
	Obtain further information from Forward Field Commander			
2.	**SCENE SIZE-UP AND COMMUNICATION**			
	Use the METHANE Methods			
	Relay back information to MECC			
	Identify ingress and egress to the area			
	Brief team members of their duty and response			
	Establish a Medical Base at an appropriate area			
	Identify and establish Casualty Collecting Point (CCP)			
3.	**COMMAND AND CONTROL**			
	Identify On Scene Medical Commander (OMC)			
	Establish Command using ICS framework			
	Manageable span of control (5-7 person/ team/ supervisor)			
	Maintain chain of command			
	Establish SMART objectives			

NO.	PROCEDURES/ ACTIVITIES	CHECKLIST		COMMENTS
		YES	NO	
4.	**RECEIVING PATIENTS AT CCP AND TRIAGE**			
	Receive patients at CCP			
	Ensure the patient is properly decontaminated			
	Triage patients using appropriate triage technique			
	Re-triage patients at CCP			
5.	**MEDICAL TREATMENT AT THE FORWARD FIELD HOSPITAL**			
	Able to recognize life-threatening conditions			
	Appropriate medical therapy at the site			
	Antidote if available			
	Rapid treatment and rapid transportation			
6.	**SURGE CAPACITY**			
	Identify and request the appropriate numbers of personnel on the ground			
	Identify the request the appropriate number of resources on the ground			
	Demobilize resources as soon as possible once there is no requirement			
	Appoint a Logistic Chief to monitor both the Support and Supply of the Medical Team			
	Identify the need for a staging area to prevent overcrowding at the Medical Base			
7.	**STAND DOWN AND RECOVERY**			
	Receive Stand Down order by Incident Commander			
	Inform MECC of the stand-down order			
	Activate the stand-down plan			
	Decontaminate all equipment			
	Decontaminate all transport vehicles			
	Decontaminate all health care personnel			
	MECC to establish a decontamination area at the hospital or nearby facilities			
	Transfer all of the HCWs with a new set of PPE to the tertiary center			

NO.	PROCEDURES/ ACTIVITIES	CHECKLIST		COMMENTS
		YES	NO	
	Decontaminate all HCWs, vehicles, and equipment at the tertiary center			
	Complete stand-down with debriefing and After-Action Report (AAR)			
8.	**ADDITIONAL COMMENTS:**			

EVALUATION CHECKLISTS

LOCATION : HEALTH CLINICS

Name of Controller:		**Name of Rapporteur:**	
Name of Evaluators:		**Names of Observers:**	

NO.	PROCEDURES/ ACTIVITIES	CHECKLIST		COMMENTS
		YES	NO	
1.	**TRIAGE**			
	Location			
	Signage			
	Case screening and identification			
	Patient flow			
	Staff with appropriate PPE			
2.	**PATIENT MANAGEMENT**			
	Decontamination of patient			
	Instruction and communication with patient			
	Appropriate waiting area/ room for patient			
	Designated route for patient to examination room			
	Designated examination room and medical instruments			
	Clinical specimen			
3.	**NOTIFICATION**			
	Notification to District Health Office (phone call)			
	Notification to hospital (phone call)			
	Fill up referral letter			
	Filling up EBS form			
	Faxing notification form (if not on web based)			
4.	**PATIENT'S TRANSFER**			
	Procedure			
	Designated route for patient to ambulance			
	Designated ambulance			
	Designated wheelchair			
	Accompanied HCW with PPEs			
	Referral letter given			

5.	**GENERAL HAZARD CONTROL IN CLINIC**			
	Appropriate use of PPE - donning and doffing			
	Decontamination of wheel chair/ trolley			
	Decontamination of room and equipment			
	Decontamination site			
	Decontamination of ambulance			
6.	**STAFF SURVEILLANCE**			
	Staff registry that attend patients			
	Others			
7.	**ADDITIONAL COMMENTS:**			

EVALUATION CHECKLISTS

LOCATION: HOSPITALS

Name of Controller:		**Name of Rapporteur:**	
Name of Evaluators:		**Names of Observers:**	

NO.	PROCEDURES/ ACTIVITIES	CHECKLIST		COMMENTS
		YES	NO	
1.	**CASE IDENTIFICATION**			
	Triage system			
	Appropriate waiting area			
	Designated staff			
	Designated route			
	Designated examination room and medical instruments			
2.	**CASE MANAGEMENT**			
	Instruction and communication with patient			
	Designated examination room and medical instruments			
	History taking			
	Clinical examination			
	PPE – donning and doffing			
	Clinical specimen			
3.	**NOTIFICATION**			
	Notification to MOH/ Hospital Director (phone call)			
	Notification to designated hospital/ isolation ward (phone call)			
	Fill up referral letter			
	Fill up EBS form			
	Designated staff to notify			
4.	**PATIENT'S TRANSFER TO WARD**			
	Designated route for patient to ambulance (for radiological/ biological)			
	Designated ambulance			
	Accompanied HCW with PPEs on			
	Decontamination of room			
5.	**RISK COMMUNICATION**			
	Communication with patients			
	Communication with staff			
	Communication with hospital's director			
	Communication with District Medical Officer of Health			

6.	**EXPOSURE CONTROL**			
	Availability of appropriate PPE			
	Proper decontamination of ambulance			
	Proper decontamination activities after patients transfer out			
	Waste management			
	Staff registry that attend patients			
7.	**LABORATORY SERVICES**			
	Type of samples			
	Type of test			
8.	**OPERATIONAL ROOM**			
	Telephone/ hotline/ fax/ walkie-talkie/ hand phone			
	Computer/ printer / internet			
	Logbook			
	Whiteboard			
	List of dedicated staff with phone number			
	Line listing of victims			
	Check list for agencies contacts			
	Notification Form			
7.	**ADDITIONAL COMMENTS:**			

EVALUATION CHECKLISTS

LOCATION: DISTRICT HEALTH OFFICES

Name of Controller:		**Name of Rapporteur:**	
Name of Evaluators:		**Names of Observers:**	

NO.	PROCEDURES/ ACTIVITIES	CHECKLIST		COMMENTS
		YES	NO	
1.	Availability RAT team			
	Availability RRT team			
	Availability of Operational Room			
2.	**ACTIVATION RAT TEAM**			
	Event Verification			
	Communication with Medical Officer of Health			
3.	**FUNCTIONAL OPERATIONAL ROOM**			
	Chairperson/ Committee			
	Communication channel			
	Logistics			
	Event report/ return			
	Map			
4.	**IN OPERATIONAL ROOM**			
	Telephone/ Hotline/ Fax/ Walkie-talkie/ Hand phone			
	Computer/ Printer/ Internet			
	Map/ Spot map			
	Logbook			
	Whiteboard			
	List of dedicated staff with phone number			
	Line listing of victims			
	Check list for agencies contacts			
	Notification form			
	Event report			
5.	**RISK COMMUNICATION**			
	Receive notification			
	Communication with Hospital Director			
	Communication with staff			
	Communication with State Health Department/ MOH			
	Communication with community			
	Communication with media			
	Communication with public			
6.	**AVAILABILITY OF PPE**			

NO.	PROCEDURES/ ACTIVITIES	CHECKLIST		COMMENTS
		YES	NO	
7.	**APPROPRIATENESS OF PPE USAGE**			
8.	**ALERT TRIAGE AT HEALTH CLINICS**			
	Alert letter			
9.	**CASE INVESTIGATION**			
	Investigation of victims			
	Surveillance for victims			
	Instruction and communication with case and victims			
	Distribution of Health Alert card			
10.	**MONITOR EXPOSED HCWs**			
	Self-monitor format			
	Report any healthcare workers who are experiencing illness			
11.	**ADDITIONAL COMMENTS:**			

EVALUATION CHECKLISTS

LOCATION: STATE HEALTH DEPARTMENT (CPRC)

Name of Controller:		**Name of Rapporteur:**	
Name of Evaluators:		**Names of Observers:**	

NO.	PROCEDURES/ ACTIVITIES	CHECKLIST		COMMENTS
		YES	NO	
1.	**RISK COMMUNICATION**			
	Operations Room			
	Receive notifications			
	Set-up Operation Room Decision			
	Incident Management System (IMS) Activation			
	Coordination of Early Report (SPOTREP) and Daily Report (SITREP): From Districts to CPRC			
2.	**COMMUNICATION**			
	Communicate with National CPRC			
	Communicate with Malaysian Civil Defence Force (MCDF)			
	Communicate with State Disaster Management Community			
	Communicate with Media			
3.	**GIVING ALERT**			
	Alert all Districts Health Offices			
	Alert all Government Hospitals and Health Clinics			
	Alert all Private Hospitals and Clinics			
4.	**ORGANIZE HEALTH EDUCATION ACTIVITY**			
	Press Release			
	Health Education via mass media			
	Printed Health Education			
	Others:			
5.	**COORDINATION OF MEDICAL ACTION**			
	a. Laboratory Support			
	Coordinate samples logistic and send specimens to designated laboratories.			
	Coordinate results			
	b. Antidote Stockpile			
	Antidote Stockpile status and needs at hospitals			
	Antidote Stockpile status and needs at clinics			
	c. PPE Stockpile			
	PPE stockpile status and needs at hospitals			
	PPE stockpile status and needs at clinics			

NO.	PROCEDURES/ ACTIVITIES	CHECKLIST		COMMENTS
		YES	NO	
	d. Staff Health Monitoring			
	Get feedback on staff that handle cases (event site/ hospitals/ clinics) health monitoring			
6	**COORDINATION OF PUBLIC HEALTH ACTION**			
	a. PPE Stockpile			
	PPE Stockpile status and needs for field activity			
	b. Staff Monitoring			
	Get feedback on staff health monitoring			
7	**ADDITIONAL COMMENTS:**			

EVALUATION CHECKLISTS

LOCATION: CPRC MINISTRY OF HEALTH

Name of Controller:		**Name of Rapporteur:**	
Name of Evaluators:		**Names of Observers:**	

NO.	PROCEDURES/ ACTIVITIES	CHECKLIST		COMMENTS
		YES	NO	
1	**DISASTER MANAGEMENT**			
	Review CBRNe Management Guidelines			
	Update CBRNe Management Guidelines accordingly			
2	**NOTIFICATION**			
	Managing notification from State Health Department/ Hospital			
	Prepare Information Note			
	Prepare Press Statement			
	Notification to Director of Disease Control Division			
	Notify other relevant agencies			
3	**VERIFY STOCKPILE**			
	Antidote stock check			
	PPEs stock check			
	Mobilization of stock			
4	**RISK COMMUNICATION**			
	Prepare Information Note			
	Prepare Press Statement			
	Notification to other agencies			
	Review Health Education materials			
	Develop new Health Education materials			
5	**ORGANISATION**			
	All relevant stakeholders are available at CPRC			
6	**LOGISTICS**			
7	**ADDITIONAL COMMENTS:**			

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