सत्यमेव जयते

PUBLIC HEALTH MEASURES FOR ALL HAZARDS APPROACH UNDER INTERNATIONAL HEALTH REGULATION (IHR) FOR GLOBAL HEALTH SECURITY

Manual for International Points of Entry

PUBLIC HEALTH- INTERNATIONAL HEALTH DIVISION
DIRECTORATE GENERAL OF HEALTH SERVICES
MINISTRY OF HEALTH & FAMILY WELFARE
GOVERNMENT OF INDIA

Foreword

As a signatory to International Health Regulations (IHR) 2005, India is abide to develop her own guiding principles to prevent, protect against and generate a public health response to international spread of diseases and events with significant public health risks. Also as a prime member of Global Health Security Agenda, we should limit the international spread of diseases through capacity building and international collaboration.

Diseases or public health risks due to events related to radio nuclear, chemical, biological and natural disasters, which spread through PoE can pose a serious threat to our vulnerable population. This in turn can have long term impact on physical, mental & social health. Points of entry being multi- ministerial set up need collaborated response with intersectoral coordination.

I take pride in introducing the manual titled 'Manual on Public Health Measures for All Hazard Approach under International Health Regulations (IHR) For Global Health Security' which is written, keeping in view the operational problems faced by our technical manpower which is posted at the International Points of Entry.

This manual introduces an integrated approach to all hazards which can occur at PoE and contains all standard operating procedures which are easy to comprehend by the technical staff. I hope that this manual will be a guide for technical training and correct implementation of Public Health Measures.

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Preface

The ever increasing International Trade and Traffic along with the advent of newer technology, has made this world a small place. The need to make world a safer place in terms of protection against infectious diseases, disasters, poverty, etc is a primary concern. A step in this direction is the Global Health Security Agenda, which acknowledges the essential need for a multilateral and multi-sectoral approach to strengthen both the global capacity and nations' capacity to prevent, detect, and respond to infectious diseases threats. Legally abiding effort in this direction is the International Health Regulations, with a wider scope to prevent and protect against and provide public health response to infectious diseases and disasters, through international Points of Entries.

Indian subcontinent is highly vulnerable to all types of natural and man- made disasters. The current manual is an effort to integrate the existing guidelines into an all hazards approach for implementation at the international points of entries, in alignment with the International Health Regulations 2005 for Global Health Security.

This manual has been put together with the efforts of experts from various organizations who have been involved in various training courses. This manual will serve as handy technical guide for enabling health manpower to take various public health measures as per IHR particularly during chemical and radio-nuclear events. I congratulate them and hope that this manual will serve as an important guide in training of technical staff and conduct of duties.

Dr. Sujeet Singh

CONTENTS

ABBREVIATIONS

AD	Auto Disable
AERB	Atomic Energy Regulatory Board
APHO	Airport Health Organization/ Officer
AQCS	Animal and Quarantine Certification Services
ARS	Acute Radiation Syndrome
BIS	Bureau of Indian Standards
BT	Bioterrorism
BW	Biological Warfare
CA (EPPR)	Chemical Accidents (Emergency, Planning, Preparedness and Response)
Ca- DTPA	Calcium Diethylene Triamine Penta Acetate
CAC	Codex Alimentarius Commission
CAS	Crisis Alert System
CBRN	Chemical, Biological, Radiological, and Nuclear
CBRNE	Chemical Biological Radiological Nuclear Explosive
CCHF	Crimean Congo Haemorrhagic Fever
CEES	Centre for Explosive Safety
CEO	Chief Executive Officer
CIF	Chief Inspector of Factories
CII	Confederation of Indian Industry
CPCB	Central Pollution Control Board
CREP	Corporate Responsibility in Environmental Planning
CRI	Cutaneous Radiation Injury
CRS	Cutaneous Radiation Syndrome
CSIR	Council for Scientific and Industrial Research
CSU	Central Surveillance Unit
DAE	Department of Atomic Energy
DAHDF	Department of Animal Husbandry Dairying and Fisheries
DCG	District Crisis Group
DCP	Deputy Commissioner of Police
DEA	District Emergency Authority
DEET	Diethyltoluamide
DGHS	Directorate General Health Services
DMP	Diethyl phthalate
DO	Designated Officer
DSO	District Surveillance Officer
DSU	District Surveillance Unit
EBS	Event Based Surveillance
EFC	Empowered Finance Committee
EOC	Emergency Operations Centre

ERC	Emergency Response Centre
ESMA	Essential Services Maintenance Act
EVD	Ebola Viral Disease
EWS	Early Warning Signal
FAO	Food and Agriculture Organization of the United Nations
FBO	Food Business Organization
FICCI	Federation of Indian Chambers of Commerce and Industry
FIFO	First In First Out
FSO	Food Safety Officer
FSP	Food Safety Plans
FSSAI	Food Safety and Standards Authority of India
FSSR	Food Safety and Standards Rules
GD	General Declaration of Health
GDWQ	Guidelines for drinking-water quality
GHS	Globally Harmonized System
GHSA	Global Health Security Agenda
GIS	Geographic Information System
HACCP	Hazard analysis and critical control points
HAZCHEM	Hazardous Chemical
HAZMAT	Hazardous Material
HCW	Health Care Worker
HPC	Heterotrophic Plate Count
HPCL	Hindustan Petroleum Corporation Limited Refinery
HW (M& H)	Hazardous Wastes (Management and Handling)
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICC	Indian Chemical Council
ICMA	Indian Chemical Manufacturer's Association
ICMR	Indian Council of Medical Research
ICRP	International Commission on Radiological Protection
ICS	Incident Command System
IDSP	Integrated Disease Surveillance Programme
IEC	International Electrotechnical Commission
IGC	International Ground Crossings
IHR	International Health Regulations
ILO	International Labour Organization
IMO	International Maritime Organization
IMS	Incident Management System
INFOSAN	International Food Safety Authorities Network
IPCL	Indian Petrochemicals Corporation Limited
IPCS	International Programme of Chemical Safety
IRPTC	International Register for Potentially Toxic Chemicals

ISI	Indian Standards Institution
ISO	International Organization for Standardization
ITCHS codes	Indian Trade Clarification based on Harmonized System of coding
IVM	Integrated Vector Management
JE	Japanese Encephalitis
JIC	Joint Information Center
KFD	Kyasanur Forest Disease
LCG	Local Crisis Group
LPHO	Land Port Health Organization/ Officer
MAH	Major Accident Hazard
MARPOL	Maritime Pollution
MERS-CoV	Middle East Respiratory Syndrome Coronavirus
MIC	Methyl Isocyanate
MOHFW	Ministry of Health and Family Welfare
MSIHC	Manufacture, Storage and Import of Hazardous Chemicals
NABL	National Accreditation Board for testing and calibration Laboratories
NCCP	National Codex Contact Point
NDMA	National Disaster Management Authority
NIMR	National Institute of Malaria Research
NiV	Nipah Virus
NOC	No Objection Certificate
ODS (R & C)	Ozone Depleting Substances (Regulation and Control)
OECD	Organisation for Economic Co-operation and Development
OIE	Office International des Epizooties
PFA	Prevention of Food Adulteration
PH (IH)	Public Health (International Health)
PHEIC	Public Health Emergencies of International Concern
PHO	Port Health Organization/ Officer
PIC	Prior Informed Consent
PLI	Public Liability Insurance
PM	Prime Minister
PoE	Point of entry
POP	Persistent Organic Pollutants
PPM	Parts Per Million
PVS	Performance of Veterinary Services
RRT	Rapid Response Team
RU	Reporting Unit
SAICM	Strategic Approach to International Chemicals Management
SCG	State Crisis Group
SHOC	Strategic Health Operations Centre
SIP	Sanitary Import Permit
SMPV	Static and Mobile Pressure Vessels

SOLAS	Safety Of Life At Sea
SPG	Special Protection Group
SSCC	Ship Sanitation Control Certificate
SSCEC	Ship Sanitation Control Exemption Certificate
SSO	State Surveillance Officer
SSU	State Surveillance Unit
TIC	Toxic Industrial Chemicals
TIM	Toxic Industrial Material
UCIL	Union Carbide India Limited
ULV	Ultra low volume
UNEP	United Nations Environment Programme
UNISDR	United Nations International Strategy for Disaster Reduction
UNITAR	United Nations Institute for Training and Research
UNSCEAR	United Nations Scientific Committee on Effects of Atomic Radiation
VIP	Very Important Person
VVIP	Very Very Important Person
VVM	Vaccine Vial Monitor
WHO	World Health Organization
WP	Wettable Powder
WSP	Water Safety Plan
YF	Yellow Fever
YFV	Yellow Fever Vaccination

UNITS

Cm	Centimetre
Gm	Gram
Gy	Gray
Kg	Kilogram
Km	Kilometre
M	metre
SI	Système international d'unités
Sv	Sievert

I. INTRODUCTION

India, due to its, physiographic and climatic conditions is one of the most disaster prone areas of the world. Many of our International Points of entry (Airports, Ports and Land Ports) are located in zones that are vulnerable to natural and man- made hazards. Hazard is defined as any dangerous phenomenon, substance, human activity, or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. The exposure to hazards, the conditions of vulnerability that are present and insufficient capacity or measures to reduce or cope with the potential negative consequences calls upon proactive, all hazards approach, especially, at International Points of entry. The response activities should be applicable to all types of hazards; major themes of response being, Early warning systems, evacuation of people and animals, search and rescue, medical care, drinking water supply, sanitation, food supply, communication, etc. This response requires intersectoral coordination and collaboration.

The earthquake which hit Andaman Sea in 2004, led to large tsunami waves which affected the East Coast of India. Ports of Chennai, Vizag and Andaman and Nicobar were worst affected. Many ships were damaged and got embedded in the sand. In Andaman the entire naval airport was swept away. India had cyclones; Hud Hud, Helen, Phailin which affected the Easter Ports. Airports and seaports in the area were visibly damaged but the impact on the population was limited due to early prediction of cyclones and rescue to safe areas. Flash flooding of Ports and Airports are rare events but the sudden Flash Flood which affected Chennai affected the lives of people of Chennai. Many of the houses, persons were swept away by the flood. Chennai Airport was flooded and flights were either diverted or took off from Airforce Port in Avadi.

Some of the public health emergencies of international concern (PHEIC) which haven't hit India (like Yellow fever, Ebola, MERS CoV and more recently Zika virus) but at the same time they have the potential to cause unprecedented damage.

Points of Entry (PoE):

International airports, ports and ground crossings are required to have health units for undertaking public health measures during routine times and specific measures during the time of PHEIC (Public Health Emergencies of international Concern). Consequent upon adoption of new International Health Regulations (IHR 2005) by 65th World Health Assembly, many specific functions are mandated for events related to ALL Hazards approach. IHR requires all WHO member countries to have specific core capacities (as per IHR) at all international points of entry. Further, each member country is required to notify to WHO the list of international ports, airports and ground crossings, where the specific core capacities have been developed (Designated Points of Entry). India is a member country of WHO and signatory to International Health Regulations (2005). In view of this, the country has to be compliant with the IHR 2005 and develop specific core capacities for routine

measures and for surveillance and response during PHEIC at all designated international points of entry (POEs).

Basic aim of these organizations is to control and prevent international spread of public health emergency of international concerns in compliance to International Health regulations, vis-a-vis, Indian Aircraft (Public Health) Rules as well as Indian Port Health Rules. These organizations are functioning since more than 6 decades and have been undertaking surveillance measures against a number dangerous diseases like yellow fever, Ebola Disease fever, Swine flu, SARS etc. The role played by these Organizations during the plague outbreak, DHF and recent pandemic of swine flu is enough evidence about the utility of these units in the overall interest of the country. In the past also, the APHOs and PHOs have played a significant role in preventing international spread of Plague in 1994 and SARS in 2003. Apart from this, these units are involved in keeping constant vigil towards preventing the import of yellow fever into the country which is a dangerous disease with high mortality and morbidity rate. The disease is presently prevalent in around 44 countries of African and South American continents and there is all likelihood of this disease being imported to India through mosquitoes and human traffic. The country is very much prone to the disease due to conducive environmental conditions and susceptible hosts. As per the existing rules, any passenger, who does not have valid certificate of vaccination against Yellow fever, coming from yellow fever infected counties are placed under quarantine for a period of 6 days.

IHR (2005) also requires the member countries to establish core capacities at all designated PoEs for taking surveillance and response measures events due to chemical, radio-nuclear and natural disaster in addition to biological agents. Details of the routine and emergency functions of these units (APHO & PHO) are detailed below.

Box No. 1 FUNCTIONS OF APHOS/ PHOS

Routine and Emergency Functions of Airport Health Organizations (APHOs) and Land Port Health Organizations (LPHOs):

1. Isolation and Quarantine work: The health screening of international passengers.
2. Disinfection, disinsection and deratting of aircrafts.
3. Supervision of sanitation, drinking water supply, anti- mosquito and anti- rodent work.
4. Dead body clearance.
5. Administration of yellow fever vaccine and issue of yellow fever vaccination certificate at identified yellow fever vaccination centres.
6. Isolation and quarantine arrangements.
7. Attend medical emergencies.
8. VVIP food inspection.
9. Inspection of food stuff, catering establishments inside the premises of airport and ports under the Prevention of Food Adulteration Act.
10. Sampling of imported food items and forwarding the lab analysis report, as and when requested by custom authorities.
11. Licensing of eating establishments within the local limits of airports as per the provisions of PFA Act, 1955.

Major Functions of Port Health Organizations (PHOs)

1. Port quarantine work: The health check of International passengers referred by immigration staff at seaports.

2. Health clearance of ships.
3. Disinfection, disinsection and deratting of ships.
4. Issue of Ship Sanitation Control Certificate and Ship Sanitation Control Exemption Certificate.
5. Administration of yellow fever vaccine and issue of yellow fever vaccination certificate at identified yellow fever vaccination centres.
6. Sampling of imported food items on request of custom authorities and forwarding the Lab report to Custom department as and when requested.
7. Periodical inspection of medicines, water supply and anti- mosquito and anti- rodent work inside the port.
9. Dead body clearance
10. Provide medical facilities for Seamen such as for their pre-entry and periodical examination for physical fitness.
11. Restriction against import of monkeys into India. Monkeys being most prone to be reservoir of yellow fever infection are not permitted to be brought to or transited through India.
12. Licensing of eating establishments within the local limits of ports as per the provisions of PFA Act, 1955.

Additional functions of APHO/ PHO in view of expansion in the scope of IHR 2005

1. Coordination with National Focal Points, DGHS, MOHFW and counterpart PoE in the event of a suspected PHEIC.
2. Development of Capacities (manpower) for surveillance for following events at PoEs: Chemical, Biological, Zoonotic and Radio-nuclear events.
3. Coordination for timely response by development of Contingency plans for each PoEs by:
   - Identification of Nodal persons at PoEs.
   - Trainings at PoEs in above disciplines.
   - Coordination with the existing manpower and resources for responding to PHEIC.

Upgradation of health units at International PoEs will help in strengthening global health security. The Global Health Security Agenda (GHSA) launched in February 2014 has a vision of a world safe and secure from infectious disease threats by prevention, rapid detection, transparent reporting and mitigation of outbreaks through interconnected global network. Envisaged are full implementation of the World Health Organization (WHO) International Health Regulations 2005 (IHR), the World Organization for Animal Health (OIE) Performance of Veterinary Services (PVS) pathway, and other relevant global health security frameworks. GHSA has grown to include a number of countries around the world, including India.

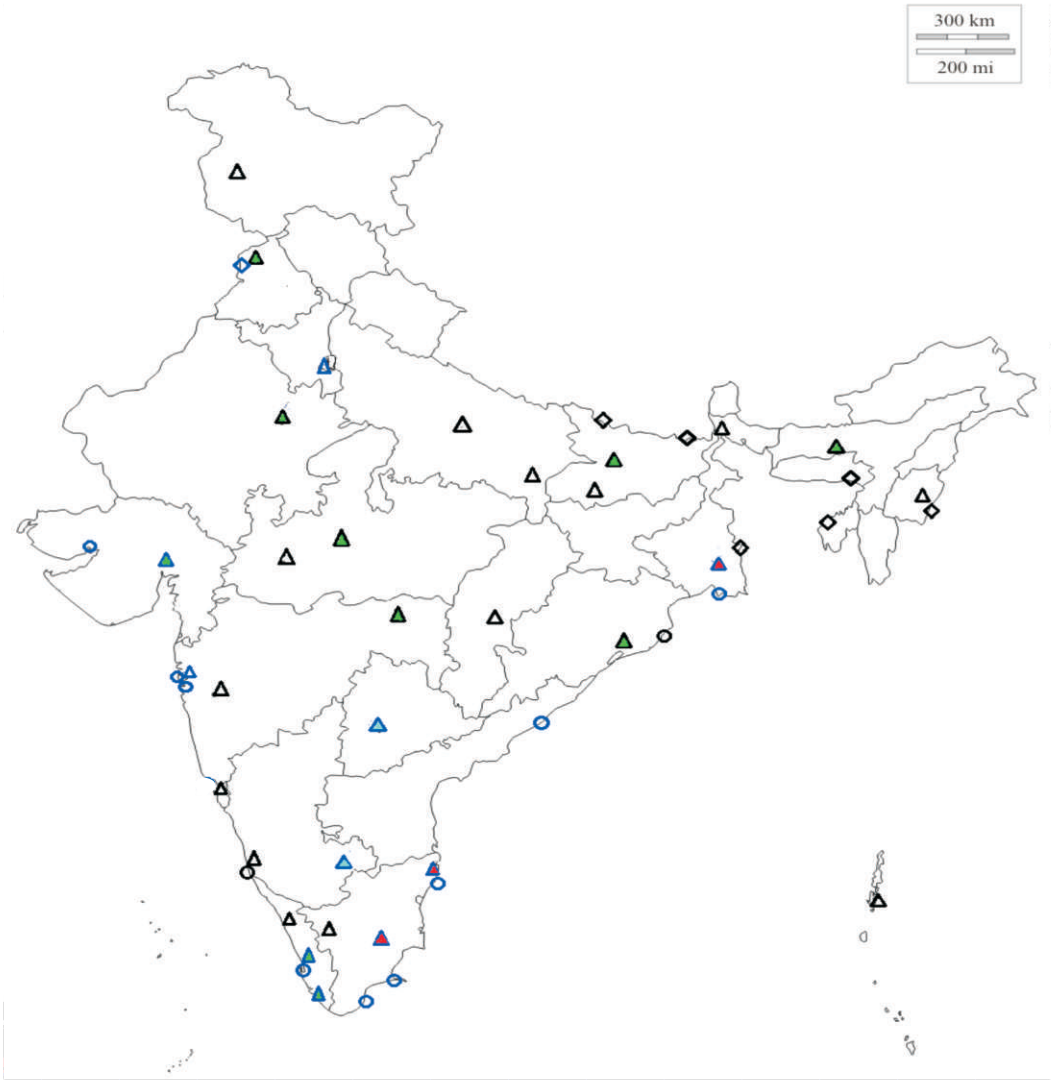
GHSA includes Eleven Action Packages which have been agreed upon by Action Package leaders and contributing countries, with the understanding that they may be changed or added to over time; Antimicrobial resistance, Zoonotic disease, Biosafety and Biosecurity, Immunization, National Laboratory System, Real- Time Surveillance, Reporting, Workforce Development, Emergency Operations Centres, Linking Public Health with Law and Multi-sectoral Rapid Response and Medical Countermeasures and Personnel Deployment Action Package.

In this manual we have included public health measures and global security issues at International Points of entry related to Food safety, Vector borne diseases, Zoonosis, Chemical Accidents, Radionuclear accidents and Disasters.

Health units at International ports/ airports are a statutory requirement and an essential requirement for compliance to (IHR-2005). Details are as follows.

Table No. 1.1 LIST OF INTERNATIONAL POINTS OF ENTRY HEALTH ORGANIZATIONS: AIRPORT, SEAPORT AND INTEGRATED CHECK POSTS (N-New, E- Existing)

Name of International Airport	Name of International Sea Ports	Name of Integrated Check Posts (ICPs)
Existing 1. Ahmedabad (E) 2. Bangalore (E) 3. Chennai (E) 4. Cochin(E) 5. Delhi (E) 6. Hyderabad (E) 7. Kolkatta (E) 8. Mumbai (E) 9. Tiruchirapalli (E) 10. Trivendrum (E) ***New*** 1. Amritsar (N) 2. Bagdogra (N) 3. Bhopal (N)* 4. Bhubaneshwar (N) 5. Calicut (N) 6. Coimbatore (N) 7. Gaya (N) 8. Goa (N) 9. Guwahati (N) 10. Imphal (N) 11. Indore (N)* 12. Jaipur (N) 13. Lucknow (N) 14. Mangalore (N) 15. Nagpur (N) 16. Patna (N) 17. Port Blair (N) 18. Pune (N) 19. Raipur (N)* 20. Srinagar (N) 21. Tirupati (N) 22. Varanasi (N) * Not yet operational	**Existing** 1. Chennai (E) 2. Cochin (E) 3. JNPT Sheva (E) 4. Kandla (E) 5. Kolkata (E) 6. Mandpam Camp (E) 7. Marmagoa (E) 8. Mumbai (E) 9. Tuticorin (E) 10. Vishakhapatnam (E) ***New*** 1. New Mangalore port (N) 2. Paradeep (Orissa) (N)	**Existing** 1. Attari, Amritsar (E) ***New*** 1. Agartala (Tripura) (N) 2. Dawki (Meghalaya) (N) 3. Jogbani (Bihar) (N) 4. Moreh (Manipur) (N) 5. Petrapole (West Bengal) (N) 6. Raxaul (Bihar) (N)



INTERNATIONAL POINTS OF ENTRY (PoES)	AIRPORTS		SEA PORTS		ICPs	
	Existing	New	Existing	New	Existing	New
	△	△	○	○	◇	◇
PoEs for Strengthening of existing Quarantine Centres						
PoEs for development of Quarantine Centres						
PoEs for development Full Quarantine Centres						

Figure No 1. International points of entry

Table No. 1.2 List of Referral Hospitals			
S. No.	**Name of POE**	**Contact Info**	**Referral Hospital**
1	**PHO Kolkata**	033-23032201	Infectious Disease (ID) & BG Hospital, Beliaghata, 57 Beliaghata Main Road, Kolkata, West Bengal 700015
2	**PHO Kandla**	0283-6270189/220	IMA Rambagh General Hospital DC-3, Adipur, Gandhidham-Gujarat- 370205
		9099928940	GK General Hospital, Vijay Nagar, Kutch District, Bhuj, Gujarat 370001
3	**PHO Tuticorin**	0461-2321051	Government (Thoothukudi), Medical College Hospital, 3rd Mile, Thoothukudi, Tamil Nadu-628001
		Blood bank - 0461-2321052	
4	**PHO Vizag**	9700508408	IDH Hospital
5	**PHO Marmagoa**	08322495312-14 8322521377 8326691919	Goa Medical College & Hospital Mumbai Port Trust Hospital V. M. Salgaocar Hospital, Off Airport Road, Chicalim, Goa- 203711
		8322540864	Cottage Hospital Chicalim
6	**PHO Mumbai**	9869246651	Kasturba Hospital for Infectious Diseases, Saat Rasta, Sane Guruji Marg, Jacob Circle, Mumbai – 400011
		9004115538	Sir Jamshedjee Jeejeebhoy (J.J.) Group of Hospitals, J J Marg, Nagpada-Mumbai Central, Off Jijabhoy Road, Mumbai, Maharashtra 400008
			Hindu Hrudya Samrat Balasaheb Thackeray Trauma Care Municipal Hospital Jogeshwari East, Mumbai – 400060
7	**PHO Chennai**	9840185742	Rajiv Gandhi Government General Hospital King's Institute of Preventive Medicine & Research, Guindy, Chennai
8	**PHO Cochin**		General Hospital, Ernakulam, Kerala 680011
9	**PHO JNPT Sheva**	02228224081, 9933082373, 9819700940	Hindu Hrudya Samrat Balasaheb Thackeray Trauma Care Municipal Hospital Jogeshwari East, Mumbai – 400060
		02223027700, 9869246651	Kasturba Hospital for Infectious Diseases, Saat Rasta, Sane Guruji Marg, Jacob Circle, Mumbai – 400011

S. No.	Name of POE	Contact Info	Referral Hospital
1	**APHO Chennai**	9840185742	Rajiv Gandhi Government General Hospital, Chennai
			King's Institute of Preventive Medicine & Research, Guindy, Chennai
2	**APHO Trichy**	0431-2770181, 0431-2774941 & 0431-2771465	Dr. K.A.P. Viswanatham Medical College & Mahathma Gandhi memorial Government Hospital.
3	**APHO Bangalore**	080 26088500, 9448062579	SDS Tuberculosis Research Center & Rajiv Gandhi Institute Of Chest Diseases
4	**APHO, Delhi**	011-23747027	Dr. R.M.L. Hospital, Delhi
5	**APHO Kolkata**	033 2370 1252/51	Infectious Disease (ID) & BG Hospital, Beliaghata Address: 57 Beliaghata Main Road, Kolkata, West Bengal 700015
		+91-(0)33-2363-3373 (Director) Fax:+91-(0)33-2363-2398 +91-(0)33-2370-5066*	National Institute of Cholera and Enteric Diseases(NICED), Address:P-33, C.I.T. Road, Scheme XM, Beleghata, Kolkata 700 010 *
6	**APHO Mumbai**	022 2822 4081, epidcellmcgm@gmail.com	Hindu Hrudya Samrat Balasaheb Thackeray Trauma Care Municipal Hospital Jogeshwari East, Mumbai – 400060
		022 23027700, epidcellmcgm@gmail.com	Kasturba Hospital for Infectious Diseases, Saat Rasta, Sane Guruji Marg, Jacob Circle, Mumbai - 400011
7	**ABQ Amritsar**	0183-2422560 9815840533	Guru Nanak Dev Hospital
8	**APHO, Ahmedabad**		Civil hospital, Ahmedabad, -380 016
9	**APHO, Hyderabad**		
10	**APHO, Cochin**		

* Designated laboratories used during routine times and during PHEIC.

Table 1.2 present the list of hospitals which are designated for referring ill passengers from International PoEs during routine times and during PHEICs.

I. PUBLIC HEALTH MEASURE FOR EVENTS RELATED TO

1. SURVEILLANCE OF OUTBREAK PRONE DISEASES AT PoEs IN COORDINATION WITH INTEGRATED DISEASE SURVEILLANCE PROGRAMME (IDSP)

Under IDSP data is collected on epidemic prone diseases on weekly basis (Monday–Sunday). The weekly data gives information on the disease trends and seasonality of diseases. In addition to the weekly data health events/media alerts are also reported on SOS basis by Media scanning units at Central Surveillance Unit/ State Surveillance units. Whenever there is a rising trend of illnesses in any area, or in response to health events/ media alerts trained Rapid Response Teams (RRT) investigates to diagnose and control the event/ outbreak.

Events under surveillance at PoE

1. Events including Food/ Water borne illnesses occurring/reported at POE
2. Events which constitute potential PHEIC or PHEIC as declared by WHO Suspected cases of diseases with mandatory notification to WHO under Annex 2 of IHR: For eg. Small pox, Poliomyelitis due to wild type poliovirus, human influenza caused by a new subtype and Severe Acute Respiratory Syndrome (SARS). Suspected cases of diseases that may lead to the use of IHR Annex 2: like Cholera, Pneumonic plague, yellow fever, viral hemorrhagic fever.
3. Deaths other than caused due to accident
4. Events that require rapid response, investigation, contact tracing, follow – up by IDSP.
5. Any other events as instructed by Ministry/ Dte GHS/State.

Type of surveillance:

Due to rapid population turnover and presence of interdisciplinary teams including nonmedical staff, event based surveillance (EBS) will be appropriate for capturing events and risks.

Event Based Surveillance: Event-based surveillance is the organized and rapid capture of information about events that are a potential risk to public health. This information can be rumours and other ad-hoc reports transmitted through formal channels (i.e. Airport/ Land Port Health Authorities etc) and informal channels (i.e. media, personnel working at PoE etc), including:

- Events related to the occurrence of disease in humans, such as clustered cases of a disease or syndromes, unusual disease patterns or unexpected deaths as recognized by health workers and other key informants in the premises of PoE; and
- Events related to potential exposure for humans, such as events related to diseases and deaths in animals, contaminated food products or water, and environmental hazards including chemical and radio-nuclear events.

Surveillance data flow between PoE and IDSP

Information received through event-based surveillance should be rapidly assessed for the risk the event poses to public health and reported to State Surveillance Officer and responded to in coordination with District Health authorities/ District Surveillance Unit.

- All the events placed under surveillance at all PoEs should be reported to State Surveillance Officer IDSP (Annexure 2) in a designated format for First Information report (Annexure 1) for the purpose of taking action, whenever suspected.
- It will be responsibility of State Surveillance Officer to direct District Health Authorities (District Surveillance Officer) or appropriate authority depending on the type of event for undertaking rapid response and investigation.
- SSU/ DSU will also provide feedback to APHO/ LPHO and Central Surveillance Unit IDSP regarding action taken.

Annexure 1

First Information Report for events at PoE to be submitted to State Surveillance Officer

Date of reporting Time of reporting

Source of information of the event:	
Contact details of source of information:	
Description of the event	
Location of the event	
Population at risk	
Date of onset of symptoms in first case	
Number of cases	
Clinical description	
Number of deaths	
Any samples taken, Description of samples and lab where samples sent.	
Health measures taken	
Status of event	
Any other information	

Signed by Health Officer

Designation

Complete address with telephone numbers and Email

Annexure 2

S.No.	State	Email Id
1	Andhra Pradesh	idsp.ssuap@yahoo.co.in
2	A & N Nicobar	idspani@gmail.com
3	Arunachal Pradesh	idsparunachal@yahoo.com
4	Assam	assam_idsp@yahoo.co.in
5	Bihar	ssobihar@gmail.com
6	Chandigarh	idsp.chandigarh@yahoo.com
7	Chhattisgarh	idspssucg@rediffmail.com
8	D & N Haveli	cmodnh@gmail.com
9	Daman & Diu	ddmssu.idsp@nic.in
10	Delhi	idspdelhi@gmail.com
11	Goa	gassu.idsp@nic.in
12	Gujarat	ssoidsp@gmail.com
13	Haryana	dhs.idspdatam@hry.nic.in
14	Himachal Pradesh	idspnhmhp@gmail.com
15	Jammu div.	ssojmu.idsp@gmail.com
	Kashmir div.	kadrism@gmail.com
16	Jharkhand	idspjharkhand1@gmail.com
17	Karnataka	ssuidspbangalore@gmail.com, ssubangalore@yahoo.co.in
18	Kerala	idspkerala@hotmail.com
19	Lakshdweep	stolakshadweep@gmail.com,
20	Madhya Pradesh	idspssu@mp.gov.in
21	Maharashtra	idspmaharashtra@rediffmail.com
22	Manipur	mnssu.idsp@nic.in
23	Meghalaya	idspmegha@gmail.com; idsp_megha@yahoo.co.in
24	Mizoram	idspmizoram@gmail.com
25	Nagaland	idsp-ngl@nic.in
26	Odisha	dirhealtho@gmail.com
27	Puducherry	idspssupdy@gmail.com
28	Punjab	punjab.idsp@gmail.com, idsppb@hotmail.com
29	Rajasthan	rajasthan_idsp@yahoo.co.in
30	Sikkim	idsp_sikkim@yahoo.com
31	Tamil Nadu	tnssu.idsp@gmail.com
32	Telangana*	idsptelangana@yahoo.com, cponhmts@gmail.com
33	Tripura	idsp_tripura@rediffmail.com
34	Uttar Pradesh	idspup@gmail.com
35	Uttarakhand	idsputtarakhand@gmail.com, idspdatamanager@gmail.com
36	West Bengal	idsp.wb@gmail.com

2. FOOD SAFETY

INTRODUCTION

Food as defined in Food Safety & Standards Act is any substance, whether processed, partially processed or unprocessed, which is intended for human consumption and includes primary food to the extent defined in the Act, genetically modified or engineered food or food containing such ingredients, infant food, packaged drinking water, alcoholic drink, chewing gum, and any substance, including water used in the food during its manufacture, preparation or treatment but does not include any animal feed, live animals unless they are prepared or processed for placing on the market for human consumption, plants, prior to harvesting, drugs and medicinal products, cosmetics, narcotic or psychotropic substances: Provided that the Central Government may declare, by notification in the Official Gazette, any other article as food for the purposes of this Act having regards to its use, nature, substance or quality.

Primary food means an article of food, being a produce of agriculture or horticulture or animal husbandry and dairying or aquaculture in its natural form, resulting from the growing, raising, cultivation, picking, harvesting, collection or catching in the hands of a person other than a farmer or fisherman.

Safe Food (2)

The general public might consider that 'safe food' means zero risk (no risk at all). Whereas the food manufacturer would consider 'what is an acceptable risk?' The opinion expressed is that *zero risk is not feasible* given the range of food products available, the complexity of the distribution chain and human nature. Unfortunately there is no public consensus on what constitutes an acceptable risk. A difficulty that arises in manufacturing 'safe' food is that the consumer is a mixed population with varying degrees of susceptibility and general life style. Food with high levels of *preservatives* to reduce microbial growth is undesirable by the consumer and perceived as '*over processed*' with '*chemical additives*' The consumer pressure is for greater varieties of fresh and minimally processed foods, natural preservatives with a *guarantee of absolute safety*.

Unsafe Food

An article of food whose nature, substance or quality is so affected as to render it injurious to health by:-

(i) the article itself, or its package thereof, which is composed, whether wholly or in part, of poisonous or deleterious substance; or

(ii) the article consisting, wholly or in part, of any filthy, putrid, rotten, decomposed or diseased animal substance or vegetable substance; or

(iii) virtue of its unhygienic processing or the presence in that article of any harmful substance; or

(iv) the substitution of any inferior or cheaper substance whether wholly or in part; or

(v) addition of a substance directly or as an ingredient which is not permitted; or

(vi) the abstraction, wholly or in part, of any of its constituents; or

(vii) the article being so coloured, flavoured or coated, powdered or polished, as to damage or conceal the article or to make it appear better or of greater value than it really is; or

(viii) the presence of any colouring matter or preservatives other than that specified in respect thereof; or

(ix) the article having been infected or infested with worms, weevils, or insects; or

(x) virtue of its being prepared, packed or kept under insanitary conditions; or

(xi) virtue of its being mis-branded or sub-standard or food containing extraneous matter; or

(xii) virtue of containing pesticides and other contaminants in excess of quantities specified by regulations.

HEALTH RISKS ASSOCIATED WITH FOOD

Food and water may be associated with certain hazards due to poor handling and storage conditions or sometimes due to certain inherent food constituents. Potential health hazards associated with food are- Physical, Chemical, Biological and Radiological.

PHYSICAL HAZARDOUS AGENTS IN FOOD AND WATER

Physical hazards are hard foreign objects that can cause physical injury or illness to the consumer. Physical hazard may be inherent to the food or ingredient. For example chaff, straw and stalks in plant produce; bone fragment, feather and hair in meat products. They could be extraneous for example, metal, glass, stones, soil, dirt, jewellery parts, rodent hairs and excreta, human hair and nails, staple pins, iron filings, plastic parts, wood, paper, insects etc. Physical hazards are easily recognized by consumers and do not need much expert help to detect.

Table no. 2.1 Potential health hazards associated with food

Physical	Glass, stones, metal, wood, bone, feathers, hairs, plastic, parts of insect pests, insulation material, rodent hair, excreta, metal pieces, staple pins, iron filings.
Chemical	Naturally occurring toxins (bacterial and fungal toxins, biotoxins), heavy metals, pesticides, veterinary drug residues, antibiotics, growth regulators, chemical residues, allergens.
Biological	Microbiological (pathogenic bacteria, parasites, protozoa, viruses,)
Radio-nuclides	Natural or man made

CHEMICAL HAZARDOUS AGENTS IN FOOD AND WATER

Chemical hazards are toxic substances that are produced naturally, added intentionally, or un-intentionally. These include heavy metals, natural toxins, sanitizers, pesticides, antibiotics and drugs. The origin of chemical hazards is:

Agronomical: These include the residues of pesticides, fertilizers, fungicides, antibiotics and growth hormones used on food crops.

Natural food toxins: Chemicals or toxins produced by fish, shellfish toxins, mushroom toxins.

Toxins produced by infecting or ingested microbes: Toxins produced by algae or diatoms consumed by fish, mycotoxins produced by mould and bacterial growth.

Food allergens: These are natural constituents, mainly proteins, of certain foods like egg, fish, milk, peanuts, sesame seeds, soybean, tree nuts and wheat gluten, and certain preservatives and additives like sulphite.

Factory chemical residues: Chemicals used for cleaning and sanitizing food contact surfaces, pest control chemicals, lubricants, coatings, paints, refrigerants and water treatment chemicals.

BIOLOGICAL HAZARDOUS AGENTS IN FOOD AND WATER

Food borne microbial infections and intoxications include a wide spectrum of illnesses that are a growing global public health risk. These diseases are caused by ingestion of foodstuffs contaminated with microorganisms or their toxic metabolites. The contamination may occur at any stage during the process of harvesting, handling, transport, storage, processing, distribution, and consumption of food. Both acute and chronic clinical manifestations of food borne illnesses are known. The best known acute clinical presentation of food borne disease involves gastrointestinal symptoms. Some well-known ailments could be attributed to the following classes of parasites and pathogens.

Viruses

Faecal contamination of food via water, soil or food handlers is reported to be the main cause of viral food borne diseases. Viral food borne diseases include hepatitis A (symptoms include fever, weakness, nausea, and jaundice), Norwalk agent or Small Round Shaped virus (causes gastrointestinal ailments like nausea, vomiting, diarrhoea, pain, headache, and fever), Rotaviruses (cause diarrhoea in infants and young children).

Bacteria

Bacterial food borne diseases can be divided into two categories, food infections, and food poisoning, caused as a result of toxins produced by the microbes and its ingestion. Common bacteria that cause food borne infections include, *Salmonella typhi*, *S. paratyphi*, *Escherichia coli*, *Shigella dysentariae*, *Campylobacter jejuni*, *Vibrio cholerae*, *V. parahemolyticus*, *Listeria monocytogenes*, *Aeromonas hydrophila*, and *Halicobacter pylori*. Among *E. coli*, the enterotoxic, and enterohemorrahagic forms are the most virulent. Food poisoning is caused by the human ingestion of toxins produced by *Staphylococcus aureus*, *Clostridium botulinum*, and *Clostridium perfringens* in contaminated food. Common rickettsia that are involved in foodborne infections include well known *Coxiella burnetti*, the cause of Q fever, *Rickettsia prowazekii*, the cause of typhus fever, and *Rickettsia rickettsii*, the cause of Rocky mountain spotted fever.

Protozoa and parasites

Several parasites are known to cause foodborne and waterborne illnesses. These organisms live and reproduce within the tissues and organs of animal and human hosts, and are transmitted to humans through the contaminated food and water. Parasites are of different types and range in size, from single-celled microscopic organisms (**protozoa),** to large multi-cellular worms (**helminthes)** that may be seen without a microscope. Amoebic dysentery is the most common ailment caused by *Entamoeba histolytica*. The symptoms include diarrhea, fever, chills, and liver abscess. Giardiasis caused by *Giardia* causes diarrhea with green stools. These diseases are caused by raw or mishandled food or contaminated water.

Toxoplasmosis caused by *Toxoplasma gondii* causes mononucleosis and death. The disease is caused by consumption of raw undercooked meat. *Trichinella spiralis*, cause of trichinellosis (also known as **trichinosis**), is an intestinal roundworm whose larvae may migrate from the digestive tract and form cysts in various muscles of the body. Infections occur worldwide, but are most prevalent in regions where pork or wild game is consumed raw or undercooked. *Taenia saginata* and *Taenia solium* are parasitic helminthes. **Taeniasis** is the intestinal infection caused by adult-stage tapeworms.

Yeasts, Moulds and Mycotoxins

Their prolonged presence, particularly of the Mycotoxins producing moulds may lead to formation of Mycotoxins. Mycotoxins can appear in the food chain as a result of pre-harvest fungal infection of crops, or during postharvest storage, if conditions are conducive for fungal growth. Once formed Mycotoxins largely are difficult to eliminate. So, they tend to remain in the food chain, and in meat and dairy products. Even drastic thermal treatments, such as cooking do not destroy some Mycotoxins. Therefore, prevention of mould growth in pre-harvest and postharvest stored crops is the best strategy to eliminate Mycotoxins in food chain.

RADIOLOGICAL HAZARDOUS AGENTS IN FOOD AND WATER

Natural: All food and drinking water may contain some level of natural radioactivity due to the presence of naturally occurring radionuclides like potassium-40, and radium-226.

Manmade: Foods and water may get contaminated with radionuclides due to their release in environment from nuclear establishments and in large quantities from nuclear accidents. In case of nuclear accidents, reactor produced radionuclides such as Iodine-131, Cesium-137, Strontium-90, may find entry in food chain. Contamination of the food or feed with radionuclides may impact human or animal health and also become barrier to trade. Contamination of foods with radionuclide shall be as low as reasonably achievable.

Hazardous substances can enter at any point along the food chain, i.e. from farm where food is produced to the consumer (Figure no 2.1).

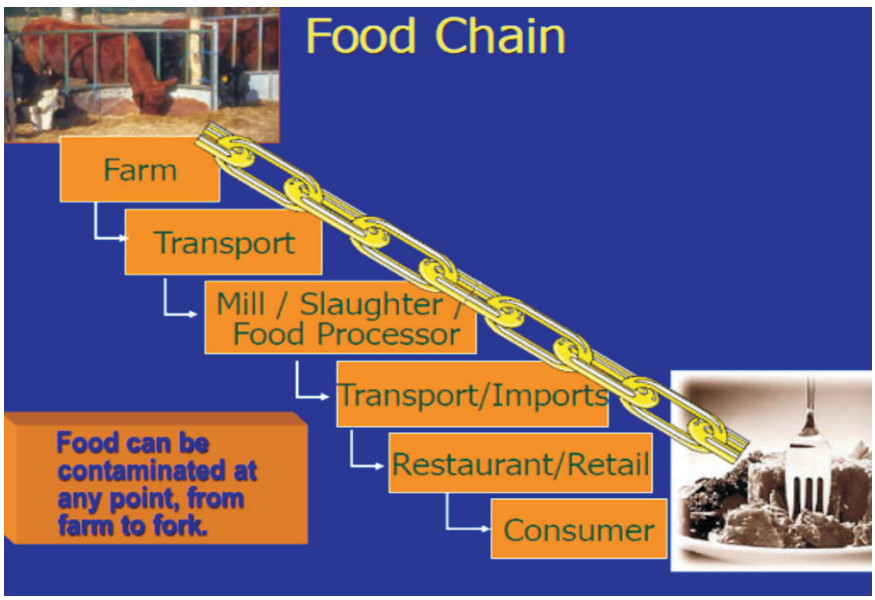


Figure no. 2.1 Food chain and points of entry of hazardous substances.

RATIONALE

All ports of entry should have surveillance and monitoring program for providing safe food for international travellers including food in transit. Food business operators should follow an established Food Safety Management System, use a HACCP Protocol to ensure production of safe food. Further, It is essential that food service personnel protect the health of consumers from food borne illnesses by practicing clean work habits and following acceptable sanitary procedures, thereby, creating a sanitary environment.

STATUS

Points of entry at airports have lounges, food and snack outlets, hotels, food courts, major flight kitchens & food outlets for provision of food and snacks for the travellers. At Seaports there are mainly small food and snacks outlets providing food to port users.

FOOD SAFETY

Food safety standards, implementation & maintenance at PoEs includes- Registration and licensing, Post licensing food safety monitoring & surveillance and Food borne disease outbreak investigation.

STANDARD OPERATING PROCEDUREs FOR

A. FOOD SAFETY & STANDARD CONTROL- General Guidelines for Food Sanitation Practices are enlisted in Annexure 2.1

B. FOOD OUTLET LICENSING

The major part of licensing of food outlet is online procedure and completed through official website of FSSAI. The notification of designated officer (DO) and FSO (food safety officer) is necessary for this online procedure. A thorough physical inspection of food outlets is to be carried out before issuing the license to Food Business Organizations (FBOs).

(For further details: https://foodlicensing.fssai.gov.in/index.aspx)

B.1 Online Registration by applicant.

B.2 Online checking of documents by DO.

B.3 Inspections of food outlet by FSO.

A team consisting of Medical officer, Food/Health inspector and Health worker visits the outlet as the schedule. During the inspection visit basic guidelines required to be followed & following activities are observed:-

- Space, Lighting, Ventilation
- Separate Storage facility
    - Non perishable
    - Perishable (Vegetables & fruit)
    - Milk & Milk Products
    - Chicken & Mutton
- Hygiene & cleanliness
- Pest & vector control measures
- Sanitation
- Floor of Kitchen
- Food packaging and labelling must be according to FSSAI (packaging and labelling) regulations, 2011.

Figure no. 2.2 Fluids from raw meat dripping onto uncovered cooked food below

Figure no. 2.3 (L-R) top row: Cleaning floor spillage, Clean cooking surface before cooking, **second row**: Hand wash, Apron and head cap.

- Cooking oil standards
- Seepage
- Drainage
- Waste product management
- Cleaning – material/ equipments storage
- Spitting / smoking/ tobacco chewing
- Cooked food handling

Figure no. 2.4 Rubbish is an important source of microbial growth.

Figure no. 2.5 Separate cooked meat from raw meat

Figure no. 2.6 Unclean Cooking equipment

- Medical records of staff
- Dish washers and hot water
- Transportation of cooked food
- Staff lockers & canteen
- Failure of Equipments, equipment maintenance record.
- Waste food disposal implementation of HACCP/ Codex guidelines.
- Water testing reports for past six months, internal quality control procedure, cooking and cleanliness.
- Details of responsible persons.

B. 4 Record maintenance

B. 5 License Certificate- Certificate issued for one to five years.

C. POST LICENSING FOOD SAFETY CONTRO

- **Random visits and regular inspections.**
- **Outlet managers are given instructions to have due precautions with regard to sickness of food handlers.**

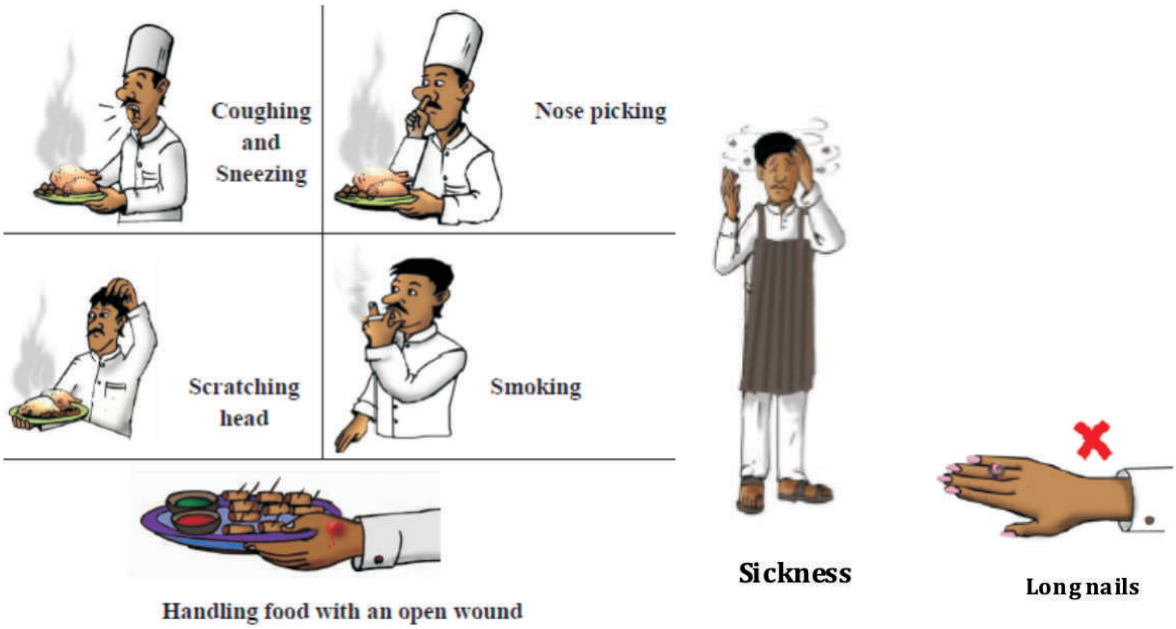


Figure no. 2.7 Ways in which pathogens are introduced into food by food handlers

D. FOOD BORNE DISEASE OUT BREAK INVESTIGATION

Food borne disease outbreaks are investigated to prevent both ongoing transmissions of disease and similar outbreaks in the future. Important considerations in investigating an outbreak of infectious diseases include determining that outbreak has in fact occurred and defining the extent of the population at risk, determining the measure of spread and reservoir, and characterizing the agent. The scale of an outbreak may range from a local outbreak of a small number of linked cases with mild disease to a nationwide or international outbreak of severe disease involving the mobilization of public health resources from all levels irrespective of the scale. A full investigation of a food borne disease outbreak will normally include:

- Epidemiological investigation
-Environmental and food investigations
-Laboratory investigation

STEPS IN OUTBREAK INVESTIGATION:

Steps that are commonly used in investigating an outbreak are listed below; however these may vary and differ in order, depending upon the outbreak:

1. **Define the Outbreak and validate the existence of Outbreak.**

   Define the "numerator "(cases)

   - Clinical features: is the disease known?

     A case definition should be established through a set of criteria for determining whether a person should be classified as being affected by the disease under investigation.

- What does serology or culture reports indicate?
- Are the causes partially understood?

Define the "denominator": what is the population at risk of developing disease?

Determine whether the observed number of cases clearly exceeds the expected number

Calculate the attack rate: $\frac{\text{No. of cases of a specified disease during specified time interval}}{\text{Total population at risk during same time interval)}} \times 100$

2. Examine the distribution of cases by the following:

- Time}Look for time-place interaction
- Place
- Person (Age group, specific group, etc)

3. Develop hypotheses based on the following:

- Existing knowledge (if any) of the disease
- Analogy of diseases of known etiology
- Findings from investigation of the outbreak.

4. Test Hypotheses

- Further analyze existing data (case – control studies)
- Refine hypotheses and collect additional data that may be needed

5. Recommend control measures

- Control of current outbreak.
- Prevention of future similar outbreaks.

6. Prepare a written report of the investigation and the findings

7. Communicate findings to those involved in policy development and implementation and to the public.

DETERMINE WHETHER A CERTAIN DISEASE IS ASSOCIATED WITH A CERTAIN EXPOSURE?

To identify whether the association exists between the disease and the suspected food, the data from case -control and cohort studies is obtained, the two type of analytical studies most commonly used in outbreak investigations. In case of the hypothetical investigation in a food borne disease, the suspected food is identified and for each food the attack rate (incidence rate) is calculated for those who ate the food (exposed) and for those who did not eat the food (non-exposed).

The value of a comparison group for identifying specific exposures is illustrated by the example of a school outbreak of gastroenteritis, in which 30 cases are identified and interviewed about their food consumption which shows that all of them ate vanilla ice-cream purchased from street vendor a day before illness. Enquiring about consumption of other foods shows that no other food was consumed by as many cases as vanilla ice cream. Comparing the exposed with non-exposed reveals that all the healthy students (non-exposed) also ate vanilla ice cream purchased from the street vendor. Comparing the other exposures revealed that most of the exposed students had lunch in the school canteen the day before illness while most of the healthy students did not. This indicates that food from the school canteen is the most likely vehicle for the outbreak. So in case of food borne outbreak to determine whether certain exposure is associated with a certain disease we must determine whether there is an excess risk of disease in exposed population by comparing the risk of disease in exposed population to the risk of disease in non-exposed population. **The Attack rate** is commonly used in disease outbreak investigations and is a key factor in the formulation of hypotheses.

IDENTIFYING FOOD BORNE OUTBREAK: A TEAM APPROACH

When a food borne disease outbreak is detected, public health and regulatory officials shall have to work together and collect as much information as possible to find out the cause of the outbreak, so as to prevent more people from getting sick. During an investigation, health officials collect the epidemiological data, which will be then collated, and analysed to establish the likely source of the outbreak and Convincing information will be gathered to link the illness with the contaminated food. In some cases, the health officials can decide to alert the public directly through electronic media, and regulatory authorities can alert the public, to avoid the implicated food product and can impose temporary restriction on the sale, distribution or import of the foods implicated in the outbreak. Outbreak investigative teams are usually made up of a variety of professionals, including

- **Epidemiologists**
- **Microbiologist**
- **Public Health Specialist**
- **Officers and Inspectors from the Regulatory Authority**

The APHOs and PHOs, notified as DO/ FSO under FSS Act 2006, will form a part of the Investigative team and will assist in collection, packaging and transportation of food samples as per provisions of the FSS Act. Food samples once collected and sealed will be transported to public health/ food laboratories for testing.

As of now 98 NABL accredited laboratories are notified for the purpose of analysing food samples under FSSAI act and rules and regulations. Further details can be gathered from this website-

http://www.fssai.gov.in/Portals/0/Pdf/Order_NABL_Lab_09_05_2016.pdf)

Details of collection of food samples; precautions need to be taken while collecting samples, quantity to be collected, packaging and transport, etc is available from:

http://www.fssai.gov.in/TRAININGMANUAL.aspx

SURVEILLANCE FOR GENERAL SANITATION AND SAFE DRINKING WATER

Surveillance is done at PoEs for general sanitation and provision of safe drinking water.

General sanitation

- Supervisory rounds and visits are done on weekly basis to see water stagnation, presence of pests, garbage, sewage, animal carcass and general sanitation in urinals & toilets. Health inspector/staff undertakes periodic inspection of the premises.
- Carriers/ conveyances arriving at points of entry from a foreign country are subjected to a sanitary inspection for presence of rodents, insects, or other vermin infestation, contaminated food or water, or other insanitary conditions.

Safe drinking water

The water safety is to be monitored at Storage, Transportation and distribution points (including drinking water outlets). The Water Safety Plan for the PoE is to be checked by periodic sample examination during the routine surveillance. Lifting of water samples is done fortnightly from taps, wells, water tanks and from carriers/ conveyances (aircrafts and ships) for various tests. At Seaports in addition to piped water supply and supply by motor tankers, water is also supplied to ships by water barges. These barges are routinely and as and when needed inspected for water testing, condition of barges, cleaning and health status of water handlers.

A monthly Chlorination report is submitted by the PoE Water Supply department and a full analysis including microbiological report is submitted in every 6 month. The levels of Chlorination at Storage point can be upto 1 to 1.5 mg/L (1 to 1.5 ppm) and at consumer points to be minimum of 0.2 to 0.5 mg/L or 0.2-0.5 ppm.

FOOD INSPECTION FOR SAFETY OF FOOD ON THE FLIGHTS FOR VVIPS

Food surveillance activities are undertaken for visits of National VVIPs (Inside country and international visits) and International VIPs at the time of their visits via flights. Activities are as follows:

Site: Designated flight kitchen for VVIP food

Standard Procedure:

1. Requisition letter by Special Protection Group (SPG), PM/ VVIP cell & Deputy Commissioner of Police (DCP) VVIP Security
2. Requisition by Air India/ Indian airlines or concerned airlines.
3. Inspection of non perishable food items is illustrated in Figure no. 2.8
4. Inspection of perishable food items for the freshness is done 24 hours before departure.
5. **Inspection and tasting for instant poisoning** of all the prepared food items for the flights is done. **Sampling** of prepared food is done from the **enlisted food items with the designated flight kitchen official.**
6. The sample container is sealed in the presence of security officials and flight kitchen official present is informed. It is ensured that the **sealed sample container box** is **kept in refrigeration for 72 hours after arrival of VVIP in India**.
7. If **any untoward event/ illness** occur on the VVIP flight then the raw material samples preserved at APHO & Delhi Police and the prepared food items preserved are to be sent to the Public Health Laboratory for testing.

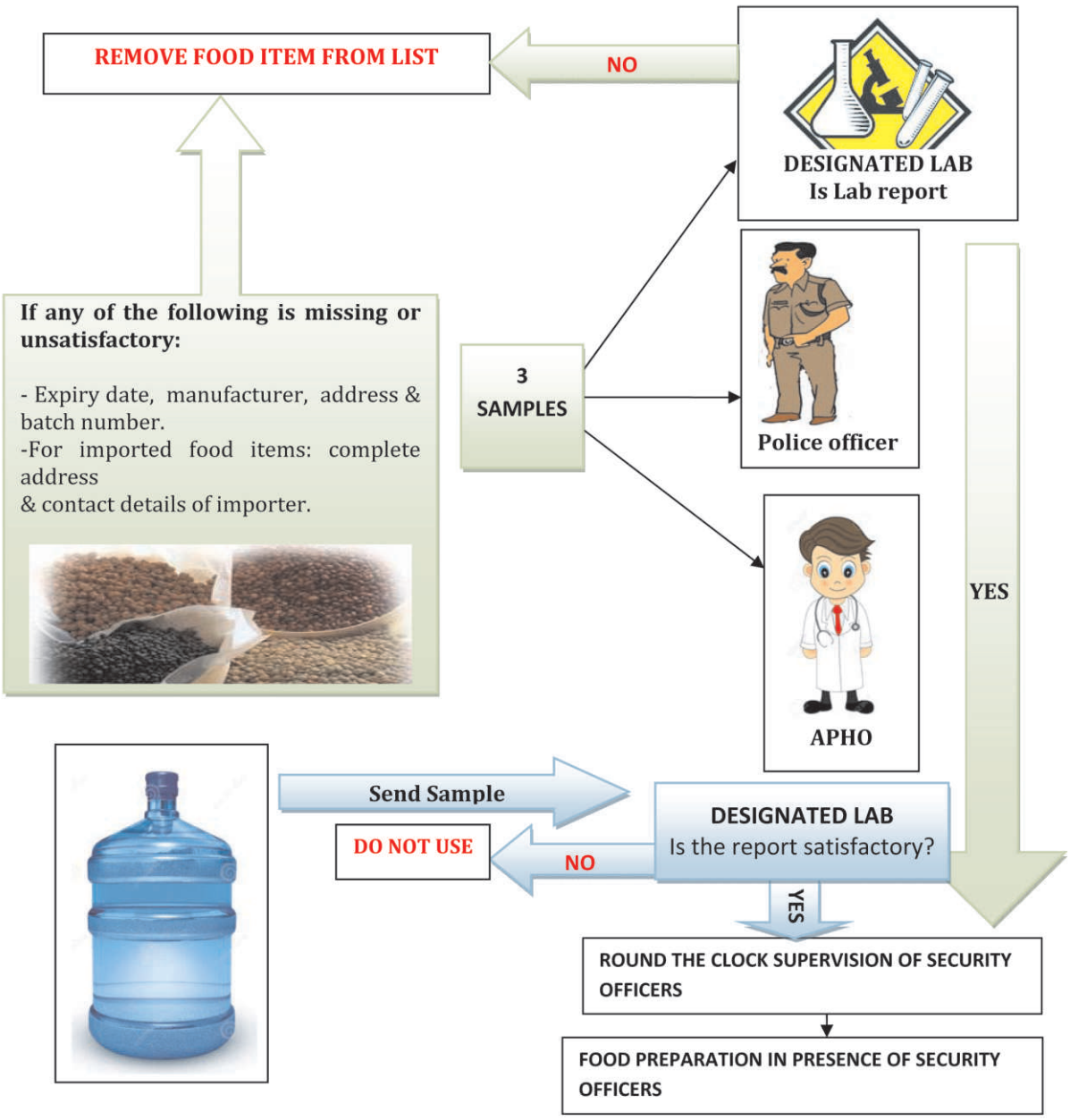


Figure no. 2.8 Inspection & Sampling of non perishable raw food items

FOOD SAFETY ON SHIPS

It is the responsibility of each ship operator to apply all practicable measures to ensure that no source of infection and contamination are present on board, including in the water system or food supplies.

WATER SAFETY ON SHIPS

Generally, the ship drinking-water supply and transfer chain consists of three major components:

1. **Source of water coming into the port**;

   The first strategy for prevention of waterborne disease should be to load ships with water that conforms to the WHO Guidelines for drinking-water quality (GDWQ) (WHO, 2011) or relevant national standards, whichever are stricter. Source water is monitored at the port to ensure that water is safe. Recommended parameters to be monitored include E. coli or thermotolerant (faecal) coliforms, disinfectant residual, corrosion-related contaminants, turbidity, heterotrophic plate count (HPC) and aesthetic parameters.

2. **Transfer and delivery system**, which includes hydrants, hoses, water boats and water barges; this water transfer process provides multiple opportunities for the introduction of contaminants into the drinking-water;

3. **Ship water system**, which includes storage, distribution and onboard production of drinking-water from overboard sources, such as seawater (by reverse osmosis or evaporation of seawater).
   - All non-potable water taps need to be labelled with words such as "UNFIT FOR DRINKING".
   - There should never be a connection between wash-water or other non-potable systems and the potable water system without using an appropriate backflow-prevention device.
   - Space is often very limited on ships. Potable water systems are likely to be physically close to hazardous substances, such as sewage or waste streams, increasing the chance of cross-connections.
   - Cold-water systems may be close to sources of heat, and this elevated temperature increases the risk of proliferation of Legionella spp. and the growth of other microbial life.
   - The production of water on ships can be associated with its own potential health problems, harmful algae and *Cyanobacteria*, certain free-living bacteria (including *Vibrio* species such as *V. parahaemolyticus* and *V. cholerae*) and some chemicals, such as boron and bromide, which are more abundant in seawater.

A Water Safety Plan (WSP) is an effective means of achieving consistency in ensuring the safety of a drinking-water supply. The entity responsible for each component of the drinking-water supply chain (i.e. port water source, shore water distribution system, transfer and delivery system and ship water system) should be responsible for the preparation and implementation of a WSP for that part of the process. WSPs are equivalent to food safety plans or programmes, incorporating hazard analysis and critical control points, implemented as part of food safety management.

GUIDELINES FOR WATER SAFETY ON SHIPS

1. A water safety plan should be designed and implemented for the port water source, for the bunker boats or barges and for the delivery system into the ship and ship water system.
2. Potable water should be available in sufficient quantities.
3. Independent surveillance of potable water safety is performed by a competent authority under the IHR 2005. This consists of following:-
   i. Audit/ inspection procedures are put in place by a competent authority under the IHR 2005.
   ii. Documentation and implementation of a WSP are reviewed, and feedback is provided.
   iii. An independent competent authority under the IHR 2005 responds to reports of incidents with the potential to adversely affect public health.

Surveillance consists primarily of sanitary inspections, based on the Water Safety Plan (WSP), of ports, watering facilities or ships. Independent inspections are conducted and the reliability of the supplier's information is verified. This does not normally need to be as frequent as the continuous control performed by ports and ship operators.

Sampling procedures for microbiological testing of potable water are described in ISO19458. Laboratories should analyse the water according to internationally accepted technical standards, such as ISO/IEC 17025. There are two reasons for sampling:

- Standard surveillance to perform verification of good management.
- More detailed inspection in case of suspected problems.

FOOD SAFETY FOR SHIPS

Generally, the ship food supply and transfer chain consists of five major components that provide multiple opportunities for the introduction, or proliferation, of contaminants in food:

- Source of food coming into the port;
- Transfer of food to storage points on board ship;
- Storage and general distribution of food on board ship;
- Preparation and serving of food, including cooking and mixing by food handlers;
- Handling and storage of food for personal consumption by passengers or crew, including taking food away and storing it in private areas for subsequent consumption.

GUIDELINES FOR FOOD SAFETY ON SHIPS

1. Food safety plans (FSP) are in place for each component of the food-chain.
2. Food is inspected and confirmed to be in safe condition upon receipt.
3. Equipment and utensils are suitable for food preparation, food storage and contact with food.
4. Materials are suitable for contact with food and protect food from contamination.
5. Facilities are suitable for safe food preparation and serving.
6. Spaces are suitable for the safe storage, preparation and service of food.
7. There are adequate toilet and personal hygiene facilities for food handling personnel.
8. There are adequate and effective dishwashing facilities.
9. There are safe food storage systems.
10. There is a comprehensive maintenance, cleaning and disinfection programme.
11. Food handling personnel practise good personal hygiene.
12. Food handlers are adequately trained in food safety.
13. Food waste is stored and disposed of in a hygienic manner

ROLE OF IDSP

In case of any food borne outbreak detected on flight/ ship or airport/ seaport/ Land port, the same will be shared with IDSP. Details of contacts also be shared with IDSP for the purpose of surveillance.

REGULATORY MECHANISMS

CODEX

The Codex Alimentarius Commission (CAC) was created in 1961/62 by Food and Agriculture Organization of the United Nations (FAO) and the WHO, to develop food standards, guidelines and related texts such as codes of practice under the Joint FAO/WHO Food Standards Programme. "**Codex India**" the National Codex Contact Point (NCCP) for India, is located at Food Safety and Standards Authority of India (Ministry of Health and Family Welfare), FDA Bhawan, Kotla Road, New Delhi -110002, India.

Hazard Analysis and Critical Control Points (HACCP) is a process control based system for food safety which has been developed based on guidelines for HACCP application as per the CAC.

The International Food Safety Authorities Network (INFOSAN) **(4)** is a global network of national food safety authorities for rapid exchange of information during food safety related events and information on important food safety related issues of global interest.

In the IMO's Life-Saving Appliance Code (IMO, 2010) additional information about potable water requirements in rescue boats is provided.

Regulation 3.2 of the **Maritime Labour Convention, 2006** includes requirements for drinking water on board.

ILO Convention C133 (Accommodation of Crews [Supplementary Provisions] Convention, 1970 defines minimum standards for provision of potable water for crews and has been ratified by many countries.

International standards in relation to sanitary design and construction of ship water supplies and potable water quality assessment.

FSSA-2006 & FSS Rules-2011 (2) An Act to consolidate the laws relating to food and to establish the Food Safety and Standards Authority of India for laying down science based standards for articles of food and to regulate their manufacture, storage, distribution, sale and import, to ensure availability of safe and wholesome food for human consumption and for matters connected therewith or incidental thereto. (More details are available at:

http://www.fssai.gov.in/GazettedNotifications.aspx#regulations2011

The Merchant Shipping (Medicines, Medical Stores and Appliances) Rules, 1994

The Merchant Shipping (Carriage of Medical Officers) Rules, 1961

The Merchant Shipping Act, 1958

The Indian Port Health Rules, 1955

The Unberthed Passenger Ships Rules, 1954

Prevention of Food Adulteration (PFA) Act 1954 Act has been repealed after FSSA-2006 & FSS Rules-2011

The Indian Ports Act, 1908

NODAL OFFICER I/C

- The inspection of the Food Business Operating units at PoE will be undertaken by the Designated Officer (DO)/ Food Safety Officer (FSO) at the PoE as per the FSSAI-2006 and FSSR-2011.
- Under the provisions of PFA Act, 1954, Health Officer of the port/airport has been designated as local authority and is responsible for ensuring safety of the food provided at these outlets/ lounges and flight kitchens. **PFA Rule 2 (e) define APHO/ PHO as 'Local Health Authority' for Airports & Ports and PFA Rule 51 (A) - define APHO/ PHO as 'A licensing Authority', for food outlets in Airports & Ports**.
- The PF Act has been repealed after FSSA-2006 & FSS Rules-2011, under FSS Act/ Rules **CEO/ Food Commissioner** is authorized to designate **Food Safety Officer** at special area like- Airports, Ports and Railways Station.
- **As Per IHR 2005- APHO/ LPHO are custodial/ Nodal/ Local Health / Implementing Authority for all food related activities (food safety & food Borne Disease Outbreak Investigation), water & sanitation related activities at POE**

ANNEXURE 2.1

General Guidelines for Food Sanitation Practices

It is essential that food service personnel protect the health of consumers. They have the responsibility of working in an efficient and safe manner. They have a responsibility to prevent food borne illness by practicing clean work habits and following acceptable sanitary procedures, thus creating a sanitary environment. Management has the responsibility of training personnel (with the help of health authorities) in acceptable personal hygiene habits and in sanitary techniques of food handling, with careful (and constant) supervision. These guidelines offer some basics for good food protection and sanitation practices.

Figure no. 2.9 Components of food sanitation practices

SAFE FOOD SOURCES FOR PREPARING FOOD FOR PASSENGERS

1. Do not use home-processed or home-prepared foods.
2. Know where foods come from (reputable distributor, supplier and manufacturer).
3. Inspect food supplies when delivered for temperature, swelled or damaged cans and packages, odour, visible mould, insect infestation, etc.
4. Eggs are intact, not expired, and are refrigerated; liquid eggs should be pasteurized and refrigerated.

DRY STORAGE (food, equipment, supplies)

1. Rotate stock according to **"first-in, first-out"** (FIFO); create some system, such as dating.
2. Store at least six (6) inches off the floor.
3. Loose and unwrapped food or food where original package has been broken should be stored in

pest proof containers or tied plastic bags after proper labelling.

4. Area should be cool, well ventilated, well lit, and well maintained; kept clean, neat and orderly.
5. Single service items are stored properly.
6. Keep foods and all toxic chemicals separate and in well-marked cabinets.
7. Clean spilled food off shelves or floor immediately.

REFRIGERATION STORAGE

1. Temperature at 41 degrees F or below: thermometer in every unit, checked frequently.
2. Potentially hazardous food stored in "chill-able" quantities (i.e. shallow containers or small portions) and uncovered while food is still warm (cover food when cooled to below 41 degrees F).
3. Storage practices on shelving allow for adequate air circulation: open wired shelves rather than solid (not covered with foil).
4. Raw food stored separate and below prepared food; better to store raw food in separate unit if available.
5. Food stored to allow adequate air circulation; not packed too tightly. Food stored at least six (6) inches off floor; no stacking of containers.
6. Food stored in a manner to permit "first-in, first-out" rotation.
7. Clean units frequently, at least weekly, to prevent dirt and microorganisms from accumulating.
8. Cover foods to protect from drippings, odours, drying out.
9. Refrigerate leftovers as soon as possible; throw away food not going to be used.

FREEZER STORAGE (walk-in and reach-in)

1. Temperature 0 degrees F or below; thermometer in each unit, checked frequently.
2. All food containers covered. Wrap all food well to prevent freezer burn.
3. Food stored to allow adequate air circulation; not packed too tightly.
4. Food not stored on floor of walk-in.
5. Defrosted routinely to eliminate ice build up.
6. Units clean, free of debris.
7. Foods rotated to permit "first-in, first-out".
8. In ships large quantities of raw material is taken hence there are separate store room for meat/ poultry/ fish/ vegetables/ dry provision / bond stores are used.

PERSONAL HYGIENE

1. Keep the hands clean. Wash as frequently as necessary. Wash with warm, soapy water, using friction action, and dry with paper towels or air dryer.
2. Always wash hands:
   * After using toilet facilities
   * Between handling raw and cooked foods to avoid cross contamination

* After blowing the nose, sneezing, or coughing
* After smoking, eating, drinking, or taking any break
* After touching the face, hair (including a beard or moustache), or any unwashed body part.
* After any other activity that could potentially contaminate hands.

3. Keep fingernails clean and well-trimmed.
4. Keep uniform clean; use a clean apron.
5. Keep hair neat and clean; use hair restraints (caps/hairnets); no loose, long hair and beards and moustaches should be kept trimmed.
6. No **smoking** or **eating** in food preparation, serving or storage areas; use designated areas.
7. No rings (except wedding band) or jewellery on hands or wrists.
8. The handling of food (including ice) should be minimized; use utensils or plastic gloves to eliminate unnecessary hand contact with prepared foods (example: do not mix salad by hand).
9. If sick (especially with diarrhoea, sore throat and/or sneezing and coughing), stay at home or go home.
10. Do not work in food preparation if a hand injury has resulted in a wound, infected cut or bum.

FOOD PREPARATION, HANDLING, HOLDING

1. Potentially hazardous food should be kept cold (below 41 degrees F.) or hot (above 135 degrees F.); not held at room temperature, except during necessary preparation (should not exceed 2 hours).
2. Food should be prepared on approved, clean, sanitized surfaces, with clean, sanitized equipment and utensils.
3. Defrost food properly, i.e. under refrigeration, under cool running water (not to exceed 2 hours), in a microwave oven, or during cooking; do not leave foods to defrost at room temperature.
4. Fruits and vegetables should be washed prior to preparation.
5. Food should be covered or protected from contamination (dust, sneezing, coughing).
6. Do not prepare raw, cooked or ready-to-serve food on same work surface(s) (e.g., cutting board) without proper cleaning and sanitizing between uses.
7. Preparation equipment (slicers, grinders, knives, mixers) and food contact surfaces should be cleaned and sanitized between uses.
8. Thoroughly cook all potentially hazardous food to proper temperatures; check temperature with a probe thermometer.
9. Reheat all potentially hazardous food quickly to 165 degrees F; *do not* use warming equipment or steam tables to do this; check temperature with a probe thermometer.
10. Microwaves tend to cook unevenly; so stir the food or food container and check temperature. Cooking temperatures should be +15 degrees hotter than required temperatures.

CUSTOMER SERVICE

1. Serve food on clean and sanitized dishware, handled properly.
2. Use appropriate utensils such as a serving spoon or fork, tongs or spatula to serve food.
3. Keep dining area clean.
4. Self-serve areas should be monitored:
   * Milk dispenser area clean and spills wiped up as necessary.
   * Salad bar display shall be supervised, with employee(s) working the operation trained in customer surveillance and product knowledge.

   <u>Sign displayed in salad bar area stating:</u>

   - That the use of hands by consumers is a violation of state law; and
   - That smoking is prohibited in the salad bar display area and adjacent areas.

   * Condiment area should be kept clean and spills wiped up.
   * Wiping clothes (used to wipe tables) should be cleaned in separate sanitizing solution.

CLEANING EQUIPMENT AND FACILITY

A planned sanitary maintenance program is crucial for good sanitation control. Each food service unit will have a somewhat different cleaning schedule depending on equipment use, amount of equipment, and business volumes. It is desirable to develop (and post) a cleaning (and sanitizing) schedule of:

1. What is to be cleaned?
2. Who is to do the cleaning?
3. When to clean (frequency; daily, weekly, monthly)?
4. How to clean (equipment and supplies to clean floors, hoods and filters, slicers, food-contact surfaces, etc.)?
5. Cleaning equipment and supplies must be stored separately from food.
6. Wiping clothes should be kept clean, stored in a sanitizing solution; the use of sponges is not recommended.
7. Clean up spills immediately because:
   * Food soil is difficult to clean when dry
   * Floors can get slippery (safety hazard)
   * They can attract pests (roaches, flies, rodents)
   * The surrounding floor area may be tracked up
   * Regular and adequate cleaning (housekeeping) of a facility promotes a sanitary physical plant and equipment used in a good service operation.

PEST CONTROL *(ROACHES, FLIES, RODENTS)*

1. Keep garbage containers clean (use plastic bag liners) and covered when not in continuous use.
2. Deprive pests of food and shelter by following satisfactory food protection and sanitation practices:

* Keep areas clean
* Keep foods covered
* Seal all junctures of walls and equipment when there is insufficient space for easy cleaning behind or between equipment (good hiding place for roaches).

3. Prevent entry:
   * Keep doors and windows tight-fitting and shut; door cracks no greater than 1/4 inch to exclude rodents.
   * Doors are self-closing.
   * Provide screens that are tight-fitting and in good repair, with screening less than 16 mesh to the inch being used.
   * Keep water in waste drains (special problem in winter where humidity is low) to keep out rodents and roaches.
4. Be aware of pest indicators:
   * Droppings of roaches and rodents
   * Tracks and rub marks of rodents along the floor and wall juncture.
5. Extermination should be planned with a licensed pest control personnel on a routine basis; no chemicals should be used by food service personnel for pest control activity
6. For fly control, "fly paper" (non-chemical) should be used outside only (away from food). No chemical resin strips are to be used. Air curtains, UV traps, and close-fitting, self-closing doors are also helpful.

DISH WASHING

1. Mechanical

- Pre-scrape and pre-rinse dishes and utensils
- Wash temperature should be approximately 140 - 160 degrees F.
- No overloading or improper racking.
- Spray arms should be kept free of food particles and other obstructions; pumps operating properly.
- Temperature and pressure gauges working.
- Unit should be cleaned at least once daily or more often if needed.
- Removal from racks and sorting done in a sanitary manner.
- Dishware and utensils air dried - no towel drying.
- If a high temp. sanitizing unit: rinse temperature should be min.180 degrees F.
- If a chemical sanitizing unit: obtain sanitizer test strips to monitor solution strength of rinse cycle
- Air dry - do not use towels.

2. Manual

a. Pre-scrape and pre-rinse.

b. Wash - use a good detergent; wash water at 110 - 120 degrees F.

c. Rinse thoroughly with clear hot water.

d. Sanitize - hot water at 180 degrees F or use an approved chemical (chlorine, iodine, or quaternary ammonium, at the proper concentrations for the proper length of time.

e. Air dry - do not use towels.

FAILURE OF EQUIPMENT

1. Close the food service establishment if:
   * You have extended electrical outage
   * Loss of water supply (or extended problems)
   * Sewage backup problems
   * Extreme, out-of-control pest infestation
2. Make sure an ample supply of disposable dishware and utensils are on hand in case of dishwasher problems.
3. Notify health authorities; get advice and/or ask for help.

3. VECTOR BORNE DISEASES

INTRODUCTION

Important vectors/carriers which can spread the disease across the international boundaries include mosquitoes, rat fleas, sand flies, tsetse flies (vectors) and rodents, houseflies, cockroaches (carriers)

A. Important Vectors and diseases transmitted by them are as follows:-

1. Mosquitoes:

Anopheles transmit **malaria** through 9 species out of which six are important; *culicifacies, stephensi, dirus, fluviatilis, minimus and epiroticus (sundaicus)*. *Aedes aegypti* and *Aedes albopictus* are vectors for **Yellow fever, Dengue/ DHF**, **Chikungunya, Zika Virus** disease**,** and. *Culex vishnui* subgroup transmits **Japanese Encephalitis**. **Lymphatic filariasis** is transmitted by a genera of mosquitoes; *Culex, Aedes*, and *Mansonia*

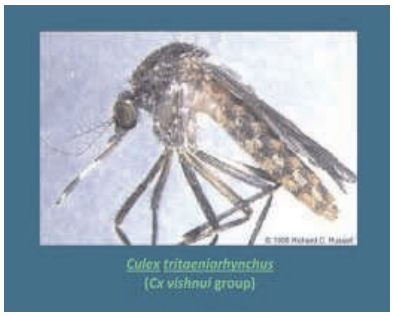
Fig. no.3.1- Different important mosquito vectors

An. stephensi

Aedes aegpyti

Aedes albopictus

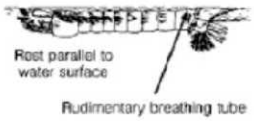
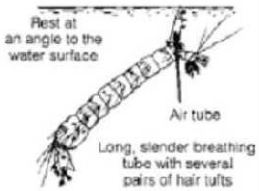
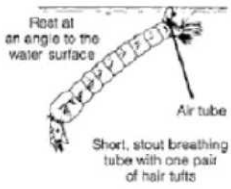
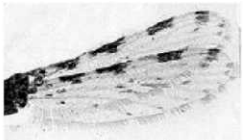
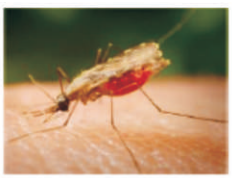
Culex quinquefasciatus



Cx. tritaeniorhynchus

Mansonia spp.

Table no. 3.1- Depicts the differentiating features of four public health important types of genera found in India; ***Anopheles, Aedes, Culex*** **and** ***Mansonia***.

ANOPHELES	CULEX	AEDES	MANSONIA
Larva:  	 	 	
Floats horizontally parallel to water surface, exclusively surface feeder **Very active with swift movement**	**Hangs down at an angle of 45° to the water surface with head downwards** **Whip-like or 'figure C' snake like movement**	**Hangs down at angle of 45° to water surface with head downwards Characteristic 'S' shaped or 'figure 8 ' movement, which involves all parts of the body**	**Larvae are attached to the rootlets of aquatic plants by theisiphon tubes. They obtain their air supply from these rootlets**
Adult: **Resting** 			
Rests inclined at an angle of 45° to the surface, proboscis and body in same straight line	**Rests parallel to the surface, probosics and body at an angle to one another**	**Rests parallel to the surface, probosics and body atan angle to one another**	**Rests parallel to the surface, probosics and body at an angle to one another**
Wings 			
Generally spotted with white and dark scales	**Generally unspotted with only dark scales**	**Dark scales with brown/ black color**	**Dark brown and pale scales; scales broad with cutoff tip**
Abdomen & legs 			
Abdomen Completely or largely devoid of scales	**Uniform layer of over lapping flat white and dark scales on the abdomen**	**Black and white basal band on abdomen and legs**	**Big, black or brown mosquitoes with sparkling on their wings and legs**

2. **Rat Fleas** : There are four important species of rat fleas that are vectors of plague viz; *X. cheopis* , *X. astia* , *X. brasiliensis* and *P. irritans*.

Rat Flea

3. **Other Important vectors and diseases transmitted by them are as follows:-**

- **Sandflies: L**eishmaniasis, Sandfly fever (phelebotomus fever)

Sand fly

- **Tsetse flies:** Sleeping sickness (African trypanosomiasis).

Tsetse fly

- **Black flies:** Onchocerciasis (river blindness).

Black Fly

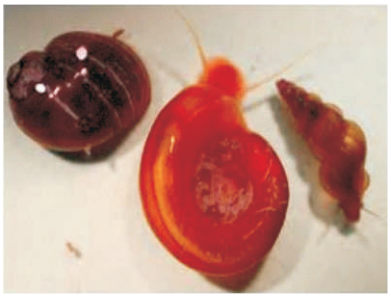
- **Ticks:** Crimean Congo haemorrhagic fever, Lyme disease, Relapsing fever (borreliosis), Rickettsial diseases (spotted fever and Q fever), Tick-borne encephalitis, Tularaemia.

Ticks

- **Triatomine bugs-** Chagas disease (American trypanosomiasis).

Triatomine Bug

- **Aquatic snails-** Schistosomiasis (bilharziasis).



Snails

B. Important Carriers and diseases transmitted by them are as follows:-

1. Common House Fly:

The **common housefly**, *Musca domestica*, lives in close association with people all over the world. The insects feed on human foodstuffs and wastes where they can pick up and transport various disease agents and act as carrier of diseases. Some of the diseases which are transmitted by houseflies include **typhoid, diarrhoea, eye inflammation, cholera polio.**

House Fly

2. Blue bottle fly and Green bottle fly are also close association with human habitation and they are also carriers of the above diseases.

Blue Bottle Fly

Green Bottle Fly

3. **Cockroaches** are proven or suspected carriers of the organism causing; **diarrhea, dysentery, leprosy, plague, typhoid fever** – **viral disease** such as **poliomyelitis**. In addition they carry the eggs of parasitic worms and may cause allergic reaction, including dermatitis, itching, swelling of the eyelids and more serious respiratory conditions.

Cockroach

Rodents

Rodents play a key role in transmission of infectious agents in addition to being hazards by their activities. Rodents are carriers of viral, **rickettsial and bacterial disease.** The causative agents could enter our body by four different ways:

- Through the ecto-parasites of rat like **fleas, ticks and mites.**
- By food or water contaminated by rodent excreta.
- Through direct contact with rodent excreta
- By rat bite.

In India, there are 104 species of rodents of which 8 are considered to be the zoonotic reservoir of various communicable diseases. Among these, five species of rodents namely *Rattus rattus, R. norvegicus, Mus musculus, Bandicoota bengaliensis and B. indica* are synanthropic i.e, they live in close association with man and play important role in the transmission and spread of various rodent borne diseases viz., plague, leptospirosis, scrub typhus, salmonellosis and Kyasanur Forest Disease.

BOX NO. 3.1 VECTOR SURVEILLANCE- METHODS FOR DETECTING AND MONITORING LARVAL AND ADULT MOSQUITO POPULATION

A. LARVAL COLLECTIONS

1. Dipping
2. Netting- large water bodies
3. Pipetting- for shallow breeding sites, narrow tree holes, axils of leaves.
4. Mansonia aquatic stages- 1 X 1 foot^2 bottom tin/ wooden tray kept on floating vegetation and number of plants are counted. Plants are then removed in another enamel tray and shaken well to disentangle the larvae from roots. Number of larvae and pupae removed per plant is then counted.

B. ADULT COLLECTIONS

1. By suction tube/ aspirator
2. By test tube
3. Bait collection
4. Spray sheet collection: Applied during early morning (6.30 AM to 10.00 AM).
5. Trap collection- window trap, magoon trap, light trap.
6. Oviposition traps/ ovitraps.

Table no. 3.2: Features of common rodent species of medical importance.

Species	***Rattus norvegicus***	***Rattus rattus***	***Mus musculus***
Common name	Brown rat or Norway rat	Roof rat or black rat	House mouse
Weight (gm)	500	250	20
Length (cm)	45	40	18
Habitat	Lives in sewers, holes, feeds on garbage	Under the roof of any type of building	Around supplies of grain, cereals, and flour
Different types of Rats	 **Brown Rat**	 **Black Rat**	 **House Mouse**

RATIONALE

Diseases such as malaria, dengue/DHF, Chikungunya, Lymphatic Filariasis, Japanese Encephalitis, yellow fever, Zika virus (by mosquitoes); Leishmaniasis(by sand flies) plague (rat fleas); sleeping sickness (tsetse fly); leptospirosis, are vector-borne diseases that pose major public health risks via PoE to a non-endemic area. As per IHR area within 400 meter radius at all the PoEs should be free from vectors. The importation of vectors from countries where certain diseases are endemic into countries where they are not endemic may have dire consequences: transmission of disease, establishment of vector and need for an appropriate control programme.

Integrated Vector Management (IVM) is a key to control vectors at Points of Entry. IVM planning cycle is illustrated in Figure no. 3.6. A situation analysis consisting of epidemiological assessment, vector assessment and prioritization of disease and areas for intervention is done. Appropriate control measures are selected based on situation analysis. Needs assessment for the area and available resources is done, followed by implementation of appropriate control measures. Effectiveness of control measures is monitored through entomological surveillance. Feedback from evaluation is further used to analyse the situation and make required changes in the process of IVM.

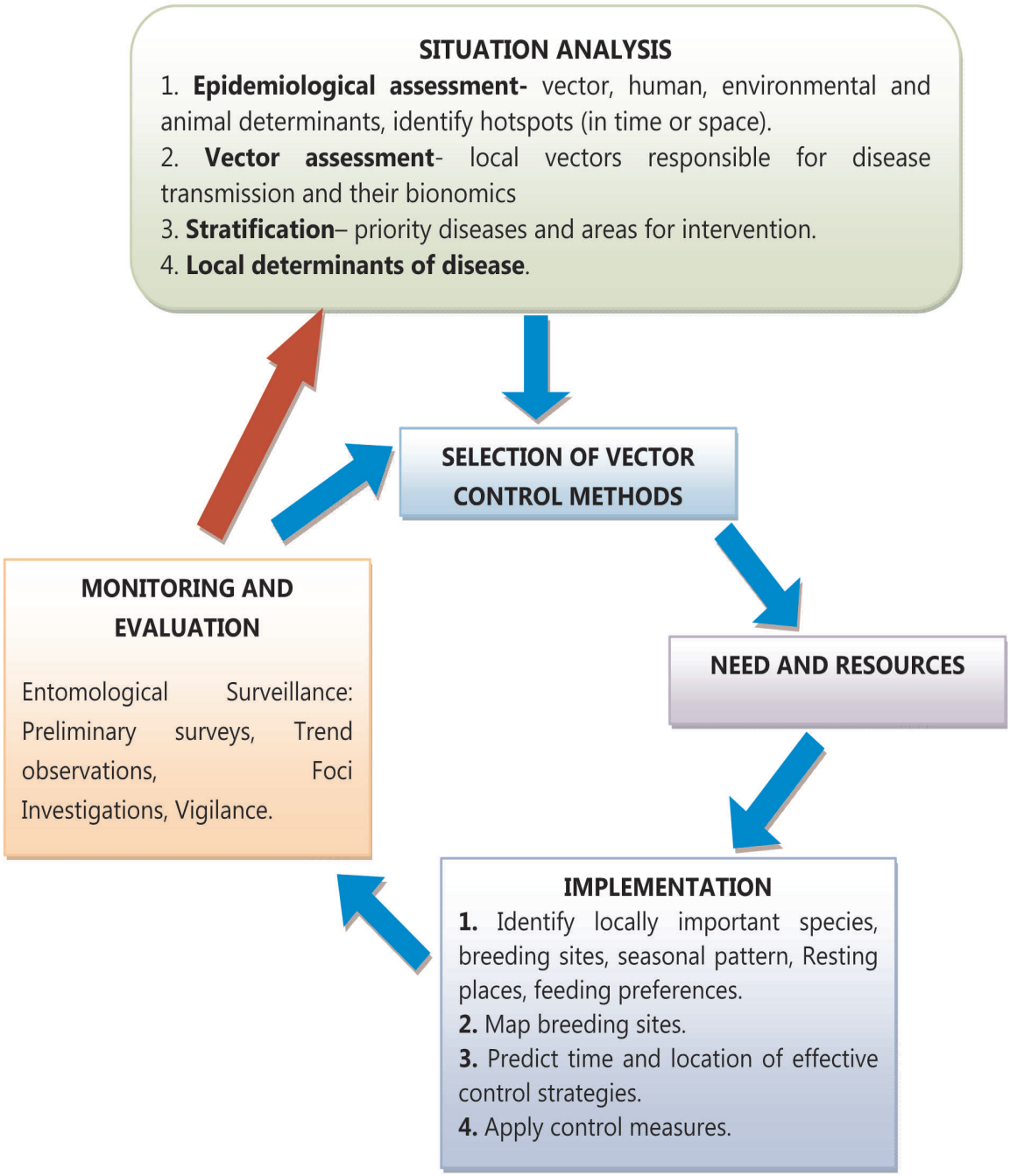


Fig. no. 3.2: IVM Planning Cycle

Various well-tested vector control measures are as follows:-

A. Mosquitoes control measures:

1. Environmental management:

- Source reduction- Environmental methods of controlling mosquito breeding including source reduction minor engineering works, by filling ditches, pits, low lying areas, streamlining, canalizing, desilting, deweeding, trimming of drains, water disposal and sanitation, emptying water containers once in a week and observing weekly Dry Day.
- Environment sanitation is very important for controlling houseflies, rodents and cockroaches.
- Proper storage of grains and foodstuff

2. Mechanical control:

- Window and door screening.
- Drilling holes in fenders for drainage.
- Removal and safe storage of scrap.
- Rat proofing of dwelling units and plugging of rodent burrows with concrete.

3. Biological control:

- Larvivorous fish: like *Gambusia affinis* and *Poecilia reticulata* (Guppy) are also used in certain situations where the chemical control is not feasible.

Gambusia affinis *Poecilia reticulata*

- Biological larvicides : Two species of endotoxin bacteria are recommended under NVBDCP- *Bacillus thuringiensis* serotype H-14 and *Bacillus sphaericus* for control of aquatic stages of vector mosquitoes.

4. Chemical control/ insecticide treatment:

Larvicidal application: Recurrent anti-larval measures at weekly intervals with approved chemical larvicides to control the vector mosquitoes are recommended. The following chemical larvicides are used in the programme: Temephos (as 50% emulsion concentrate, as 1% granules to deliver dose of 1ppm), Insect Growth Regulators (Pyriproxifen, Diflubenzuron).

Adulticides application-

1. For Indoor Situations:

- Indoor residual spraying: **Malathion25% WP**, Deltamethrin2.5% WP, Cyfluthrin 10% WP,

Alphacypermethrin 5% WP, Lambdacyhalothrin 10% WP and Bifenthrin 10 WP are to be used as per the NVBDCP program.

- Indoor space spraying: Pyrethrum extract, Cyphenothrin

2. For Outdoor Situations:

- Outdoor spraying (fogging)- Malathion , Cyphenothrin

3. Both Indoor & outdoor Situations:

- Insecticide treated material/ special circumstances
- **Repellents: R**epellents like Benzyl benzoate, Diethyl tolumide (DEET), Diethyl phthalate (DMP) on exposed parts of the body sparing eyes and other sensitive parts of the body to avoid flea bite.

B. Rat Fleas Control:

1. **Dust formulation:** The most rapid and effective method of controlling the fleas is the application of an insecticidal dusting powder and it is called as *insuffalation* Malathion 5% dust powder (1 part of 25% WP) is used. Insecticide dust applied on rodent runways and burrows is more effective in controlling fleas. The insecticide can be used at 8 weekly intervals.
2. **Residual insecticidal spray for flea control:** The use of residual sprays may be undertaken in lower parts of the walls up to one metre above ground level in residential areas. The residual spray of malathion and synthetic pyrethroids may be carried out at 6-8 weeks and 10-12 weeks intervals respectively.The residual spray of insecticide is undertaken for flea control with the use of following spray formulations:

   Malathion 25% WP: Malathion suspension is applied @ 2.0 gm/m^2 of active ingradient.

   Synthetic pyrethroids: Generally the use of synthetic pyrethroids should be avoided but may be used during emergent situations.

   Deltamethrin 2.5% WP: The suspension is applied @ 20.0mgm/ m^2 of active ingredient.

   Cyfluthrin 10% WP: The suspension is applied @ 25mgm/ m^2 of active ingredients.

   Lambdacyhalothrin 10% WP: The suspension is applied @ 25mgm/ m^2 of active ingredients.

C. Sand Flies Control Measures

1. Sanitation:

Removal of shrubs and vegetation, filling of cracks and crevices in the wall & floor and distance of cattle sheds and poultry from human habitations.

2. Indoors Applications:

House, offices, pet – house, etc have been infested by sand flies, then below listed steps need to followed.

- **Vacuuming** – Vacuum every nook and corner of the house, especially the carpets. If you come across any cracks in walls, floors, ceiling, window panels, etc then vacuum these as well. It has been proven the vacuuming kills adult and eggs of sand flies.

- **Steam Cleaning** – Steam cleaning is another most powerful way to kill eggs, larvae, pupae and adult sand flies. Reason being that sand flies cannot sustain in very high temperatures and while steam cleaning the temperature will rise to 1030 degrees eradicating the sand flies.
- **Closing cracks and gaps** – If you have come across any cracks/gaps in walls, floor, ceiling, window panels, door panel then you would need to close them out after vacuuming properly. This will prevent sand flies for future infestation as they love to breed in cracks.
- **DEET Insect Repellent** – After cleaning the house properly, spray the DEET Insect Repellent. You could easily find them in the shopping store next to your house.
- **Insecticides** –Easily spray insecticides inside the house to exterminate sand flies. However make sure that you follow the instructions written on the insecticide carefully, in some cases you might need to keep children and pets outside the sprayed area for couple of hours.

3. **Outdoors Applications:** Garbage can, garden, lawn, etc have been infested by sand flies, then below listed steps need to followed.
   - **Boric Acid** – If the sand flies have infested your garbage can then just put some boric acid on the floor near garbage can.
   - **Diatomaceous Earth** – If the infested area is sand, soil or any moist area then you can sprinkle diatomaceous earth. However you would need to sprinkle it again in case of a shower or rain.
   - **Insecticides** – If your garden or lawn is infested then you could spray insecticides.

D. Housefly Control Measures

1. **Environmental Sanitation:**

   The key to managing all filth flies is *sanitation*. Eliminating fly breeding sites, i.e., the material to which they are attracted to and on which they lay eggs, is usually sufficient to eliminate and prevent fly infestations. Conversely, without thorough sanitation, other control methods are largely ineffective. Therefore, trash should be kept in sealed containers (in trash bags and/or cans with tight-fitting lids). Dumpsters should be kept as clean as possible, emptied regularly and kept as far away from buildings as is practical. Manure and other decaying plant and animal material should be promptly removed. Also, eliminate areas of excessive moisture.

2. **Inspection:**

   Just as sanitation is the key to successful filth fly management, *inspection* is the key to sanitation. To eliminate fly breeding sites, one must first locate the attracting material. Often this can only be accomplished by conducting a thorough inspection of the premises, and by knowing what to look for and where to look. First, identify the flies involved, inspect for material that attracts the species and then eliminate the material.

3. **Exclusion:**

   Another important step in fly management is to exclude them from the premises. This is done by keeping doors, windows and vents closed as much is practical, and by screening and sealing around these and other fly entry points. Automatic door closing devices and air curtains that blow air away from doorways also can be installed to supplement an integrated fly management program.

4. Mechanical Control:

In addition to fly swatting, mechanical fly control includes **Trapping. Sticky fly paper** is one type of fly trap. Ultraviolet light traps are another, often used to supplement fly control in commercial buildings. To be effective light traps must be properly placed. This type of trap should be placed where it cannot be seen from outside the building, no more than 5 feet above the floor (where most flies fly), and away from competing light sources and food preparation areas. Bulbs should be changed at least once per year.

Fly Light Trap

Sticky Fly Paper Trap

5. Chemical Control:

While the use of pesticides is usually *not* the best means of managing filth fly problems, sometimes chemical control can be a valuable component of an integrated fly management program. Pesticide-releasing fly strips can be placed in attics and smaller, *unoccupied* closed rooms where filth flies are a problem. Contact (*non-residual*) pesticides labelled for fly control can be applied as a space treatment ("fogged") to kill adult flies. This type of control provides only temporary relief and cannot be relied upon to eliminate the problem. *Residual* pesticides – those that remain active for some time – can be applied to *outdoor* surfaces where flies rest, such as the outside surfaces of barns, stables, restaurants and houses. Some pesticide bait formulations are also available for outdoor fly control, including use around dumpsters.

E. <u>Cockroaches Control Measures:</u>

1. Environment Management & Reduction of accessibility-

- ***Leave no food for cockroaches***

  a. Keep premises, especially kitchen, dry and clean

  b. Store food properly and remove pet food completely after feeding

  c. Put all refuse and food remnants into a bin with well-fitting lid. Contents of the dustbin must be emptied completely at least daily. Refuse bags should be tied up before disposal to prevent spilling.

- ***Eliminate Harborages for Cockroaches***

  a. Clean up refuse and unused articles especially old newspapers and magazines at homes;

  b. Inspect at least quarterly the bottom and back of furniture and concealed places like false ceilings, air ducts and wire ducts; and

  c. Seal any cracks and crevices at ceilings and on walls and floor.

2. *Stop Cockroaches from entering premises*

a. Install drain covers (without openings) which can be opened for the discharge of the drainage water. Replace them if they are found damaged;

b. Seal all openings on external walls, floors and roofs through which pipes and wires pass or left by installation of split-type air-conditioners;

c. Apply a band of petroleum jelly at least 10 cm in width around dry drain hole to prevent cockroach from passing through the hole; and

d. Install wire mesh of 2mm at drain holes for preventing entry of *Periplaneta americana*.

3. *Trapping*

a. Use sticky traps at places frequented by cockroaches. Whenever possible, place traps either against a wall or in a corner of a floor, a shelf or a drawer

4. *Poisoning (Chemical Control)*

Use insecticide with residual effect for killing the pest by contact;

1. Set poisonous bait to kill cockroaches. The bait will not only kill those cockroaches consuming the bait but also those in the harborage indirectly;

   Caution must be taken when using insecticides. Follow strictly the application instructions on the label to avoid harming people and animals.

2. Boric Acid: mixed with condensed milk and *besan (lentil flour)* will act as to control cockroaches. During the initial phase of the cockroach control the paste has to be reapplied weekly once for a month. Then depending on the control, the timing of reapplication can be extended to 2 weeks & then to 3 weeks.

5. *Handling of dead cockroaches*

a. Wear gloves when handling dead cockroaches.

b. Areas or equipment including the gloves having contacted with cockroaches should be washed and disinfected with household disinfectant as soon as possible

F. <u>Rodents Control</u>

1. Environmental & Sanitation:

Sanitation is fundamental to rat control and must be continuous. If sanitation measures aren't properly maintained, the benefits of other measures will be lost and rats will quickly return. Good housekeeping in and around buildings will reduce available shelter and food sources for Norway rats and, to some extent, roof rats. Neat, off-the-ground storage of pipes, lumber, firewood, crates, boxes, gardening equipment, and other household goods will help reduce the suitability of the area for rats and also will make their detection easier. Collect garbage, trash, and garden debris frequently, and ensure all garbage receptacles have tight-fitting covers. Where dogs are kept and fed outdoors, rats can become a problem if there is a ready supply of dog food. Feed your pet only the amount of food it will eat at a feeding, and store pet food in rodent-proof containers.

2. **Rodenticides (Chemical Control):**

   a) **Anticoagulants-** Warfarin, fumarin, arsenic trioxide etc. are multiple dose baits; they cause internal haemorrhage and slow deaths in 4-10 days. They are slow acting, effective and safe rodenticide and marketed as 0.5% concentrate powder.

   b) **Zinc phosphate:** is a single dose rodenticide, when moist it slowly releases the phosphine gas, which kills the rat and fleas.

   c) **Aluminium phosphide tablets:** Two pellets of 0.6 gm/burrow is applied in the burrow, they are closed with wet mud for killing the rodents. It may be used for killing the wild rodents in active burrows, however it should never be used in the domestic and peridomestic situation because of its high toxic effect on human beings.

   d) **Fumigants:** Cyanogas is pumped into the burrow by using "cyanogas pump". About 56 gm dust is pumped into each burrow after closing the exit openings and burrow is then promptly sealed with wet mud and the hydrogen cyanide gas released will kill the rodent as well as the fleas.

Persons involved in the clean-up of heavy rodent infestations should wear the protective equipment listed here:

- coveralls (disposable, if possible);
- rubber boots or disposable shoe covers;
- rubber, latex, or vinyl gloves;
- protective goggles;
- An appropriate respiratory protection device, such as a half-mask air-purifying (or negative-pressure) respirator with a high-efficiency particulate air (HEPA) filter or a powered air-purifying respirator (PAPR) with HEPA filters. Follow local and state requirement regarding pulmonary function and fit testing before beginning any work requiring the use of a respirator.
- Personal protective gear should be decontaminated upon removal at the end of the day. All potentially infective waste material (including respirator filters) from clean-up operations that cannot be burned or deep-buried on site should be double-bagged in appropriate plastic bags. The bagged material should then be labeled as infectious (if it is to be transported) and disposed of in accordance with local requirements for infectious waste.

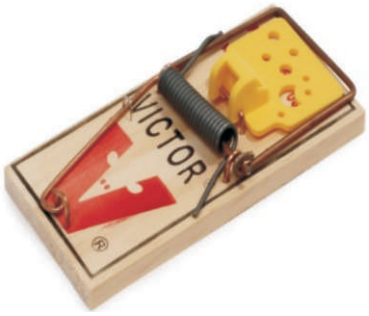
3. **Rodent Control and prevention:** Mass destruction of rats by baiting and trapping should be undertaken during inter epidemic period. During epidemic situations the rodent control activities should be discouraged because the killing of a large number of rodents may result in large number of fleas leaving their dead hosts and give rise to a further increase in plague cases as the flea may attack the human population. Therefore, rat control should always be preceded by measures to control fleas.

4. **Permanent Rodent Bait Stations**

   Using permanent bait stations in a rodent control programme may increase the effectiveness and safety of rodent baits. Permanent bait stations are useful as they protect the baits from dust and rain, the baits are most acceptable to the target animals while keeping non target animals and children away from baits, provide a protected place for rodents to feed thereby allowing them to feed more securely, Allow to attract and kill rodents from the inaccessible/ vast areas, Easy monitoring, cleaning and replacement of baits, help in studying the impact of rodenticides on rodent density and bait shyness.

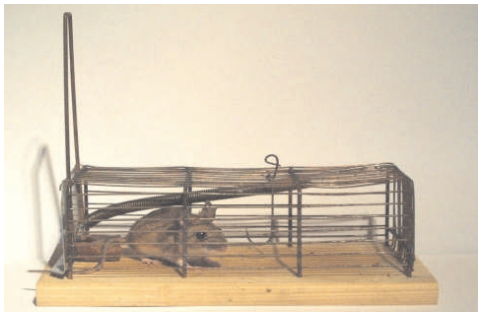
5. **Rodent Traps-** like snap traps, live capture traps, glue boards and baiting the traps.(Further details on Integrated vector management are available at: http://www.nvbdcp.gov.in/iec.html)

Fig. No 3.3-Different Types of Rodent Traps



Snap Mouse Trap

Glue Mouse Trap



Live-Catch Mouse Trap

Bucket Mouse Trap

BOX NO. 3.2 INTEGRATED VECTOR MANAGEMENT FOR MOSQUITOES UNDER NVBDCP

- A package of vector control interventions against **dengue** is advised, targeting both immature and adult stages. Evidence base on vector control against dengue is poor.
- Control programmes should monitor the effectiveness of their interventions.
- **Larval source** management should be in place for routine control.
- **In case of outbreak, additional interventions like IRS, fogging or ultra low volume (ULV) spray should be implemented.**
- The evidence for aerial or truck mounted ULV is limited as such interventions have no sustained impact on mosquito populations, is not cost effective during outbreaks and efficacy is variable.
- Vector control interventions are same for urban and rural areas.
- Surveillance on insecticide resistance is critical for deciding the type of insecticide which should be used. Surveillance of resistance is done by ICMR, NIMR and Zonal entomologist. Vector management for malaria is done on the basis of API and ecotype. Details can be downloaded from:

  http://www.nvbdcp.gov.in/Doc/IVM10_March_2016.pdf

BOX NO. 3.3 DISPOSAL OF REMAINS OF INSECTICIDES AND EMPTY PACKAGING

1. At the end of spray activities, the inside of the spray pump should be washed and any residual insecticide should be flushed from the lance and nozzle.
2. The rinsing water should be collected and carefully contained in clearly marked drums with a tight fitted lid. This should be used to dilute the next day's tank loads or disposed properly by the supervisor at disposal sites, i.e. pits or digs.
3. NEVER POUR THE REMAINING INSECTICIDE INTO RIVERS, POOLS OR DRINKING WATER SOURCES.
4. Decontaminate containers where possible. For glass, plastic or metal containers this is done by triple rinsing: part filling the empty container with water three times and emptying into bucket or sprayer for the next application.
5. All empty packaging should be returned to the supervisor for safe disposal according to national guidelines.
6. Never re-use empty insecticide containers.
7. It is the duty of manufacturers, formulators of insecticides and operators to dispose packages or surplus materials and washing in a safe manner so as to prevent environmental or water pollution.
8. The used packages shall not be left outside to prevent their re- use.
9. The packages shall be broken and buried away from habitation.
10. The expired stock should be returned to manufacturer for disposal as per guidelines preferably through incineration process.

VECTOR CONTROL: CONVEYANCES (AIRCRAFT)

Activity on arrival of aircraft/ cargo

All the International flights coming to India has to undergo following standard procedure:-

A. Examination of document of all incoming International Aircrafts:

i. On arrival all international flights, captain/cabin crew in-charge has to submit to the Health authorities of the airport General Declaration of Health (GD) and passenger Manifest.

ii. Health official inspect/verify health declaration portion *of GD* for any on-board death and for disinsection/ sanitation details (fumigation) in the General Declaration of Health (GD) for place, time, date and method used for fumigation.

iii. Health official may inspect the conveyance for presence of vectors (mosquitoes): If vector is found in Aircraft or Disinsectization of the craft was not done or inappropriate, then fumigation spray is to be done in the aircraft.

iv. Travel details of the sick traveller and contacts are examined from GD.

v. The Health official arranges for necessary transportation and medical services for sick traveller.

vi. Identification of passengers with whom the sick traveller came in contact during his journey can be traced through *Passenger Manifest*.

B. Luggage & baggage: No routine inspection or health measures are required to be undertaken for luggage & baggage

Activity on departure of aircraft/ cargo:

No routine inspection or health measures are required to be undertaken for the travellers or conveyances for international departure. In case of PHEICs occurrence the measures are to be taken as per direction from the Government of India.

WHO defines "**disinsection**" as the procedure whereby health measures are taken to control or kill the insect vectors of human diseases present in baggage, cargo, containers, conveyances, goods and postal parcels. Details of various aircraft disinsection methods are elaborated in Table no. 3.2

Rodent control

Aircraft occasionally have to be fumigated by highly trained, licensed operators if **rodents** are present or if there is a very severe **cockroaches** infestation. This requires the aircraft to be taken out of service for **7–15 hours**. The airport health authorities and aircraft management are informed of any fumigations being carried out.

Pest control:

Passenger aircraft are regularly treated with insecticides for the control of **cockroaches and other insect pests** in the galley and toilet areas. Some of the insecticides applied, both as residuals and ultra-low-volume aerosols, are the same as those used for controlling insects of public health importance. Pest control treatments are carried out once a month or immediately on the return of aircraft to their base if cockroaches or biting insects have been seen especially by crew members.

Table no. 3.3 Methods of Disinsection of Aircrafts

S. No.	Method	Details	Insecticide
1.	***Residual disinsection***	Regular spraying of certain internal surfaces of the aircraft cabin (excluding food preparation areas) and hold with a residual insecticide. Treatment must be repeated at intervals not exceeding 8 weeks.	Permethrin 25:75 (cis:trans) emulsifiable concentrate at a target dose of 0.2 g/m2
2.	**Pre-flight *cabin disinsection***	Aerosol containing an insecticide with rapid action and limited residual action is applied by ground staff to the flight deck, passenger cabin including toilet areas, open overhead and side-wall lockers, coat lockers and crew rest areas. The treatment lasts for the duration of the single flight sector. Applied before the passengers have boarded but not more than 1 hour before the doors are closed. Pre-flight spraying is followed by a further in-flight spray (i.e. top-of-descent)	A 2% permethrin cis: trans (25:75) formulation @ of 35 g per 100 m^3.
3.	***Blocks away disinsection***	Treated by cabin crew members by discharging aerosols at the prescribed dosage. Crew must treat all possible insect harborages, including toilets, galleys, wardrobes and lockers. Fight deck are sprayed before departure and before boarding by the crew. Cargo holds should be disinsected when the passengers are on board, after closure of the cabin door and before the flight takes off,	2% d-phenothrin @ of 35 g per 100 m^3
4.	**Top-of-descent**	Top-of-descent spraying is carried out as the aircraft starts its descent to the arrival airport	2% d-phenothrin @ of 35 g per 100 m^3
5.	**Pre-embarkation disinsection**	Treatment of interior aircraft surfaces with a water based solution containing 2% permethrin, on the ground when no passenger are on board and about 1 hour before the departure of aircraft.	2% permethrin

Disinsection for specific disease agents:

Ebola virus disease:

Ebola is killed by a range of disinfectant agents **including sodium hypochlorite**, lipid solvents, phenolic disinfectants, peracetic acid, methyl alcohol, ether, sodium deoxycholate, 2% glutaraldehyde, 0.25% Triton X-100, β-propiolactone, 3% acetic acid (pH 2.5), formaldehyde and paraformaldehyde, and detergents such as sodium dodecyl sulphate (SDS).

MERS-CoV/H1N1/SARS

1% Virkon is a multi-purpose disinfectant. It contains oxone (potassium peroxymonosulfate), sodium dodecylbenzenesulfonate, sulfamic acid, and inorganic buffers. It is typically used for cleaning up hazardous spills, disinfecting surfaces and soaking equipment. The solution is used in many areas, including hospitals, laboratories, nursing homes, funeral homes, dental and veterinary facilities, and anywhere else where control of pathogens is required. Virkon has a wide spectrum of activity against viruses, some fungi, and bacteria.

However, it is less effective against spores and fungi than some alternative disinfectants.

Abstract:

Peroxygenic acid, under the brand name Virkon®, has unleashed great debate following contradictory reports of its efficacy and spectrum of activity. The aim of this study was to test the biocidal activity of the compound against 10 different micro-organisms, following standard in-vitro test procedures. Bactericidal, fungicidal and sporicidal activities were determined using quantitative suspension and germ carrier tests and virucidal activity was assessed using a simple dilution suspension test, following the Association Française de Normalisation (AFNOR) guidelines. One percent Virkon® has demonstrated bactericidal activity against:

Pseudomonas aeruginosa, *Escherichia coli*, *Staphylococcus aureus*, *Enterococcus hirae* and *Mycobacterium smegmatis, P. aeruginosa*, *E. coli*, *S. aureus* and *E. hirae*.

One percent Virkon® showed virucidal activity against poliovirus in the suspension test. However, this concentration did not comply with sporicidal and fungicidal activity guidelines. In conclusion, 1% Virkon® is effective only against vegetative bacteria, yeasts and viruses, and should therefore be considered a low-level disinfectant.

FOR AERIAL DISINFECTION:

To replace dangerous and ineffective formalin fumigation in empty farm buildings and veterinary hospitals. Shutdown the ventilation system during the disinfection. Use a mechanical fogging machine as part of terminal disinfection routine with a 1% w/v solution of Virkon®. Apply at a rate of one litre of solution per 100 m^3 with particle size not exceeding 70 microns in order to get a minimal contact time of 10 minutes with microorganisms in the air. Leave the room during the fogging. Users and animals may re-enter the treated area once the fog has dispersed. No rinsing is required after fogging.

www.drugs.com/vet/virkon-disinfectant-cleaner-p-w-s-virucide-can.html

Micoorganisms for which a dilution rate of Virkon® >1% w/v or a contact time >10 minutes are required.

Microorganism	Effective Dilution of Virkon®	Contact Time Required (minutes)	Test Method
Aspergillus fumigatus	3%	10	AOAC Fungicidal Test
Bovine Papilloma Virus	1%	30	VLA, UK Method
Dermatophilus congolensis	*2%*	*10*	*AOAC Use Dilution Test*
Fusarium moniloforme	2%	10	AOAC*
PRRS Virus	0.5%	30	VLA, UK Method
Salmonella enteritidis	*2%*	*10*	*AOAC Use Dilution Test*
Trichophyton mentagrophytes	2%	10	AOAC*

** Modification of AOAC Fungicidal Test*

Table 2:

Viruses for which a 1% w/v dilution rate of Virkon® and a contact time of 10 minutes are known to be effective.

Viruses	Effective dilution of Virkon®	Contact time required (minutes)	Test method
Avian Infectious Bronchitis Virus	1%	10	AOAC*
Avian Influenza Virus	1%	10	AOAC*
Avian Laryngotracheitis Virus	1%	10	AOAC*
Bovine Adenovirus Type 4	1%	10	EPA Method
Bovine Viral Diarrhea (BVD) Pestivirus	1%	10	EPA Method
Calf Rotavirus	1%	10	EPA Method
Canine Parvovirus	1%	10	EPA Method
Duck Adenovirus	1%	10	EPA Method
Equine Arteritis Virus	1%	10	EPA Method
Equine Herpes Virus Type 1	1%	10	EPA Method
Equine Herpes Virus Type 3	1%	10	EPA Method
Equine Influenza Virus Type A	1%	10	EPA Method
Feline Calicivirus	1%	10	EPA Method
Feline Panleukopenia Virus	1%	10	EPA Method
Feline Rhinotracheitis Virus	1%	10	EPA Method
Infectious Bovine Rhinotracheitis Virus	1%	10	EPA Method
Infectious Bronchitis Virus	1%	10	AOAC*
Infectious Bursal Disease (Gumboro) Virus	1%	10	AOAC*
Infectious Canine Hepatitis Adenovirus	1%	10	EPA Method
Newcastle Disease Virus	1%	10	AOAC*

Parainfluenza Virus	1%	10	EPA Method
Parvovirus	1%	10	EPA Method
Pseudorabies Virus	1%	10	EPA Method
Simian Virus 40 (SV40)	1%	10	EPA Method
TGE-Coronavirus	1%	10	EPA Method
Turkey Herpes Virus	1%	10	EPA Method

** Modification of the AOAC Germicidal Spray Test*

Table 3:

Bacteria for which a 1% w/v dilution rate of Virkon® and a contact time of 10 minutes are known to be effective.

Bacteria	**Effective dilution of Virkon®**	**Contact time required (minutes)**	**Test method**
Actinobacillus pleuropneumoniae	*1%*	*10*	*AOAC**
Bordetella avium (Alcaligenes faecalis)	*1%*	*10*	*AOAC Use Dilution Test*
Bordetella bronchiseptica	*1%*	*10*	*AOAC Use Dilution Test*
Brucella abortus	*1%*	*10*	*AOAC Use Dilution Test*
Helicobacter pylori (Campylobacter pyloridis)	*1%*	*10*	*AOAC Use Dilution Test*
Campylobacter jejuni	*1%*	*10*	*AOAC**
Chlamydia psittaci	*1%*	*10*	*EPA Method*
Erysipelothrix rhusiopathiae	*1%*	*10*	*AOAC Use Dilution Test*
Escherichia coli	*1%*	*10*	*AOAC Use Dilution Test*
Haemophilus somnus	*1%*	*10*	*AOAC Use Dilution Test*
Klebsiella pneumoniae	*1%*	*10*	*AOAC Use Dilution Test*
Listeria monocytogenes	*1%*	*10*	*AOAC Use Dilution Test*
Moraxella bovis	*1%*	*10*	*AOAC Use Dilution Test*
Mycoplasma gallisepticum	*1%*	*10*	*AOAC Use Dilution Test*
Pasteurella hemolytica	*1%*	*10*	*AOAC Use Dilution Test*
Pasteurella multocida	*1%*	*10*	*AOAC Use Dilution Test*
Pseudomonas aeruginosa	*1%*	*10*	*AOAC Use Dilution Test*

Salmonella choleraesuis	*1%*	*10*	*AOAC Use Dilution Test*
Salmonella typhimurium	*1%*	*10*	*AOAC Use Dilution Test*
Serpulina (Treponema) hyodysenteriae	*1%*	*10*	*AOAC Use Dilution Test*
Shigella sonnei	*1%*	*10*	*AOAC Use Dilution Test*
Staphylococcus aureus	*1%*	*10*	*AOAC Use Dilution Test*
Staphylococcus epidermidis	*1%*	*10*	*AOAC Use Dilution Test*
Streptococcus equi	*1%*	*10*	*AOAC Use Dilution Test*
Streptococcus suis	*1%*	*10*	*AOAC Use Dilution Test*
Haemophilus (Taylorella) equigenitali	*1%*	*10*	*AOAC Use Dilution Test*

**Modification of the AOAC Use Dilution Test*

Table 4: Fungi for which a maximum 1% w/v dilution rate of Virkon® and a contact time of 10 minutes are known to be effective.

Fungi	**Effective dilution of Virkon®**	**Contact time required (minutes)**	**Test method**
Candida albicans	*1%*	*10*	*AOAC Use Dilution Test*
Microsporum canis	*0.5%*	*10*	*MHW Guideline, Japan*
Trichophyton verrucosum	*0.5%*	*10*	*MHW Guideline, Japan*

** Modification of AOAC Fungicidal Test*

A00964656/VirkS/IFU/Vetoquinol,Canada/04.12.15/G

NET CONTENTS: Code:

50 x 50 g	02353001	03.05
500 g	01111	03.05
5 kg	02353000	12.15
10 kg	993530	12.15

CONVEYANCES (Integrated Check Posts)

Activity on arrival of conveyances carrying international passengers:

Liaison officer/ operator of conveyance have to submit to the Health authorities the *General Declaration of Health* (GD) and *Passenger Manifest.*

- Health official will examine the *General Declaration of Health* (GD) for travel itinerary to see from where it is coming or is there any health event happened on board during the journey that could pose a public health risk.
- Routinely no passenger is examined unless passenger himself reports to or is reported by conveyance Operator to the health officials.

Affected conveyances are those which have any condition on the board that could constitute a public health risk. Condition like presence of passenger suffering from infectious disease or death of a passenger on board due to infectious disease can constitute Public Health Risk (refer Article 27 of IHR 2005)

Health official will scrutinise the travel itinerary to see if the conveyance is coming from affected area or has passed an affected area*?

YES

- Park in the area ear marked for such conveyances.
- Inspect for the presence of any vector which can transmit the disease and treated accordingly.
- If vector is found in conveyance, then fumigation spray is to be done in conveyance by vector control agency under the supervision of health officer.

NO

No health measure shall be applied to a civilian lorry, train or coach not coming from an *affected area which passes through a territory without embarking, disembarking, loading or discharging (refer Article 26 of IHR 2005)

*Affected area is yellow fever affected area or any other area declared by WHO.

Figure no. 3.4 Application of appropriate measures to conveyances which carry passengers across Integrated Check Posts.

Conveyance carrying goods for the trade purpose in the cargo area:

The procedure for conveyances carrying goods for trade purpose that arrive at ICP is shown in **Fig. no**. 3**.5**

- If any staff member of stakeholders of ICP is reported sick, he or she must be followed up and details are to be recorded.
- On departure side no passenger or conveyance is checked unless there are specific instructions from MOHFW.

Is conveyance carrying goods from the affected area?

YES — **NO**

- Unload goods in earmarked area
- Inspect Conveyance for vectors.
- **IS THE CONVEYANCE SUPPOSED TO BE PARKED FOR ≥1 WEEK?**

YES — **NO**

INSECTICIDE RESIDUAL SPRAY (Except Conveyances carrying fishes)

FUMIGATION (Except Conveyances carrying fishes)

IS THE CONVEYANCE GOING BACK THE SAME

YES — **NO**

NO ACTION REQUIRED

PARK CONVEYANCE SEPARATE FROM THE VEHICLES WHICH ARE COMING FROM AFFECTED AREAS

Figure no. 3.5 Application of appropriate measures to conveyances carrying goods that arrive at Integrated Check Posts.

A. INSPECTION

Inspection is undertaken by observing areas of the ship. The main purpose of the inspection is to confirm that all points of control have been correctly identified, and that any appropriate control measures have been implemented or corrective actions taken. Following documents are examined:

1. **The Maritime Declaration of Health:** It contains basic data relating to the state of health of crew and passengers during the voyage and on arrival at the port, and provides valuable information on:
   - Identification of the ship;
   - Ports of call within past 30 days (to be listed);
   - All crew members and travellers within past 30 days (to be listed);
   - Validity of the existing SSCC and whether re-inspection is required;
   - Affected areas visited.

2. **The International Certificate of Vaccination or Prophylaxis** verifies that crew members and passengers have been vaccinated according to entry requirements.

3. The following additional sources of information may be required for assessment of public health risk: **Management plans** (E.g., water bunkering, food safety, pest control, sewage or waste) An **IMO Ballast Water Reporting Form,** A **medical log**, A **list of medicines**, A **Potable Water Analysis Report.**

4. **Evidence Report Form** is used to enlist the evidence found and measures indicated for containment of public health risk found on board. After the inspection, the inspecting officer should debrief the master about any deficiency found. The master or representative is allowed sufficient time to address the deficiencies and to retrieve the necessary documentation before completing the certificate.

B. ISSUE OF CERTIFICATES (8)

According to the evidence of the adequacy of sanitary measures detected during the inspection, either an SSCEC or an SSCC is issued. **Ship Sanitation Control Exemption Certificate (SSCEC)** issued when no evidence of a public health risk is found on board and the competent authority is satisfied that the ship is free from infection and contamination, including vectors and reservoirs. **Ship Sanitation Control Certificate (SSCC)** is issued when evidence of a public health risk, including sources of infection and contamination, was detected on board and the required control measures have been satisfactorily completed. The SSCC records the evidence found, the control measures taken, and the samples taken and corresponding results (if applicable); if necessary, an Evidence Report Form can be attached.

C. CONTROL MEASURES

In general, when clinical signs or symptoms of illness or disease are present, evidence of a public health risk (including sources of infection and contamination) is found on board, or a public health risk is definitively identified, the competent authority determines the appropriate public health measures to be applied for an adequate level of control

- Control measures for public health risks on ships should be applied only after all key parties (i.e. the **master, the conveyance operator or agent and the port authorities** involved in this activity) have been **fully informed** of the intended methods.
- Critical activities, such as the **designation of port areas for quarantine of ships** suspected of carrying a public health risk, should be identified well in advance, in cooperation with the port operator for ship movement.
- **Disinsection, decontamination, deratting, disinfection and other sanitary procedures** taken pursuant to the IHR (2005) shall be performed in a manner that avoids injury and, as far as possible, discomfort to persons.
- **Environmental damage** that affects public health, baggage, cargo, containers, conveyances, goods or postal parcels should be avoided.
- As far as practicable, **facilities used by travellers at points of entry** should be maintained in a **sanitary condition** and kept free from sources of infection or contamination, including vectors and reservoirs.
- These measures shall be initiated and completed **without delay**, and applied in a **transparent and non-discriminatory manner**.

D. VECTOR CONTROL

Vector control guidelines for ships are given in Box No. 3.4

BOX NO. 3.4 VECTOR CONTROL GUIDELINES FOR SHIPS

1. Insect-proof screens

- Sleeping quarters, mess rooms and dining-rooms, indoor recreational areas and all food spaces must be effectively screened when ships are in areas where flies and mosquitoes are prevalent.
- Screening of sufficient hole tightness, no more than 1.6 mm spacing, is recommended, with screens on all outside openings.
- Screen doors should open outwards and be self-closing, and the screening must be protected from damage by heavy wire netting or other means, which may include the use of metal kick plates.
- Ship holding water must be screened from insects and inspected frequently to check for, and eliminate, mosquito breeding.
- Refuse stores must be screened and inspected frequently to check for, and eliminate, the breeding of flies or other vermin.
- Screens need to be kept in good repair.
- Bed nets, in good repair/ condition and properly placed, need to be used in sleeping quarters which are not provided with screens.

2. Insecticides are used to control vector densities in air spaces and on surfaces.

- When leaving an area where vectors are prevalent, and at regular intervals, residual and space sprays must be used for the control of **flying insects** that have entered the ship.
- **Crawling insects and other vermin** are best controlled by specific insecticides, properly applied to crawling, resting and hiding places.
- All surfaces that come in contact with food, all dishes and utensils and all food and drink need to be covered or removed during spraying operations.
- Insecticides, rodenticides, any other poisonous substances and all equipment for their use must not be stored in or immediately adjacent to spaces used for storage, handling, preparation or serving of food or drink. Further, such poisonous substances should not be stored near dishes and utensils or tableware, linen and other equipment used for handling or serving food and drink.
- To prevent the accidental use of these poisons in foodstuffs, such hazards must be kept in coloured containers clearly marked as "POISON".

RODENT SURVEILLANCE *is done in Port premises &surrounding areas and On board a ship:*

Rodent surveillance in *Port premises and surrounding areas*:

- The idea is to find as many areas as possible that might provide harborage, food, water, or access.
- Detailed notes have to be made regarding the schematic map of the ship or the building.
- Try to locate all entry points and nesting areas.
  - *"Starter holes"* for rodents to enlarge and these can be openings as small as 1/4 inch in diameter in walls, around pipe entries, sewer outlets, under doors, cable duct outlets, vent holes, life boat stores, life rafts, rescue boats, mooring ropes & stores on ships, etc. Unscreened Sewer outlets and even toilets can give rats.
  - Access to buildings. Nests are often composed of Shredded paper, pieces of plastic, and bits of fabric gathered together into a 5-inch diameter mass for Mice and 8 to 12 inch diameter for rats. In addition, many a times there would be evidence of food debris, bones etc

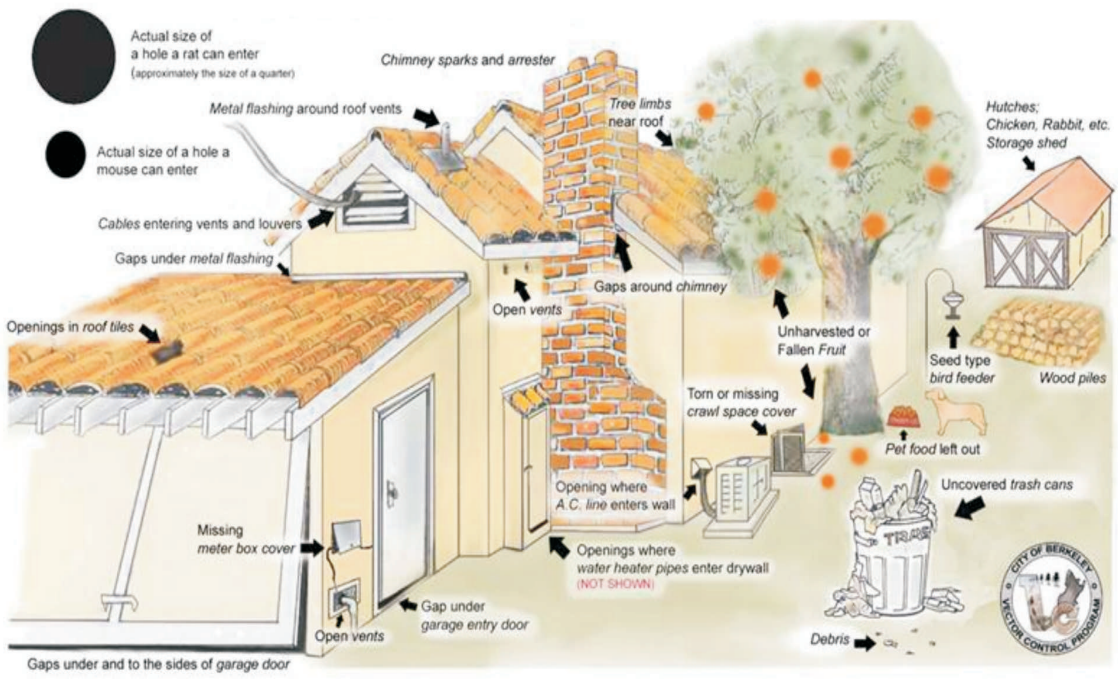


Figure no.3.6 - Common Rodent Entry and Harbourage Locations.

- Look for water leaks and rooms where water condenses on the walls.
- Always be on the lookout for piles of trash, clutter or other debris.

  Note where the crew takes their breaks or eat lunch. These areas can present Sanitation problem.
- Rodents like to follow edges; inspect these areas for excreta, rub marks, urine, or other indications of activity (Figure no. 3.7- 3.9).

Roof rat- pointed ½ inch Norway rat blunt- ¾ inch House mouse- pointed ¼ inch

Figure no. 3.7 Rat droppings

Figure no. 3.8 Rodents gnaw to keep their incisors sharp, leaving behind marking on the surfaces of wood, plastic pipes or containers.

Figure no. 3.9 Foot prints of rats. The five-toed tracks of the rear paws are more commonly observed than the four-toed front paws, yet both may be present. This can be used to find the direction

- Inspect port user's locker rooms, changing and rest rooms, cafeteria, kitchen, canteens, pantries in office buildings, store rooms, cargo sheds etc.
- Garbage Station is one of the important areas to look out for activity. Take note of how garbage is dealt with, what condition dumpsters and garbage cans are in, and whether rodents have easy access to garbage.
- It is essential to inspect godowns storing food grains.
- On the outside of the ship or the building, it is essential to check doorways for gaps or holes and note windows without screens or glass.
- Look for other openings in the structures; holes, vents without screens, holes around plumbing, and electrical wire entry points.

- Note any power lines running into the upper portions of ship; these give rodents access to the roof.
- Check for irrigation leaks and any standing water such as irrigation or drainage ditches, stagnant pools.
- On the roof, check air conditioning units that might provide water and harborage for rats.

Rodent surveillance on board a ship: Surveillance on board a ship comprises inspection as per inspection in docks premises to look for evidence of presence of rodents on board. Additionally:

- Screening starts before boarding the ship with the inspection of Rat guards on mooring lines (Figure no. 3.10), position of gangway, and condition of lighting near gangway.

Figure No. 3.10 Rat Guards on mooring lines

- Advice Master of the ship to provide schematic plan of various areas of the ship, cargo manifest and information of cargo loading and discharging plan.
- Inspect the Mooring Ropes placed on deck (Figure no. 3.11) by removing them fully and seeing in between the space created by their placements and the floor for excreta, food debris.

Figure no. 3.11 Mooring lines on deck

Figure 3.12 Life boats

- Inspection of life boats (Figure no. 3.12), life rafts, rescue boats, mooring ropes & stores on ships are ideal places for rodent harbourage.

- Inspect the store rooms, provision stores, galley, pantry, mess rooms, cargo holds, fore peak and after peak stores, for evidence of rodent activity.
- Get information from crew specially catering and provision handling crew about rodent activity.
- Garbage Station is one of the important areas to look out for rodent activity (Figure no. 3.13). Take note of how garbage is dealt with, what condition dumpsters and garbage cans are in, and whether rodents have easy access to garbage.

Figure no 3.13 Garbage station on ship

REGULATORY MECHANISMS

- The **International Health Regulations (2005)** advocate achieving a **vector-free zone** at seaports, airports, and ground crossings and within 400-metre perimeter around these entry points.
- **The Epidemic Diseases Act, 1897**-

  Central Government may take measures and prescribe regulations for the inspection of any ship or vessel leaving or arriving at any port in India and for such detention of any person intending to sail therein, or arriving thereby, as may be necessary. Any person disobeying any regulation or order made under this Act shall be deemed to have committed an offence punishable under section 188 of the Indian Penal Code (45 of 1860).
- Aerial navigation in British India was governed by **The Indian Aircraft Act, 1911.**
- **The Aircraft Act 1934, section 8A** provide the power to central Govt. to make rules for protecting the Public Health and **Section 8B** has the provision of emergency powers with central Govt. to take measures as deems necessary for prevention of danger arising to public health through introduction or spread of disease.
- **The Aircraft (Public Health) Rules-1954 was made by central Govt. of India, in exercise of the powers conferred by Section 8A** of **The Aircraft Act 1934,** in supersession of **Indian Aircraft (Public Health) Rules-1946.**

Nodal I/C

Airport

The overall responsibility lies with the managing authority of the airport. Field Survey-once a week by APHO officials is done to observe potential breeding sites and presence of mosquitoes/ larvae within 400 meter radius of Airport.

Sea port

Surveillance in sea ports is being carried out by the Port Health Organization (PHO), a statutory body implementing the IHR (2005) and the Indian Port Health rules. The Port Health Officer is assisted by **Medical Officers, Health inspectors, Health Assistants and field workers** to carry out surveillance activities on board which include routine checks of **ships for issue of free pratique and health clearance for sailing, screening of** passengers, **inspection of ships for issue of Ship Sanitation certificates and other certificates, screening of ships on international voyage,** sailing and **coastal** vessels for rodent activities.

Integrated Check Posts

Vector Control Plan has to be developed by the Health Team under the Leadership of the Land Port Health Officer, in consultation with the stakeholders at the Point of Entry and has to be renewed regularly. The custodian (LPAI) will engage an agency which will take vector control measures as per the advice of LPHO. This agency must be approved by the centre or state government.

4. ZOONOSIS

INTRODUCTION

The infections naturally transmissible between vertebrate animal hosts and humans are called Zoonoses. (***Rudolf Virchow 1880***). WHO ***(1959)*** defines Zoonoses as "those diseases and infections which are naturally transmitted between vertebrate animals and man". Major modern Zoonoses include Ebola virus disease, Salmonellosis, Anthrax, Brucellosis and Influenza. Zoonoses can be caused by a range of disease pathogens such as viruses, bacteria, fungi and parasites; out of 1, 415 pathogens known to infect humans, more than 61% were zoonotic. Factors influencing Zoonotic diseases are enlisted in Table no. 4.1

Table No. 4.1 FACTORS INFLUENCING PREVALENCE OF ZOONOSES
1 Ecological changes in man's environment
✓ Entering of humans in the unaccustomed ecosystem, Change in biting habits of the blood sucking vectors and alteration in the population of reservoir animals. Eg. leptospirosis, tularaemia.
2. Handling animal by-products and wastes (occupational hazards)
✓ Higher attack rates in workers during the course of their occupation than the rest of the population. E.g. anthrax in carpet weavers, live stock raisers, leptospirosis in rice field workers, etc.
3 Increased movements of man
✓ Due to land development, engineering project work, pilgrimages, tourism, etc. ✓ Exposure to contaminated food and water leading to diseases: amoebiasis, colibacilliosis, giardiasis, salmonellosis, shigellosis, etc.
4 Increased trade in animal products
Countries which import livestock products and livestock are likely to introduce the disease into their territories. E.g. salmonellosis, foot and mouth disease, anthrax and many diseases exotic to India.
5 Increased density of animal population
6 Transportation of virus infected mosquitoes
Aircraft, ship, train, motor and other vehicles. Eg. yellow fever, Chikungunya, Dengue.

Several zoonotic diseases are major public health problems not only in India but also in different parts of the world. Examples from recent past are Ebola Viral Disease (EVD) and Swine Flu. **Around 80% of pathogens that could potentially be used for bioterrorism are of animal origin. The disease may be introduced into susceptible human or animal populations following a deliberate (as bioweapons or for bioterrorism) or accidental release of an infectious agent or toxin. The AQCS clearances at designated ports are very important keeping in view accidental, intentional and normal entry of** Infectious disease agents and toxins found in animal populations and animal products.

Zoonotic diseases in India

Table no. 4.2 enlists the zoonotic diseases of major public health importance in India. Clinical features and case definitions of some important zoonotic diseases is given in Annexure 4.1

Table no. 4.2 Zoonotic diseases of major public health importance in India			
Endemic diseases	**Re- emerging Diseases**	**Emerging Diseases**	**Future Threat for India**
Rabies	**JE**	**Avian Influenza**	**Yellow fever**
Anthrax	**Plague**	**NiV (Nipah Virus)**	**Hanta Virus**
Brucellosi	**Leptospirosis**	**Trypanosomiasis**	**Rift valley Fever**
Toxoplasmosis	**Scrub Typhus**	**H1N1**	**Ebola and Marburg**
Cysticercosis	**KFD**	**CCHF**	**MERS CoV**
Echinococcosis		**Trichenellosis**	**Zika virus disease**

A list of laboratories for diagnosis of zoonoses in humans is given in Annexure 4.2

Box No. 4.1 Guidelines for sample collection and transportation for Ebola Virus, Zika Virus and yellow fever

After washing hands, wear Personnel protective equipment- shoe cover, gown, cap, mask, eyeshield/ face shield and two pairs of gloves. Carefully remove PPE after the collection and packing the sample and discard in the yellow bag. Wash hands. Carefully manage all the waste as per guidelines.

Sample: 5 ml of blood in sterile plain vial/ vacutainer (red/ yellow cap)

Time of collection: within first five days of onset of illness

Packaging and transportation: Triple layer package to be sent in cold chain.

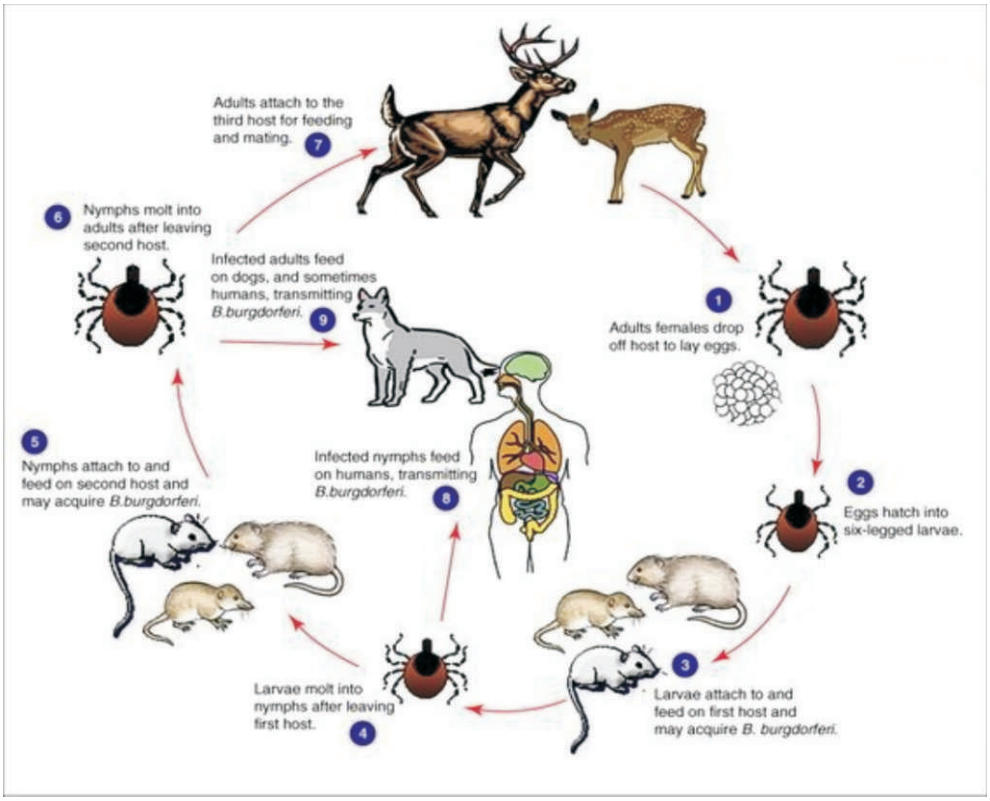


Figure no 4.1 Cycle of Lyme Disease.

REGULATORY MECHANISMS

1. **Indian Penal Code (45 of 1860)**

   Addresses offences affecting public health and provisions relating to infectious diseases specifically.

2. **The Drugs and Cosmetics Acts, 1940 (Act No. 23 of 1940)**

   Regulates the import, manufacture, distribution and sale of drugs and compliance with standards of quality as set out in the Act.

3. **Municipal acts of Delhi, Gujarat, West Bengal, Tamil Nadu and Manipur**

4. **The Essential Services Maintenance Act (ESMA), 1968. (Act No. 59 of 1968) National Health Bill, 2009**

5. **LIVESTOCK AND LIVESTOCK PRODUCT IMPORTATION ACT, 1898 (amended, 2001) Notification No. S.O. 2666 (E) dated 16.10.2014 and Notification No. S.O. 1495 and 1496 (E) dated 10.6.2014 –Rules and Procedure for import of livestock products and livestock respectively.**

ANNEXURE 4.1

Clinical features of Zoonotic diseases and their case definitions.

S.No.	Clinical Symptoms	Modes of transmission	Incubation Period	Case Definitions & Remarks
1	**Zika Virus diseases** [Zika Virus (Arbovirus)]			
	-Mild fever, -rash (mostly maculopapular) -headaches -arthralgia -myalgia -asthenia -non-purulent conjunctivitis -Guillion Barre Syndrome -Microcephaly	-Mosquito bite (*Aedes* mosquito) -Sexual Route (established) -Perinatal transmission	2-7 days Extended upto week	**Suspected case -** Patient with skin rash or elevation of body temperature ≥ 37.2 degrees C with ≥ 1 of the following symptoms (not explained by other medical conditions): -Arthralgia or myalgia -Non purulent conjunctivitis or conjunctival hyperemia -Headache or malaise With history of travel to countries with indigenous transmission of ZIKV in last 2 weeks. **Confirmed case** – A suspected case with laboratory positive result for the specific detection of ZIKA by RT-PCR. **For More details:** http://www.ncdc.gov.in/writereaddata/linkimages/zika_alert9138919266.pdf
2	**Ebola Virus Diseases** (Flavivirus)			
	- fever -headache -joint and muscle aches -weakness -diarrhea -vomiting -stomach pain, -lack of appetite -abnormal bleeding	-Direct contact with the blood or bodily fluids of an infected symptomatic person or -Exposure to objects (such as needles) that have been contaminated with infected secretions. -It is not transmitted through air.	EBVD is 2-21 days. Symptoms may appear with in 2 to 21 days (commonly between 8-10 days) after exposure to Ebolavirus.	**Suspected (clinical) case**: Any person ill or deceased who has or had fever with acute clinical symptoms and signs of hemorrhage, such as bleeding of the gums, nose-bleeds, conjunctival injection, red spots on the body, bloody stools and/or melena (black liquid stools), or vomiting blood(haematemesis) with the history of travel to the affected area. Documented prior contact with an EBVD case is not required. **Probable case (with or without bleeding):** Any person (living or dead) having had contact with a clinical case of EHF and with a history of acute fever. OR Any person (living or dead) with a history of acute fever and ≥3 of the following Symptoms: headache/ vomiting/nausea/ loss of appetite/ diarrhea/ intense fatigue/ abdominal pain/ general muscular or articular pain/ difficulty in swallowing/ difficulty in breathing/hiccoughs. OR Any unexplained death. The distinction between a suspected case and a probable case in practice relatively unimportant as far as outbreak control is concerned. **Contact:** A person without any symptoms having had physical contact with a case or the body fluids of a case within the last three weeks.

				The notion of physical contact may be proven or highly suspected such as having shared the same room/bed, cared for patient, touched body fluids, or closely participated in a burial (e.g. physical contact with the corpse). **Confirmed Case:** A suspected or probable case with laboratory confirmation (positive IgM antibody, positive PCR or Viral isolation). **For more details:** http://www.ncdc.gov.in
3	**Yellow Fever** (Flavivirus)			
	Fever, chills, severe headache, back pain, general body aches, nausea and vomiting, fatigue, and weakness. In severe cases, a person may develop high fever, jaundice, bleeding (especially from the gastrointestinal tract), and eventually shock and failure of many organs.	Bite of *Aedes agyepti* mosquito	3–6 days	**For More details:** https://www.cdc.gov/yellowfever/ http://www.who.int/mediacentre/factsheets/fs100/en/
4	**MERS CoV** (Middle east Respiratory Syndrome Corona Virus)			
	Severe acute respiratory illness with symptoms of fever, cough and shortness of breath.	Droplet Infection, through close contact, such as caring for or living with an infected person.	5 or 6 days, but can range from 2-14 days.	**For More details:** (http://www.who.int/csr/disease/coronavirus_infections/en/).
5	**Pandemic Influenza-**(Orthomyxoviridae); three types of influenza A virus, namely A, B & C (H1N1), (H2N2), (H3N2), (H5N1)			
	flu-like symptoms, including fever, cough, sore throat, body aches, headache, chills and fatigue. nausea, vomiting and/or diarrhea	spreads mainly through the coughs and sneezes of people who are sick with the virus, but it may also be spread by touching infected objects and then touching nose	1- 4 days and in some cases upto seven days	**A suspected case of the Pandemic Influenza**: person with acute febrile respiratory illness (reported or documented fever, and one of the following: cough, sore throat, shortness of breath, difficulty in breathing or chest pains) with onset: -Within 7 days of close contact with a person who is a probable or confirmed case of the new influenza A (H1N1) virus infection, OR - Within 7 days of travel to a community internationally where there has been one or more confirmed Pandemic influenza A (H1N1) cases,

		or mouth.		OR -Resides in a community where there are one or more confirmed new influenza cases. **A Probable case of Pandemic Influenza**: A (H1N1) 2009 virus infection is defined as an individual with an influenza test that is positive for influenza A, but is not subtypable by reagents used to detect seasonal influenza virus infection; OR An individual with a clinically compatible illness or who died of an unexplained acute respiratory illness who is considered to be epidemiologically linked to a probable or confirmed case. **A Confirmed case of Pandemic Influenza**: A (H1N1) virus infection is defined as an individual with laboratory confirmed new influenza A (H1N1) virus infection by one or more of the following: • real-time RT-PCR, • viral culture • four-fold rise in new influenza A(H1N1) virus-specific neutralizing antibodies. **For more details:** http://www.ncdc.gov.in
6	**Crimean Congo Hemorragic Diseases** (Nairovirus/ Bunyavirus)			
	fever, myalgia, dizziness, neck pain, stiffness, backache, headache, sore eyes and photophobia, **nausea, vomiting**, sore throat**,** diarrhoea and generalized abdominal pain, sharp mood swings, and confusion and aggressiveness, sleepiness, depression , lassitude, hepatomegaly, tachycardia, lymphadenopathy and a petechial rash both on internal mucosal surfaces,	**Animal to human:** tick bite or crushing of infected tick **Human to human**: infected blood, body fluids and wastes from patients through broken skin or mucous membranes, aerosol contact of blood of the patient can also lead to transmission of the virus.	5-6 days with maximum of 13 days	**Suspected case:** A patient with abrupt onset of high fever >38.5°C and one of the following symptoms: severe headache, myalgia, nausea, vomiting, and/or diarrhea. **AND/OR** History of insect (tick) bite within 14 days prior to the onset of symptoms; **or** History of contact with tissues, blood, or other biological fluids from a possibly infected animal (e.g., abattoir workers, livestock owners, veterinarians) within 14 days prior to the onset of symptoms; **or** History of exposure to a suspect, probable, or laboratory-confirmed CCHF case, within 14 days prior to the onset of symptoms (contacts of the patient including health care workers) **Probable case:** A probable CCHF case is defined as a suspected CCHF case fulfilling in addition the following criteria: Thrombocytopenia < 50,000/cmm **AND** Two of the following hemorrhagic manifestations: hematoma at an injection site, petechiae, purpuric rash, rhinorrhagia, hematemesis, hemoptysis, gastrointestinal hemorrhage, gingival hemorrhage, or any other hemorrhagic manifestation in the

				absence of any known precipitating factor for hemorrhagic manifestation. **Confirmed case:** A confirmed CCHF case is defined as a case that fulfills the criteria for suspect/ probable CCHF and in addition is laboratory-confirmed with one of the following assays: -Detection by RT-PCR of CCHF virus genome in a clinical specimen, by ELISA or IFA of specific IgM antibodies or a 4-fold increase in specific IgG antibodies in two specimens **For More details:** http://www.ncdc.gov.in/writereaddata/linkimages/January7434567273.pdf
7	**Anthrax** (Bacillus *anthracis,(*a gram-positive, spore-forming bacillus).			
	Cutaneous anthrax: a painless, pruritic papule, followed by vesicle and painless ulcer, malaise and low-grade fever, regional lymphangitis and lymphadenopathy. **Inhalation anthrax:** symptoms resembling common cold, may progress to severe breathing problems and shock. ***Intestinal anthrax:*** nausea, vomiting, fever, abdominal pain, haematemesis, bloody diarrhea, massive ascites, toxaemia and shock ***Oropharyngeal anthrax:*** sore throat, dysphagia, fever,lymphadenopathy, toxaemia.	Exposure to infected animals and contaminated animal products. **Inhalation anthrax** results from inhalation of spores in particles < 5 µm. **Oropharyngeal anthrax** results from : ingestion of contaminated meat.	Few hours to seven 7days extendable up to 60 days.	**Suspect:** A case that is compatible with the clinical description and has an epidemiological link to confirmed or suspected animal cases or contaminated animal products **Probable:** A suspected case that has a positive reaction to allergic skin test (in non-vaccinated individuals) **Confirmed:** A suspected case that is laboratory confirmed by one or more of the following: -Isolation of *B.anthracis* from a clinical specimen (e.g., blood, lesions, discharges) -Demonstration of *B.anthracis* in a clinical specimen by microscopic examination of stained smears (vasicular fluid, blood, CSF, pleural fluid, stools) -Positive serology (ELISA, Western blot, toxin detection, chromatographic assay, FAT) **For More details:** http://www.ncdc.gov.in/writereaddata/linkimages/Anthrax353873444.pdf

ANNEXURE 4.2

Laboratories for diagnosis of zoonotic infections in India	
Anthrax	National Centre For Disease Control , Delhi Indian Veterinary Research Institute , Izatnagar Christian Medical College, Vellore Behrampore Medical College , Orrisa Defense Research & Development Establishment, Gwalior
Plague	National Centre For Disease Control , Delhi Plague surveillance unit , National Centre For Disease Control , Bangalore
Glanders	Central Military Veterinary Laboratory, Meerut National research Centre on equines , Hissar
Crimean Congo Hemorrhagic Fever	National Institute of Virology , Pune National Centre For Disease Control , Delhi
Japanese Encephalitis/Acute Encephalitis	National Centre For Disease Control, Delhi. All India Institute Of Medical Sciences, Delhi Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow National Institute of Mental Health And Neurosciences, Bangalore National Institute of Virology, Pune School of Tropical Medicine, Kolkata Regional Medical Research Centre, Dibrugarh
Exotic viruses	National Institute of Virology, Pune High Security Animal Diseases Laboratory, Bhopal
Zika Virus	King Institute of Preventive Medicine, Chennai, Tamil Nadu NIV Field Unit, Allapuzzha, Kerala Manipal Centre for Virus Research, KMC, Manipal BJ Medical College, Ahmedabad Regional Medical Research Centre, Bhubaneshwar National Institute for Cholera & Enteric Diseases, Kolkata King George Medical University, Lucknow Regional Medical Research Centre, Dibrugarh Regional Medical Research Centre, Jabalpur Jawaharlal Institute of Post Graduate Education & Research, Puducherry NCDC, New Delhi
Yellow fever	NCDC Delhi KIPM Chennai NICED Kolkata NIV Pune NIV Field Unit, Bangalore NIV Field Unit, Alappuzha

ANNEXURE 4.3 List of AQCS Stations along with designated officers.

S. No.	Addresses of AQCS Station	Contact Details
1	Animal Quarantine and Certification Service, Sector- 11, Koper Khairane, New Mumbai- 400709.	Tel: 022-27552021, 26828194 (Airport) Fax: 022-27552021, 9810193241 Email: aqcs.mum-dadf@nic.in, aqcs_mumbai@yahoo.com
2	Animal Quarantine and Certification Service, Village & Post- Narayanpur, Via- Rojarat Gopalpur, District- 24 Pargana (North), Kolkata	Tel: 033-25119418 (Airport), 9748660436 033-25196777 (Narayanpur) Fax: 033-25119418 Email: aqcs_cal@yahoo.in roaqcser.kol-dadf@gov.in
3	Animal Quarantine and Certification Service, Old Delhi Gurgaon Road, Kapashera, New Delhi- 110037	Tel: 011-25063272, 9958199310 Fax: 011-25060647 Email: aqcsnr-dadf@nic.in
4	Animal Quarantine and Certification Service, Alpha- 3, Kempegowda International Airport, Bangalore- 560300	Tel: 080-22001351, 9916133405 Fax:080-22001355 Email: aqcsbng-ka@nic.in aqcsbng@yahoo.in
5	Animal Quarantine and Certification Service, Cargo Satellite Building, Block- A, Mezannine Floor, Rajiv Gandhi International Airport, Shamshabad- 501218, Hyderabad	Tel: 040-24008243 Fax:040-24008243 Email: aqcs_hyd@yahoo.in, aqcs-hyd@nic.in
6	Animal Quarantine and Certification Service, No. 115, Velachery Main Road, Village- Palikarani, Chennai- 600100	Tel: 044-22460659, 9892526150 Fax: 044-22463070 Email: aqcs_sr@yahoo.com aqcssr.chennai@gov.in

5. CHEMICAL ACCIDENTS

INTRODUCTION

The impacts of chemical accidents can be deadly, for both human beings and the environment. A chemical accident or emergency refers to an event which results in the release of a substance or substances that are hazardous to human health and/or the environment in the short or long term. These events can cause illness, injury, disability or death to human beings, often in large numbers, and can result in extensive damage to the environment with considerable human and economic costs (OECD/ UNEP). Chemical accidents may be categorised as a major accident or a disaster depending upon the number of casualties, injuries and damage to the property or environment. A major accident is defined in the Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989, issued under the Environment (Protection) Act, 1986, whereas 'disaster' is defined in the DM Act, 2005. (12)

HAZCHEM: HAZCHEM are chemical compounds that can be used for mass destruction, causing serious damage to the health and property of society. (13)

HAZMATs: HAZMATs are any solids, liquids, or gases that can harm people, other living organisms, property, or the environment. HAZMAT may be radioactive, flammable, explosive, toxic, corrosive, biohazardous, an oxidiser, an asphyxiant, a pathogen, an allergen, or may have other characteristics that render it hazardous in specific circumstances. (13)

CHEMICAL INDUSTRY IN INDIA

The Indian Chemical Industry owing to the wide spectrum of products manufactured and also due to the increasing development of new products has begun to pose a challenge in terms of the environment and health risks. Growth of chemical industry in India has increased the risk of occurrence of incidents associated with hazardous chemicals (HAZCHEM). Chemical industries in India manufacture a wide and diverse range of products. These can be grouped into ten important chemical sectors: Pesticides, Fertilisers, Oil Refineries, Petrochemicals, Bulk Drugs, Dyes & Dye Intermediates, Chlor-Alkali, Soda Ash, Paint and Ink & Printing Ink.

Based on threshold criteria in the law (MSIHC Rules, 1989) certain installations are categorized as Major Accident Hazard (MAH) Units. There are about 1861 Major Accident Hazard (MAH) units, spread across 301 districts and 25 states & 3 Union Territories, in all zones of country. Besides, there are thousands of registered and hazardous factories (below MAH criteria) and un-organized sectors dealing with numerous range of hazardous material posing serious and complex levels of disaster risks. Multihazard districts are illustrated in Figure no. 5.1

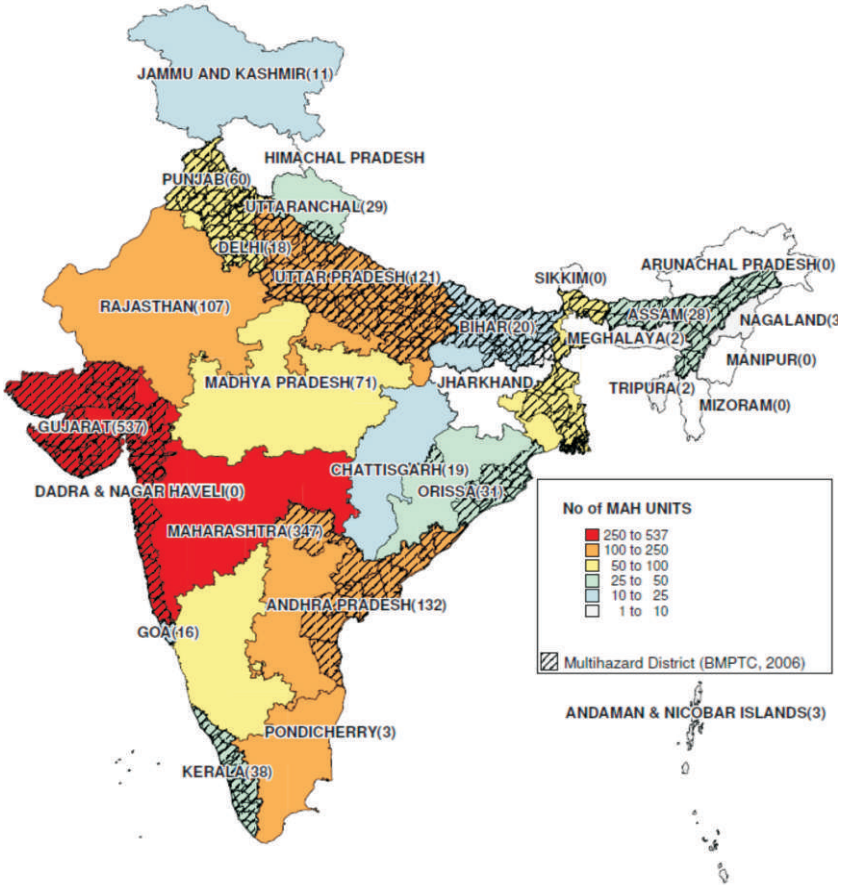


Figure no. 5.1 Distribution of MAH units and multi hazard districts across India [16].

MAJOR CHEMICAL ACCIDENTS (WORLD)

- March 23, 2005, a disaster at a major petroleum refinery in Texas City, United States, was considered US' worst industrial disaster in 15 years. A series of explosions took place when a hydrocarbon isomerization unit was restarted and a distillation tower flooded with hydrocarbons. As a result, 15 were killed and another 180 were injured.
- In September 2001 an explosion occurred in a shed containing about 300 tonnes of downgraded ammonium nitrate at a chemical plant in Toulouse, belonging to one of France's leading fertilizer producers. The explosion caused 31 deaths and injured more than 4,500 people, while destroying 27,000 buildings in the area.
- In February 2000 a poisonous chemical spill that took place in the Romanian city of Baia Mare destroyed wildlife and fish stocks while threatening the water supplies of 2.5 million people all over the Central and Eastern Europe. Approximately 100,000 m^3 of cyanide, used in the gold extraction process at a local mine, was released into the river Somes when a reservoir wall at the mine collapsed. The event was described as Europe's worst disaster since Chernobyl.
- In June 1974, near the village of Flixborough in the United Kingdom, took place an event which led to a significant tightening of the UK government's regulations covering hazardous industrial processes. A locally owned chemical plant, while repairing one of its chemical reactors, produced in less than a minute a leak of 40 tonnes of cyclohexane, which formed a vapour cloud with a diameter of about 200 m. The cloud exploded and completely destroyed the plant, also damaging about 1,800 buildings on a more than 1.5 km radius.

MAJOR CHEMICAL ACCIDENTS (INDIA)

Bhopal Gas tragedy

One of the deadliest chemical accidents took place in 1984 at a pesticide plant in the state of Madhya Pradesh in central India. On the midnight between December 2nd and 3rd, a combination of factors ranging from hazardous handling of dangerous chemical substances to the use of outdated and malfunctioning industrial equipment led to the exposure of over 5, 00, 000 people to toxic gases and by products, resulting in nearly 3, 800 officially confirmed human deaths. The aftermaths of the disaster are present even today.

Figure no. 5.2 Bhopal Gas Tragedy

Following the Bhopal Gas Disaster in 1984, major incidences of chemical disasters in India include a fire in an oil well in Andhra Pradesh (2003); a vapour cloud explosion in the Hindustan Petroleum Corporation Limited Refinery (HPCL), Vishakhapatnam (1997); and an explosion in the Indian Petrochemicals Corporation Limited (IPCL) Gas Cracker Complex, Nagothane, Maharashtra (1990). Over 20 major chemical accidents have been reported in MAH units during 2002–06.

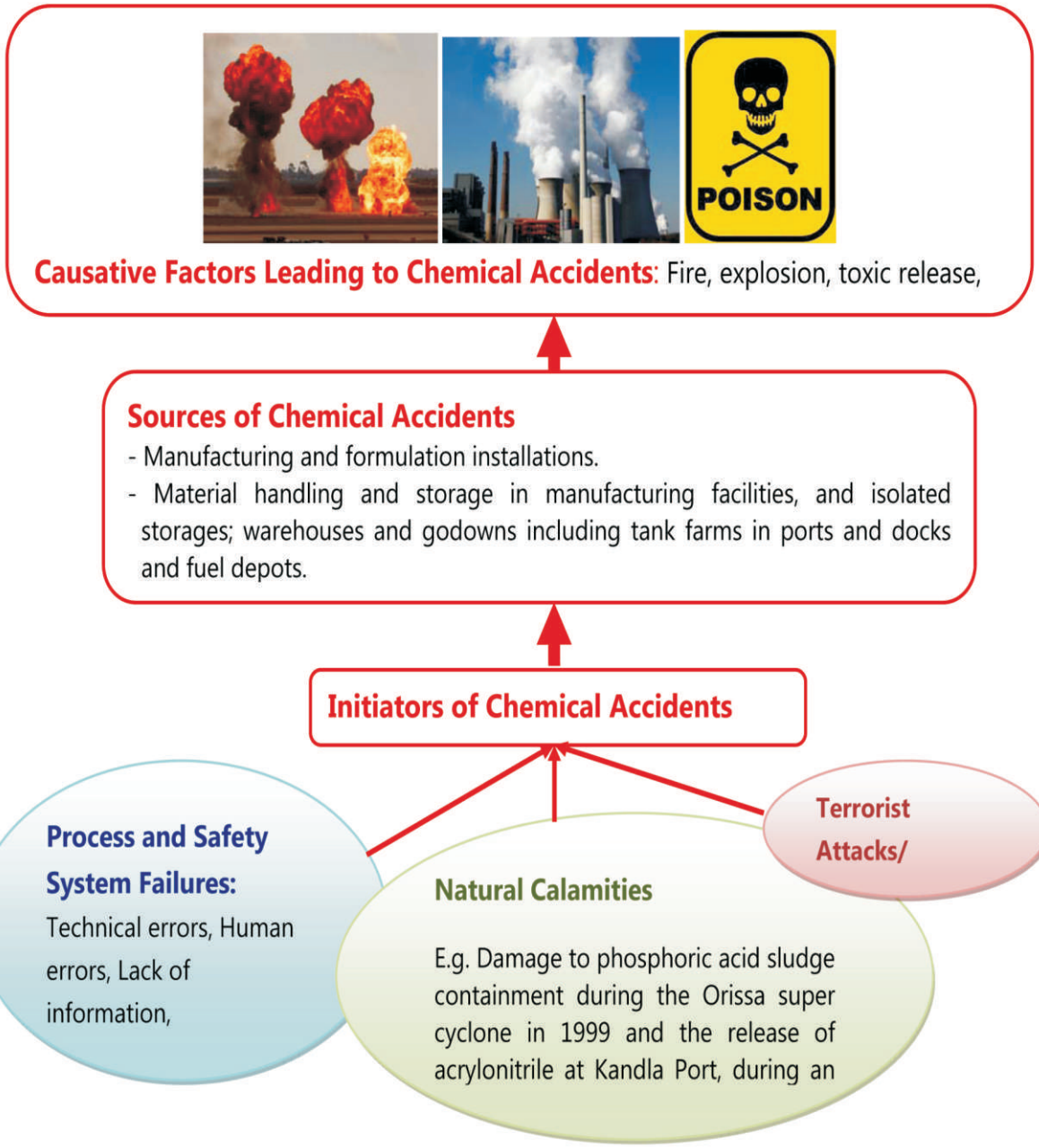


Figure no. 5.3 Initiators, sources and causes of chemical accidents

Box No. 5.1 Following agencies recognize institutes and laboratories where chemical analysis is undertaken. :-

The **Central Pollution Control Board** under the Environment (Protection) Act 1986 laboratories under the Environment (Protection) Act 1986, Section 12(1) B. The CPCB has listed precise criteria for short-listing laboratories based on equipment available, size, manpower and various other criteria. The criterion is based on analysis of wastes and pollutants rather than basic chemical synthesis.

The Ministry of Science and Technology, **Council for Scientific and Industrial Research (CSIR)** and are capable of undertaking basic chemical analysis

The Ministry of Agriculture (National level and state level Institutes, Bureaus, Project Offices etc.) these are capable of analysing agro chemical compositions and crops/ seeds analysis

Bureau of Indian Standards (BIS)

Central Board for Excise and Customs (Central Revenue Laboratories) have an important role in analysing hazardous waste and other chemicals entering the country.

Centre for Explosive Safety (CEES), Ministry of Defence for the purpose of testing of explosives/ explosive charges/ detonators/ fuses etc., some of these are accredited by the NABL.

Ministry of Labour: These are capable of undertaking basic analysis for occupational hygiene.

The **National Accreditation Board for Laboratories** (NABL)

The major universities and research institutes have well known departments of chemistry and chemical technology/ engineering compounded with good in house Research and Development activity.

Points of entry are particularly vulnerable to chemical accidents as many PoE are located in districts with MAH units. Points of entry need to develop specific capacities in the application of public health measures required to manage a variety of public health risks. These capacities include access to appropriate medical services (with diagnostic facilities), services for the transport of ill persons, trained personnel to inspect ships, aircraft and other conveyances, maintenance of a healthy environment as well as ensuring plans and facilities to apply emergency measures such as quarantine.

The Ministry of Environment and Forests (MoEF) is the nodal ministry for chemical disasters and has played an active role in the process of enhancing emergency preparedness at all levels. Role of Ministry of Health and Family Welfare in chemical accidents is supportive.

Accident data remains scattered and with multiple agencies. Petroleum incidents, Explosive accidents, Factory incidents, Nuclear accidents, Mines incidents, Insecticides incidents and Port incidents are to be informed to the respective "authority" specified under various legislations. As a result, accident data is not presently compiled at a central location. The MoEF, being the 'nodal" ministry for chemical accidents, is supposed to be notified on occurrence of any chemical incident.

CENTRAL CRISIS GROUP (15)

The Central Crisis Group (CCG) has been set up by the Ministry of Environment, Forest and Climate Change. This is an apex body comprising senior officials of the Government and technical experts.

The functions of the Group are as follows:

i. To deal with major chemical accidents and provide expert guidance for handling major chemical accidents in the country.

ii. Continuously monitor the post-accident situation arising out of a major chemical accident and suggest measures for prevention and to check recurrence of such accidents.

iii. Conduct post-accident analysis of such major chemical accidents and evaluate responses.

iv. Review District Off-Site Emergency Plans with a view to examining its adequacy in accordance with, the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 and suggest measures to reduce risks in the industrial pockets.

v. Review the progress reports submitted by the State Crisis Group.

vi. Respond to queries addressed to it by the State Crisis Group and District Crisis Group.

vii. Publish a State-wise list of experts and officials who are concerned with the handling of chemical accidents.

viii. Render in the event of a chemical accident in a State, all financial and infrastructural help as may be necessary.

EMERGENCY RESPONSE CENTRES (ERCs)

MoEF has set up Emergency Response Centres (ERCs) in the following locations viz:

- Mahad, Maharashtra
- Manali, Tamil Nadu
- Bhopal, Madhya Pradesh
- Vishakhapatnam, Andhra Pradesh
- Hyderabad, Andhra Pradesh

The MoEF has recently approved the proposal to establish three more Emergency Response Centres (ERCs) at Vijaywada, Kurrool and Kakinada in Andhra Pradesh. [13]

This is a voluntary scheme and is instituted in the larger interest of environment. The ERC establishes link among industries, expert crisis groups and expert environmental agencies during the crisis situation to ensure proper mitigation measures for any possible accident and control the scenario in case of an accident. These Centres are set up on mutual cost sharing basis (equity participation) with 50% share from the State Government and 50% from the beneficiary or member units. The ERCs maintains technical information including safe isolation distances during chemical mishap, data on Major Accident Hazard (MAH) units, contact addresses of relevant agencies, etc. They coordinate with the Local Crisis Group (LCG), District Crisis Group (DCG) and State Crisis Group (SCG) during the chemical emergency. They organise programmes at various levels in the State to bring awareness among the common citizens regarding hazards associated with handling and management of chemicals and the associated safety aspects for prevention and mitigation of possible chemical mishaps.

CENTRAL CRISIS CONTROL ROOM (15)

MoEF has set up a Crisis Control Room for fast flow of information and coordination of activities during an

emergency. The Control Room is part of the Crisis Alert System (CAS), located at Room No. 705 in Paryavaran Bhawan with a 24 hour contact telephone number (Phone 4360734).

Operation of Control Room during Office Time

The Control Room operate during office hours from 9.00 a.m. to 5.30 p.m. on working days only i.e. Monday through Friday. The Control Room will be used for managing crisis situations and also as a venue for convening the meeting of Central Crisis Group (CCG) in case of a crisis. In addition, messages can be faxed at Fax no. 4360678 and 4363577.

Operation of Control Room before and after Office Hours including Holidays

After office hours and on holidays, the Central Registry Room on the Ground Floor, Paryavaran Bhavan, B-Block,CGO Complex, Lodi Road, New Delhi-110003 receive messages and pass them on to the Member Secretary immediately (Phone: 4360634 (O)/ 4677974 (R). In case Member Secretary is not available the next contact person will be contacted (Phone: 4360734 (O), 6101487 (R)). It will be manned for twenty four hours on all days (Phone and Fax : 4360734, Telex:31-66185 DOE-In, 31-63015 WILD-IN, E-Mail: indu@envfor.delhi.nic.in. The Member Secretary will immediately after intimation, activate the Control Room in Room No.705 mentioned in (a) above.

Further details can be accessed from: http://envfor.nic.in/divisions/hsmd/red.html

NATIONAL POISON INFORMATION CENTRE (NPIC)

The National Poison Information Centre was set up in the Department of Pharmacology in 1995 at All India Institutes of Medical Science (AIIMS), New Delhi, funded by MoEF. The centre functions round the clock, 365 days in year and provides information on various poisonings and treatment protocols on telephone, fax, e-mail and in person. The NPIC has the back-up of latest literature on poisoning due to a variety of products that include household items, agricultural and industrial chemicals, drugs, environmental toxins including plants, animal bites and stings and other miscellaneous products. The data received by Centre is compiled and analysed for knowing the trend.

POISON CONTROL CENTRES

Poison Control Centres are specialised units providing information on poisoning, and their main function is to provide information and advice concerning the diagnosis, prognosis, treatment and prevention of poisoning as well as information about the toxicity of chemicals and the risks they pose.

The following five poison control centres are also recognised by World Health Organisation:

i. The Poisions Information Centre, Department of Pharmacology, All India Institute of Medical Sciences (AIIMS), Ansari Nagar, New Delhi 110 029, Emergency telephone: +91 11 6859391; E-mail: skgupta@medinst.ernet.in, Fax: +91 11 6859391.

ii. The Poisons Information Centre, The Amrita Institute of Medical Sciences (AIMS), Elanakkar Post, Kochi, Kerala (webmaster@aimshospital.org - Tel: 0484-2801234/ 2804321)

iii. The Poisons Information Centre, National Institute of Occupational Health, Meghani Nagar Ahmedabad 380 016, E-mail: dewan@ad1.vsnl.net.in, Emergency telephone: +91 79 562 1400; Fax: +91 79 286 6630

iv. The Poisons Information Centre, The Toxicology & IMCU Unit, Government General Hospital, Chennai 600 003, E-mail: thiruma@satyam.net.in; Tel. No. +91 44 536 3208/ 5363131

v. The Poisons Information Centre, The Industrial Toxicology Research Centre. Post Box 80, M. Marg, Lucknow 226-001, E-mail: itrc@itrcindia.org, Tel. No: +91 0522-227586; Fax: 228227

EMERGENCY MANAGEMENT

Chemical accidents often require specialized protective measures and highly sophisticated responses because of the nature of the materials involved. These responses are not well understood even by emergency agency personnel in the local communities, and certainly not by the general public. Off-site emergency response is relatively more complex and complicated as it involves unorganized, multi-stakeholder and multi-agency coordination. First response from **police, fire, medical aid and life saving, transport route controls**, and **handling transport emergencies involving hazardous chemicals** are important aspects for off-site emergency preparedness and response.

EMERGENCY PLANNING FOR MEDICAL FACILITIES

- Health units should maintain an inventory of available equipment that might be needed and have up to date information on how to obtain additional support.
- Ensure that decontamination equipment and facilities are available (if not on site then by mobile units)
- Have access to specialised information and to specialists for appropriate treatment of exposed victims.
- Maintain a register of health/ medical professional who could be called upon to assist the health units.
- Have plans/ procedures for sending patients to other health facilities when necessary, protecting other people from contamination, registering all individuals who arrive at the health unit for treatment as a result of exposure to HAZCHEM.
- Have a designated (separate) telephone line, in service 24 hours a day for use by emergency services in event of an accident, with a back up communication system.

LEGAL ISSUES

International Bindings and Guidelines:

1. International Programme of Chemical Safety (IPCS).
2. Strategic Approach to International Chemicals Management (SAICM), including:
   - Rotterdam Convention on Prior Informed Consent Procedure (PIC) for highly hazardous industrial chemicals and pesticide formulations in international trade, adapted in 1998.
   - Basel Convention on the Control of Trans-boundary Movement of Hazardous Wastes and their Disposal, adapted in 1992
   - Stockholm Convention on Persistent Organic Pollutants (POP), adapted in 2001
3. International Register for Potentially Toxic Chemicals (IRPTC) and UNEP cleaner production programme.
4. UNITAR – Globally Harmonized System (GHS) for Chemical Classification and Labelling

5. Asia Pacific Environmental Innovation Strategy Project

There are some regulations which are the direct result of international convention and agreements such as:

- Hazardous Waste (Management and Handling) Rules, 1989 amended 2000 and 2003 – based on the Basel Convention.
- Ozone Depleting Substances (Regulation and Control) Rules, 2000– based on the Montreal Protocol

Table no. 5.1 enlists all the legal provisions related to chemical disasters and their management in India. Figure no 5.4 shows the legal instruments for management of chemicals in India.

Non-regulatory Mechanism for Managing Chemicals

These are very important in management of chemicals in India as they take several initiatives for environmental protection and chemical management, such as Responsible Care, Corporate Responsibility in Environmental Planning (CREP), ISO 14001, OHSAS 18001, ISRS, Bureau of Indian Standards (BIS) 1986 (Initially The Indian Standards Institution (ISI) set up in 1947) Eco Mark, Agmark (promotes Grading and Standardisation of agricultural and allied commodities under Agricultural Produce (Grading & Marking) Act, 1937) etc. Additionally, several awards related to chemical and environmental management are initiated on voluntary basis by industrial associations, who play an important role in encouraging industries to go for non-regulatory mechanisms.

Important industrial associations include:-

- Indian Chemical Council (ICC) (formerly the ICMA – Indian Chemical Manufacturer's Association)
- Confederation of Indian Industry (CII)
- Federation of Indian Chambers of Commerce and Industry (FICCI)

In addition to the illustrated regulations in Figure no. 5.3, transportation is regulated by following guidelines/ conventions:-

1. **Air Transportation** of dangerous goods is required to conform to the International Air Transport Association (IATA), Dangerous Goods Regulations which govern the packaging and labeling of HAZCHEM. A set of technical instructions for the safe transport of dangerous goods by air was also issued by International Civil Aviation Organization (ICAO) in 1982–83.
2. **Maritime Transportation** of dangerous goods follows the conventions of the International Maritime Organization (IMO); Maritime Pollution (MARPOL) Conference; and Safety Of Life At Sea (SOLAS) Convention. There is also a UN committee of experts, which is part of the international efforts to standardize handling and carriage of dangerous goods.

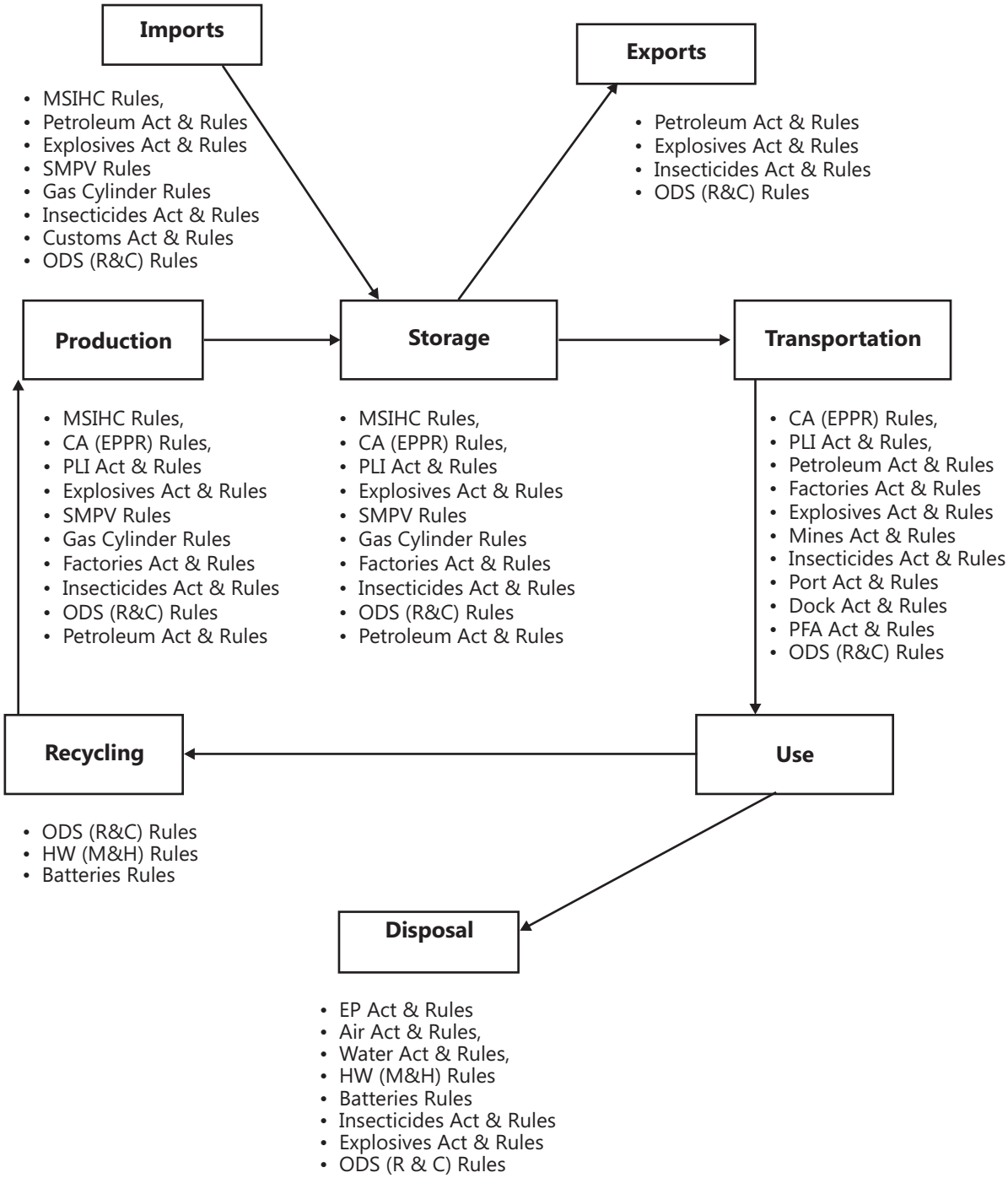


Figure no. 5.4 Legal instruments addressing chemicals management

Acts and Rules related to Environmetal Management	***The Air (Prevention and Control of Pollution) Act, 1981 amended 1987***
	The Air (Prevention and Control of Pollution) (Union Territories) Rules, 1983
	The Water (Prevention and Control of Pollution) Act, 1974, amended 1988
	The Water (Prevention and Control of Pollution) Rules, 1975
	The Environment (Protection) Act, 1986, amended 1991
	Environmental (Protection) Rules, 1986 (amended in 1999, 2001, 2002, 2002, 2002, 2003, 2004)
	Hazardous Wastes (Management and Handling) Rules, 1989 amended 2000 and 2003
	EIA Notification, 1994
	Ozone Depleting Substances (Regulation and Control) Rules, 2000
	Batteries (Management and Handling) Rules, 2001
Acts and Rules related to Chemical Safety and Emergency Management	*Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 amended 2000*
	Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996
	Public Liability Insurance Act, 1991 amended 1992
	Public Liability Insurance Rules, 1991 amended 1993
Acts and Rules related to Specific Chemical Category/Container	***The Petroleum Act, 1934***
	The Petroleum Rules, 2002
	The Calcium Carbide Rules, 1987
	The Explosives Act, 1884
	The Explosives Rules, 1983
	The Gas Cylinder Rules, 2004
	The Static and Mobile Pressure Vessels (Unfired) Rules, 1981
	The Insecticides Act, 1968
	The Insecticides Rules, 1971
	The Essential Commodities Act, 1955
	The Fertiliser (Control) Order, 1985
Other Acts and Rules Relevant to Chemicals Management	***Factories Act, 1948***
	The Motor Vehicles Act, 1988
	The Central Motor Vehicles Rules, 1989
	The Mines Act 1952
	The Customs Act, 1962
	The Merchant Shipping Act, 1958 amended in 2002 and 2003
	Merchant Shipping (carriage of Cargo) Rules 1995
	The Indian Ports Act, 1908
	The Dock Workers (Safety, Health and Welfare) Act, 1986
	The Dock Workers (Safety, Health and Welfare) Rules, 1990
	Drugs and Cosmetics Act, 1940
	The Prevention of Food Adulteration Act, 1954
	The National Disaster Management Act, 2005
	The Prevention of Food Adulteration Rules, 1955
	The Prevention of Terrorism Act, 2002

Table no. 5.1 List of legal instruments

NODAL I/C

1. Responsibility to prepare and maintain an on-site emergency plan lies with the occupier of the chemical facility or installation. (13)
2. The MSIHC Rules, 1989 assigns the responsibility of preparation of the off-site emergency plan of a district to the District Collector of the district or the District Emergency Authority (DEA), if such is explicitly designated by the State Government. The Plan is required to be prepared in consultation with the occupiers of MAH installation in the area. The Chief Inspector of Factories (CIF) appointed under the Factories Act, 1948 is required to assist the District Collector in the preparation of the off-site emergency plan. District Collector/ Magistrate is also responsible for preparation and maintenance of Multi hazard District Disaster Management Plan (including human induced disasters) mandated under the DM Act 2005 and issues of integrating the two has arisen to be resolved by finding a feasible mode of structural and operational synergy. Such planning can be done at district level for better organization and administrative control of emergency response and services. (13)

6. RADIOLOGICAL & NUCLEAR ACCIDENTS

INTRODUCTION

In the 21st century nuclear radiation is being used in diverse fields like medicine, in agriculture and the food processing industries. Power generated through nuclear technology is seen as a prime economic move in taking the country forward in a world with fast-depleting reserves of fossil fuels. While excessive exposure to nuclear radiations is harmful, safe work practices, safe and well-designed nuclear plants and stringent regulatory control can bring down the risks due to radiation exposure to negligible levels.

International points of entry are vulnerable to accidents involving radio-nuclear activity due to their vicinity to the nuclear reactors, potential of radio-nuclear substances for terror attack and many times, covert nature of radiation exposure. To prevent, protect against and treat injuries due to accidents involving radio-nuclear substances is a priority area.

TYPES OF ACCIDENTS:

A **nuclear accident** involves nuclear fission, especially in a nuclear reactor. This covers accidents in nuclear reactors, 'criticality' situations in fuel cycle facilities, nuclear explosions, etc.

Currently 21 nuclear reactors are there in India distributed in the states of Rajasthan (Rawatbhata), Karnataka (Kaiga), Maharashtra (Tarapur), Tamil Nadu (kalpakkam, Kundalkulam), Gujarat (Kakrapur) and Uttar Pradesh (Narola).

A **radiological accident**, on the other hand, involves a release of ionizing radiation (X-ray equipment or sealed sources like 60Co, 137Cs or 192Ir in tele-therapy equipment, industrial radiography cameras or irradiators) or discharge of radioactive materials (unsealed sources used in nuclear medicine and scientific research) into the environment. Examples of such emergencies are the accidents that took place at Goiania in Brazil, San Salvador, Istanbul in Turkey, Panama, etc.

Radiological accidents may occur in the following situations:

(a) A radioactive source (in tele-therapy equipment or industrial radiography cameras) may be stolen, lost, misplaced or sold and may come into the possession of unsuspecting people thereby exposing them and possibly others to radiation.
(b) A radioactive source (in tele-therapy equipment, industrial radiography cameras or irradiators) may fail to get retracted after use and may remain unshielded, exposing the operator to high levels of radiation.
(c) Contamination through leak or break in vial containing radioactive material in a nuclear medicine facility.
(d) Transportation accidents involving radioactive materials.

Eight nuclear/ radiological emergency scenarios envisaged in the disaster planning are listed below:

- Accidents in Nuclear Power Plants and other facilities in the Nuclear Fuel Cycle
- 'Criticality' Accidents (If Critical Mass of fissile material is achieved)
- Accidents during Transportation of Radioactive Materials
- Accidents at facilities using Radioactive Sources
- Disintegration of Satellites during Re-Entry
- Nuclear/Radiological Terrorism and Sabotage at Nuclear Facilities
- State-Sponsored Nuclear Terrorism
- Explosion of Nuclear Weapons

RADIATION UNITS:

The universally accepted *Système international d'unités*, (SI unit) of the absorbed dose is Gray (Gy). In order to compare the damaging potential of different kinds of radiation and to assess the damage caused, the equivalent dose is used. The SI unit of the equivalent dose is Sievert (Sv).

Factors affecting the effects of radiation on human body are enlisted in Table no. 6.1

Table no. 6.1 FACTORS AFFECTING EFFECTS OF RADIATION

A.	**Type of Injury**	**1. Exposure to radiation**- The affected person is not a source of radiation. **2. Contamination:** radioactive substance getting deposited on the skin/ clothing or gaining entry into the body through airway, mouth or through the intact or broken skin.
B.	**Dose rate**	**1. Acute-** as a single dose **2. Fractionated-** in divided doses as in case of radiotherapy **3. Protracted**- over a long period of time
C.	**Type of radiation involved**	1. Alpha (α) particles- have intense ionization effect if they get incorporated in the body following **inhalation, ingestion or through open wounds.** However, it does not penetrate the outer horny layer of skin. 2. Beta (β) particles- penetrate 1 centimeter (cm) in tissue. They can give rise to severe burns (also called β burns). 3. Gamma (γ) and X rays travel many cm in tissue and eventually pass through the body. They cause harm to the deeper structures and vital organs, including the bone marrow, giving rise to systemic effects of "Acute Radiation Syndrome (ARS)".
D.	**Tissue sensitivity**	Highly sensitive cells/ tissues are lymphocytes, the fast dividing cells of the bone marrow and the cells lining the intestinal villi. The nerve tissue, by contrast, is the most radio resistant tissue.
E.	**Dose distribution:**	1. Whole body exposure (causing Acute Radiation Syndrome) 2. A localized exposure (causing radiation burns) 3.The pattern of deposition or incorporation (internal contamination) of radioactive material in the body.
F.	**Half Life**	Radioactive materials decrease in activity over time (radioactive decay), thereby transforming into a more stable form. Half life is the time taken for activity of radioactive substance to reduce to half.

TYPES OF INJURY

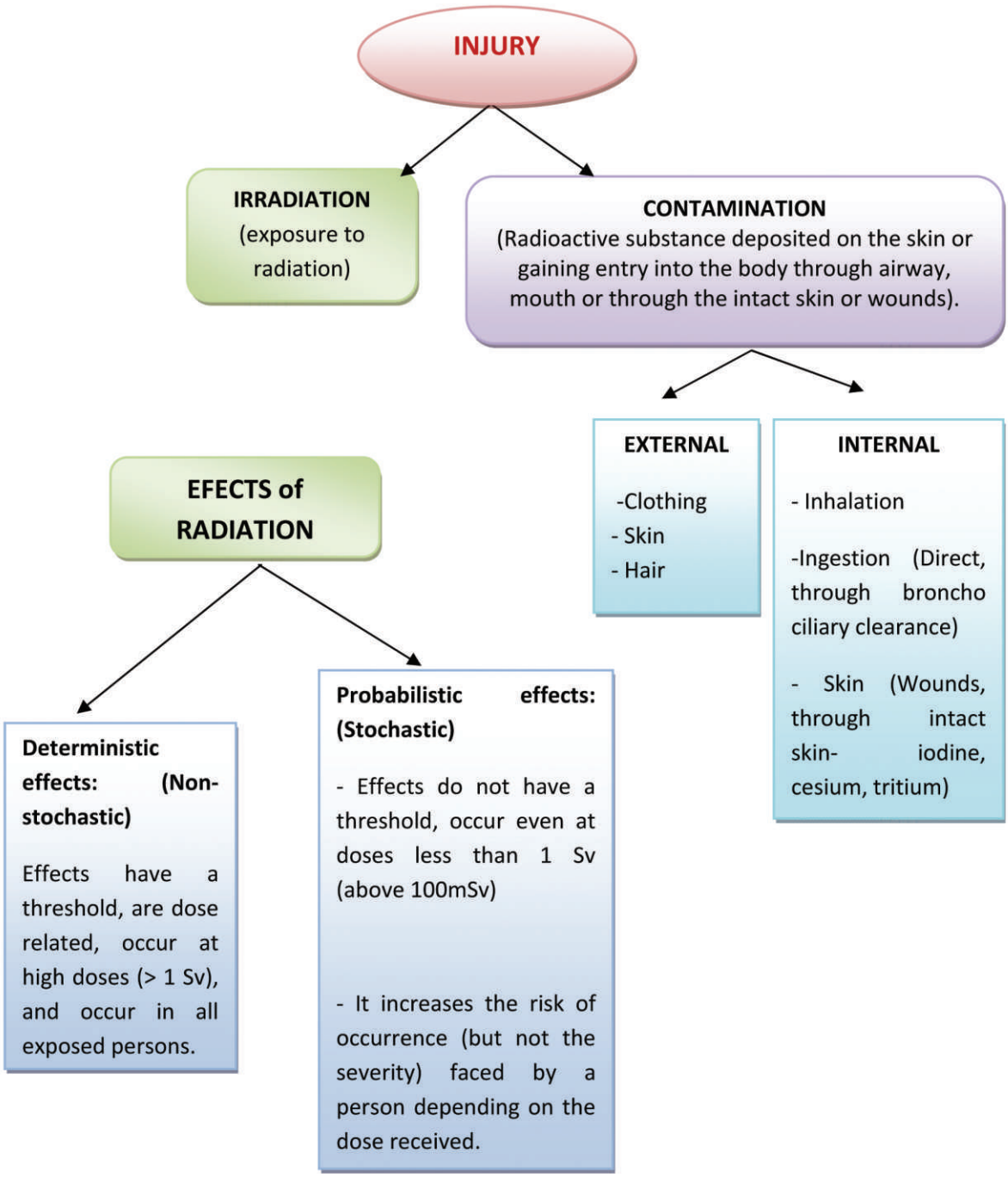


Figure no. 6.1 Types of injuries due to radiation.

EFFECTS OF EXPOSURE TO RADIATION (IRRADIATION):

Effects of radiation exposure can be deterministic or stochastic as illustrated in Figure no.1. Table no. 6.2 enlists some deterministic effects of irradiation and their threshold.

Table no. 6.2 Deterministic effects of irradiation and their threshold.

S. No.	Effect	Threshold
1	Chromosomal aberrations	100 mGy
2	Gonads (Sterility after 2 months in males)	
	Temporary	1 Gy
	Permanent	6 Gy
3	Cataract in Lens(appears in 2-3 yrs)	5 Gy (Under revision to 500 mGy)
4	Skin	> 3 Gy
5	Haemopoietic	1 – 8 Gy
6	Gastro Intestinal	8 – 30 Gy
7	Neuro-Vascular	>30 Gy

ACUTE RADIATION SYNDROME (ARS)

A single acute high dose (≥1 Gy) exposure of penetrating radiation like γ radiation or x-rays to the major portion of the body can give rise to a clinical entity of "Acute Radiation Syndrome (ARS)". ARS is typically divided into four phases:

1. **Prodromal Phase:** The condition is heralded by a prodromal phase which may be marked by nausea, vomiting (indicating Hematopoietic involvement), diarrhea (indicating Gastrointestinal involvement), prostration, giddiness (indicating Cardiovascular involvement), imbalance and convulsions (indicating Central nervous system involvement) in increasing order of severity. The time of onset of vomiting and its severity may give an indication of the dose received by the person as described in the Table no. 6.3.

As lymphocytes are extremely sensitive to radiation exposure, depleting absolute lymphocyte counts can also provide a good guidance about the dose during this phase.

Table no. 6.3 Time of onset of vomiting and the likely dose of exposure to radiation			
S. No.	Time of onset after exposure	Likely Dose (Gy)	Action required
1	No vomiting in 6 h	< 1	Outpatient with 5 week surveillance
2	Vomiting 2-3 h	1 – 2	Surveillance in a general hospital (or outpatient for 3 weeks followed by hospitalization)
3	Vomiting 1-2 h	2 – 4	Hospitalization in a hospital with good hematological support (isolation from days 10 to 20)
4	Vomiting earlier than 1 h or symptoms like diarrhea, giddiness Signs like erythema on affected are	> 4	Admission in a hospital having sterile, reverse isolation facilities

1. **Latent Phase:** The prodromal period may be followed by a variable asymptomatic latent period of 2-3 weeks during which the person may feel better (at higher doses the latent period may be very short or absent) only to be followed by a stage of manifest illness.
2. **Stage of Manifest Illness:**

   ARS may be classified according to the system most affected as:

   3.1 **Hematopoietic syndrome (1-8 Gy):** The injury to bone marrow results in reduction of platelets (thrombocytopenia) and white blood cells (granulocytopenia) with resultant bleeding and infections needing blood component therapy and treatment of opportunistic infections. With good medical and nursing care, the person may recover or death may ensue due to bleeding and infection in 2 months.

   3.2 **Gastro intestinal syndrome (8-30 Gy):** The injury to intestinal mucosal stem cells gives rise to death due to severe diarrhea leading to severe dehydration, electrolyte disturbances, infection and death in 2 weeks.

   3.3 **Neurovascular syndrome (>30 Gy):** The low blood pressure and swelling of the brain and injury to various other vital organs like lungs, kidneys and liver results and only terminal care remains possible. Death may occur in 2 days.
3. **Recovery Phase or Death**

RADIATION EFFECTS ON THE SKIN

This is also known as Cutaneous Radiation Syndrome (CRS) or Cutaneous Radiation Injury (CRI). Handling of highly radioactive sources (e.g. placing a hand in the beam of industrial radiography camera) may give rise to a very high dose locally.

- As opposed to thermal burn, the signs of radiation burn may take several days to appear and healing is delayed beyond months. Blood supply to the site can get affected due to narrowing of blood vessels and hence they evolve very slowly and can be deceptive in appearance vis-à-vis thermal burns.
- The insufficient blood supply due to damage to underlying blood vessels may result in breaking down of previously healed skin.
- Skin changes in absence of contact with corrosives, heat or insect bites should arouse suspicion of a radiation injury.
- Further, the immunity may be suppressed. Radiation burns need prolonged management with frequent follow-ups.

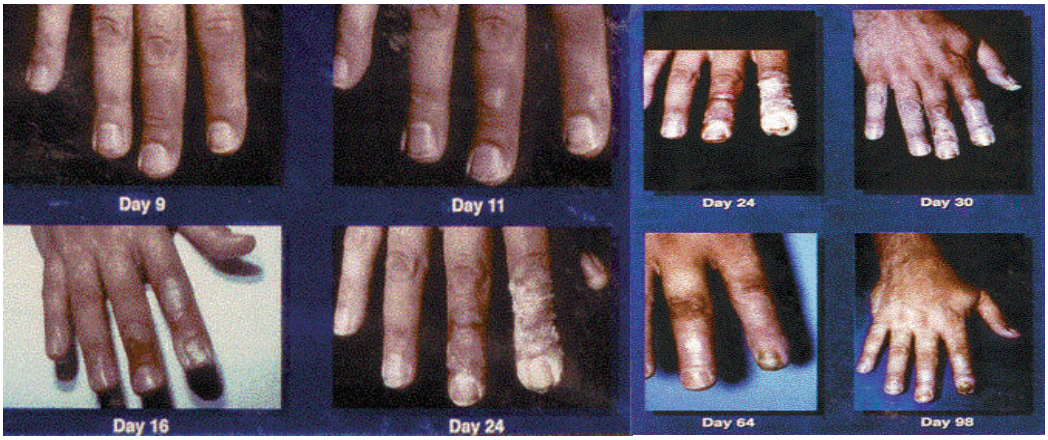


Figure no. 6.2. Progression of erythema in a patient involved in an x-ray diffraction accident.

Management of Radiation Burns

- Sterile protective dressings, use of antibiotics and pain killers are required.
- Skin grafting in case of full thickness burn if area is more than 2 to 3 cm^2.
- Excision of tissue and amputation in case of large areas of necrosis and gangrene.

RADIOACTIVE CONTAMINATION

Radiation Exposure (irradiation) and contamination are often confused. Radiation is energy, which, after causing the damage, does not remain in the body, whereas contamination is the physical presence of a radioactive material. Radioactive contamination, as against radiation exposure, is important from the public health point of view.

It is called **External Contamination** when there is presence of this material on shoes, clothing or on skin/hair

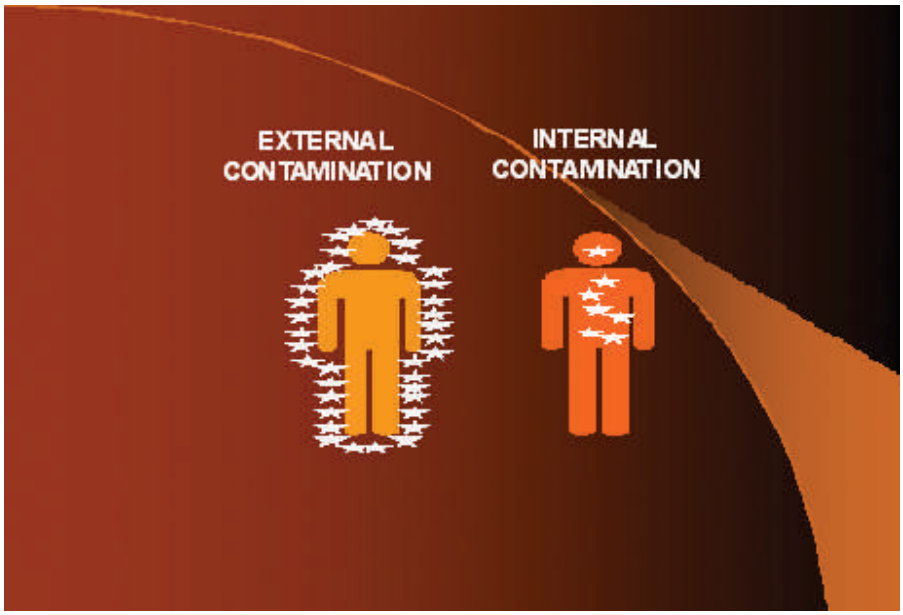


Figure no. 6.3 External and Internal Contamination

EXTERNAL DECONTAMINATION

Objectives:

(a) To reduce the surface dose rate.

(b) To prevent the activity from entering the body.

(c) To prevent contamination from spreading to other persons or objects.

DECONTAMINATION PROCEDURE:

Figure no. 6.4 Decontamination as issued by CDC.

1. First Aid

- The person should be stabilized physiologically before decontamination is attempted.
- Place: Decontamination should be carried out at the site of the accident preferably in separate place earmarked for this purpose. It should be easily accessible to the exterior of the building to ensure minimum spread of contamination when the patient arrives. The floor of the room should be easily washable or should be covered with polythene sheets. The room should have water supply, low- level sink for collection of contaminated water, and a place for monitoring instruments.
- Elimination of 90% of contamination is achieved by removal of clothing alone. Over-aggressive and over- zealous treatment should be avoided in order to prevent injury to the natural barriers of the skin resulting in enhanced absorption.
- Measures like removal of contaminated clothing at the site of accident, shower bath, administration of first aid for internal contamination should be done at the first aid before sending patient to site hospital.
- Measures to reduce absorption:
  1. Stomach wash– To remove the contaminant before getting absorbed.
  2. Inducing vomiting.
  3. Laxative– To hasten the movement through the intestines to reduce the time of contact of the contaminant in the gut.
- Generally, trained Health Physics Staff does the monitoring. The doctor is required in case of persistent contamination with associated injury or contamination of sensitive parts of the body; e.g. eyes, nose, mouth etc.

INTERNAL CONTAMINATION (INCORPORATION)

Usually this follows dispersal of powdered, liquid, or gaseous radioactive material. Effective treatment requires knowledge of both the radionuclide and its chemical form. Effectiveness of treatment is dependent on an early treatment.

It can occur due to accidental intake of a radioisotope by Inhalation, Ingestion, Injection (or absorption through broken/ intact skin).

DECORPORATION

Early effective decontamination of internal contamination can considerably reduce late effects of inhaled or ingested radionuclides. Decorporation has to be carried out using specific antidotes (Table no. 6.4).

Table no. 6.4 Specific treatment for internal contamination.				
S. No.	**Radionuclide**	**Common mode of contamination**	**Target organ**	**Specific Treatment**
1	Iodine (I-131)	Inhalation Ingestion Subcutaneous absorption	*Thyroid*	Potassium iodide
2	Strontium (Sr-90)	*Ingestion* *Wound*	Bones	Aluminum phosphate gel Calcium alginate Aluminum hydroxide gel
3	Caesium (Cs-137)	Inhalation Ingestion	Muscles	Prussian blue
4	Tritium (H-3)	Inhalation Ingestion Skin absorption	Whole-body	Increased fluids Diuretics
5	Phosphorus (P-32)	Ingestion	Bones	Stable phosphorus in the form of Glycero-phosphates
6	Uranium (U-235)	Inhalation Ingestion Wound	Kidneys	Sodium bicarbonate infusion
7	Plutonium (Pu-239)	Inhalation Wound	Liver Bones	Ca-DTPA aerosol Intra-venous Ca-DTPA

LEGAL ISSUES

We continue to get exposed to about 2.4 mSv/ year because of natural background radiation which comprises of Cosmic radiation (from sun and outer space), Terrestrial radiation (from earth's crust), Radon (decay product of Uranium, Radium) and Internal (Potassium-40 in our body).

1. Various advisory groups review the use of radiation, evaluate the risk, and make recommendations on safe use, including exposure levels for personnel and the general population, the most prominent international organization being the ***International Commission on Radiological Protection (ICRP)***. Another organisation **United Nations Scientific Committee on Effects of Atomic Radiation (UNSCEAR)**, since 1955, has been scientifically evaluating the sources of radiation like natural background radiation, medical exposures and effects like cancer, DNA change, systemic effects on immune system, cardiovascular system and assessing the risk posed by such low level exposures.
2. The regulatory body in India is **Atomic Energy Regulatory Board (AERB)**. As per its recommendations,
    - Occupational exposure to radiation (Figure 6.3):

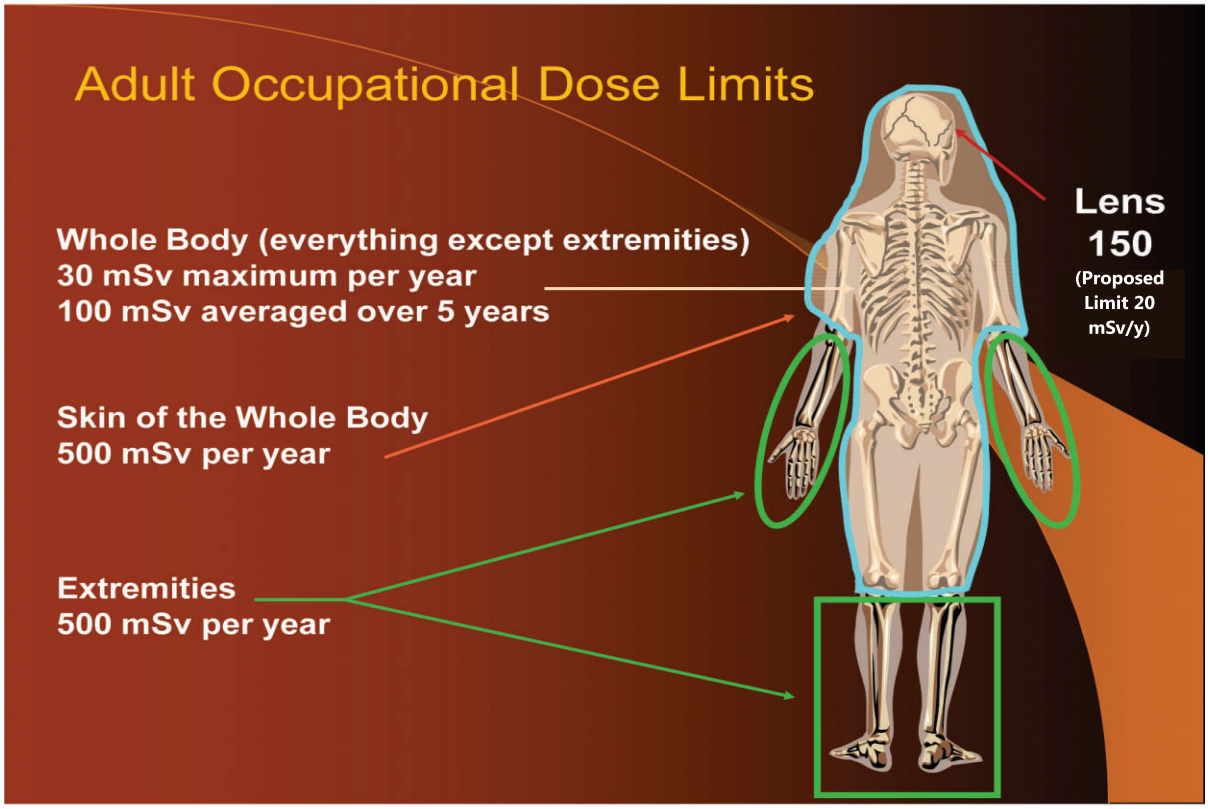


Figure 6.5 Occupational dose limits for radiation exposure in Adults

- The AERB recommends that the general public should not be exposed to more than an average of 1 mSv per year over the natural background as a result of nuclear activities (Figure no. 6.4).

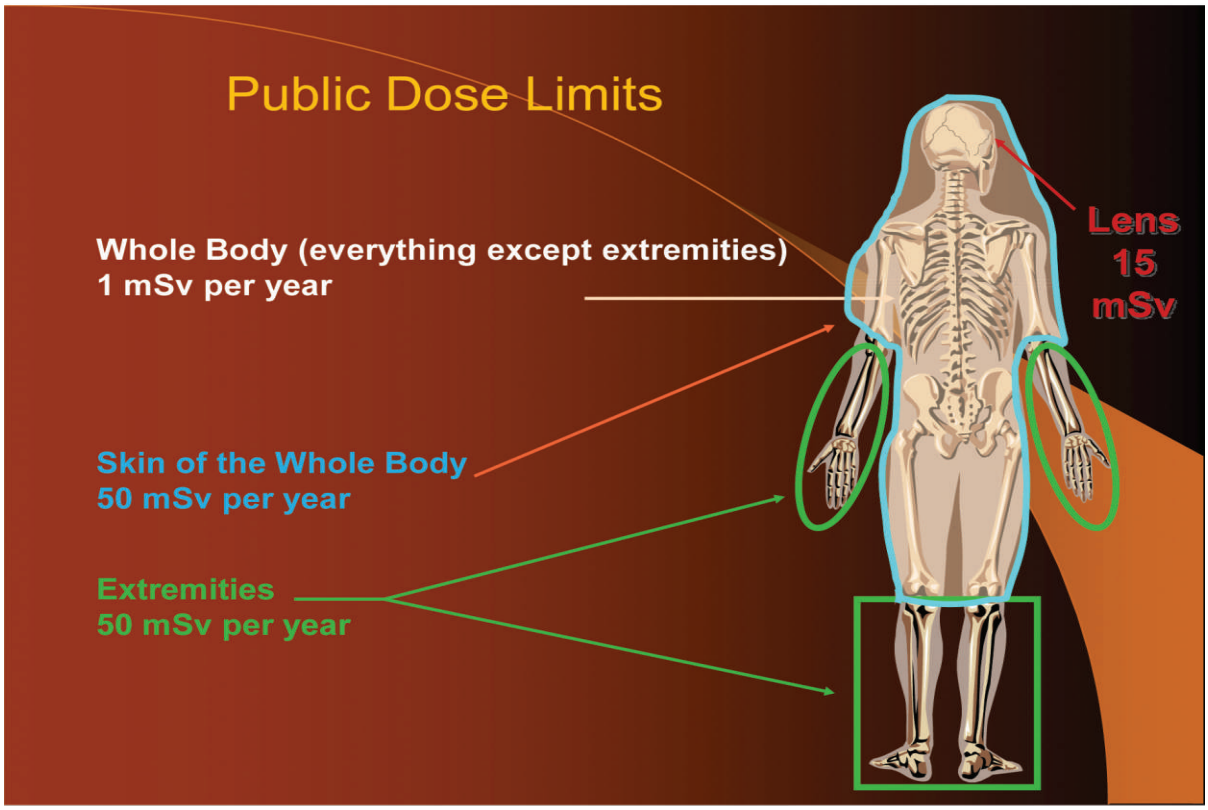


Figure 6.6 Dose limits for radiation exposure for Public

CMG-DAE - Emergency Control Rooms (ECRs) at Mumbai

DAE, ECR			
DAE ECR	Phone	Fax	E- mail
CMG Anushakti Bhavan, C.S.M Marg, Mumbai (24X7)	022-22023978 022-2202 1714	022-22830441	daeecr@dae.gov.in
VSB Standby ECR			
NPCIL VS Bhavan Anushatki Nagar Mumbai (24X7)	022-25991070 022-2551 5283	022-25991080 022-25993080	vsbecr@npcil.co.in

Contact details of DAE Officials

DAE - Emergency Response Director (DAE-ERD)	**Nodal DAE-ERC's Emergency Response Manager (ERM)**	**Alternate Nodal DAE-ERC's Emergency Response Manager (ERM)**
Dr. Pradeep kumar K.S. **Associate Director, HS & E Group and** **Head, Radiation Safety Systems Division, B.A.R.C,** **Mumbai- 400085** **022-25593717 (O)** 022-25517108 (R) 09869270285 (M) Fax: 022-25505313 E-mail pradeep@barc.gov.in **pradeepdrks@gmail.com**	Shri Rajvir Singh Head, Emergency Response Systems & Methods Section, Radiation Safety Systems Division B.A.R.C, Mumbai-400085 022-25593201 (O) 022-25564729 ® 09869271214 (M) **Fax: 022-25505313** **E-mail** **rajvir@barc.gov.in,** **rajvir_singh_yadav@yahoo.co.in**	**Dr. S.Murali** **Officer In Charge,** **Emergency Preparedness and Response Centre,** Radiation Safety Systems Division B.A.R.C, Mumbai-400085 022-25593774 (O) 022-27812970 (R) 09869270245 (M) **Fax: 022-25505313** E-mail smurali@barc.gov.in mrliyengar@gmail.com

CRISIS MANAGEMENT GROUP, DEPARTMENT OF ATOMIC ENERGY

For any radiation related emergency in public domain, Emergency Control Room (ERC) can be contacted, contact details of which are tabulated below.

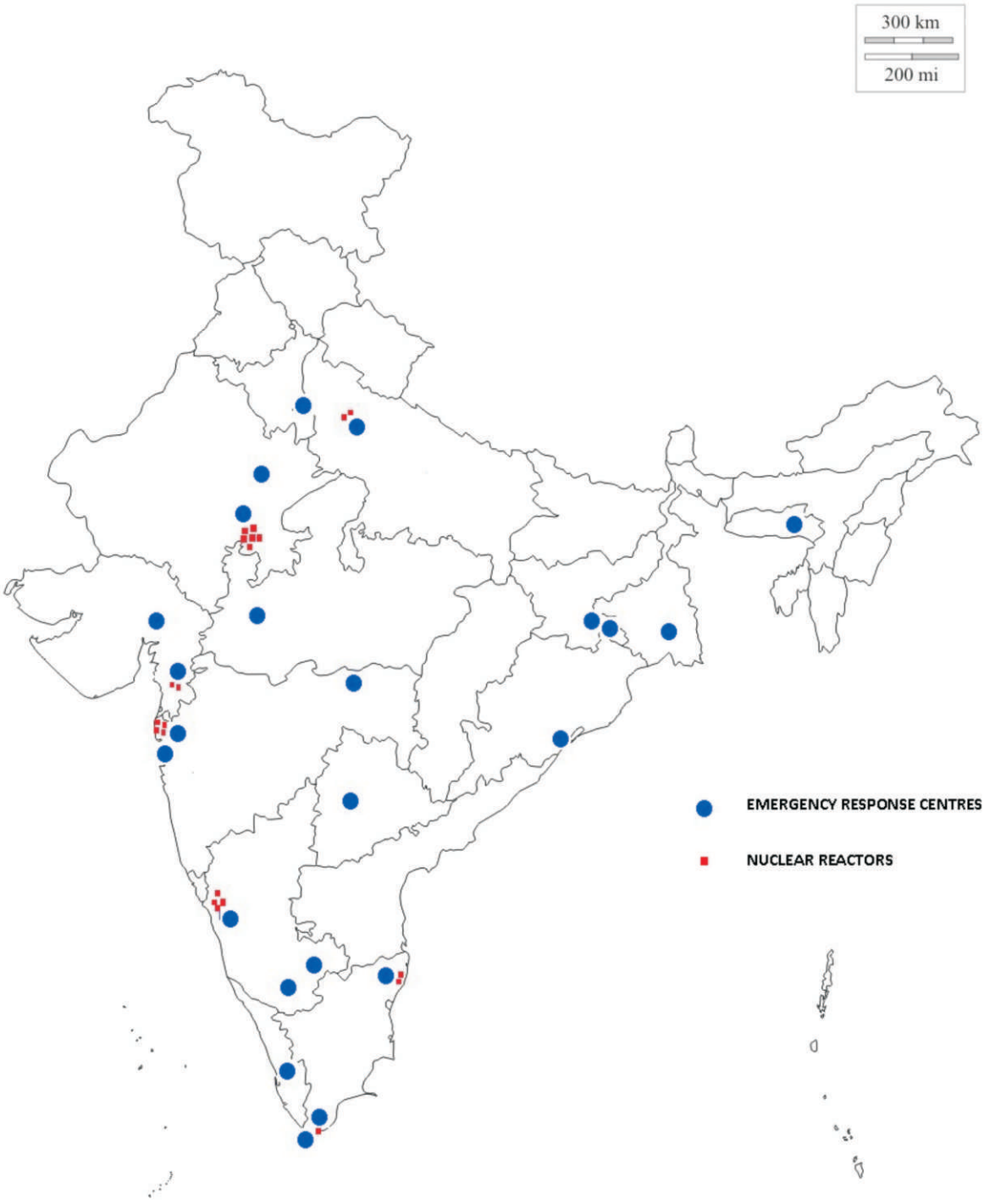


Figure 6.7 Location of Emergency response Centers and Nuclear Reactors in India

CONTACT DETAILS OF DAE-ERCs (*As on 11/05/2016*)

S. No	ERC	Contact Person	Address	Email ID
1.	BARC, Mumbai	1. Dr. S.Murali	G-130 H, Mod. Lab., BARC, Trombay, Mumbai-400085	smurali@barc.gov.in mrliyengar@gmail.com
		2. Shri A Bhatnagar	G-171,Mod. Lab., BARC, Trombay, Mumbai-400085	bamit@barc.gov.in amit_barc@yahoo.com
2.	Alwaye Kerala	1.Shri S Suryakumar	Head IRE Ltd, Udyogamandal Kerala-683501	head-red@irel.gov.in
		2.Shri M Harikumar	OIC, HPU,IRE Ltd,Udyogmandal, Alwaye, Kerala-683501	mhari07@rediffmail.com
3.	Bengaluru (AMD)	1. Dr Syed Zakaulla	ERC Manager, Regional Director, AMD Complex, Nagarbhavi Bengaluru, Karnataka- 560072	rdsr.amd@gov.in
		2. Shri.Ram Mohan Reddy B.	ERC coordinator AMD Complex, Nagarbhavi Bengaluru, Karnataka-560072	rammohanreddy.amd@gov.in
4.	Delhi (AMD)	1. Shri G.B.Joshi	Regional Director AMD, West Block-7, R.K.Puram, Sec-1,New Delhi-110066	rdnr.amd@gov.in
		2.Shri Aapsr Acharyulu	AMD, West Block-7, R.K.Puram, Sec-1, New Delhi-110066	icphy-nr.amd@gov.in aapsacharyulu.amd@gov.in
5.	Hyderabad	1.Dr. N. Saibaba	Chairman & CE, NFC, Hyderabad	cenfc@nfc.gov.in
		2. Shri K. Vishwa Prasad	OIC, HPU, NFC, Post: ECIL. Hyderabad- 500062	vishwa@nfc.gov.in vishwaprasad@rocketmail.com
6.	Indore	1.Dr P.D.Gupta	Director, RRCAT & ERD, Indore Indore-452013	pdgupta@rrcat.gov.in
		2. Shri. T.A.Puntambekar	Head, IOBDD Division, RRCAT & ERM	tushar@rrcat.gov.in
		3. Dr. Haridas.G	OIC, Health Physics Unit RRCAT, Indore-452013 & ERC Co-ordinator	haridas@rrcat.gov.in
		4. Shri. Dilip Kumar Gupta	Alternate ERC Co-ordinator	dilipgupta@rrcat.gov.in
7.	Jaduguda	1. Shri D.Acharya	Chairman & MD, UCILPO-Jaduguda Mines Dt.Singhbhum (E), Jharkhand-832102	cmducil@gmail.com d.acharya@ucil.gov.in

		2. Dr. V.N.Jha	OIC, HPU, UCIL, PO-Jaduguda Mines Dt.Singhbhum (E), Jharkhand-832102	jhavn1971@gmail.com
8.	Jaipur (AMD)	1.Shri R.K Purohit	Regional Director, AMD Complex Sector-5(Ext), Pratap Nagar, Jaipur, Rajasthan-302033	rdwr.amd@gov.in
		2.Shri Manu Thandra	OIC,Phy Section, AMD Complex, Sector-5(Ext), Pratap Nagar, Jaipur, Rajasthan-302033	manuthandra.amd@gov.in manuamd@yahoo.com
9.	Kaiga	1.Shri H.N.Bhat	Site Emergency Director, Kaiga, Karwar, U.K. Dist, Karnataka-581400	hnbhat@npcil.co.in
		2. P. G. Raichur	ERM, TSS, KGS 3&4, Kaiga, Karwar, U.K. Dist, Karnataka-581400	pgraichur@npcil.co.in
		3. G. K. JHA	Alt-ERM, TSS, KGS 1&2, Kaiga, Karwar, U.K. Dist, Karnataka-581400	gkjha@npcil.co.in
		4.B.N.Dileep	ERC Co-ordinator, OIC,ESL, Kaiga Township, Kaiga, Karwar, U.K. Dist, Karnataka-581400	bndileep@npcil.co.in
10.	Kakrapar	1. Shri. L. K. Jain	Site Director, Kakrapar Gujarat Site, Kakrapar, Anumala P.O, Surat, Gujarat-394651	lkjain@npcil.co.in
		2. Shri. G P S Jajpuria	ERM, CE (U&ES), Kakrapar Gujarat Site, Kakrapar, Anumala P.O, Surat, Gujarat-394651	gpsjajpuria@npcil.co.in
		3. Shri. A K Mishra	Alt-ERM, TSS, KAPS-1&2, Kakrapar, Anumala P.O, Surat, Gujarat-394651	akmishra863@npcil.co.in
		4. Dr. A. K. Patra	ERC Co-ordinator, Officer-in-Charge, Environmental survey Laboratory, Kakrapar, Anumala P.O, Surat, Gujarat-394651	akpatra@npcil.co.in, akpatra74@gmail.com
		5. Shri. S. Karthik	Alt. ERC Co-ordinator, RSO, HPU, KAPS-1&2, Kakrapar, Anumala P.O, Surat, Gujarat-394651	skarthik@npcil.co.in

11.	Kalpakkam	1.Dr. B Venkataraman	Associate Director, RSEG, IGCAR, Kalpakkam, Tamilnadu-603102	bvenkat@igcar.gov.in
		2.Dr. S. Rajaram	OIC, ESL, Atomic Energy Township, Kalpakkam, Tamilnadu-603102	srajaram@igcar.gov.in
12.	Kolkata	1. Dr. D. K. Srivastava	Director, VECC Bidhannagar,Kolkatta, West Bengal-700064	dinesh@vecc.gov.in
		2.Dr. Tapas Bandopadhyay	OIC, HPU, VECC, 1AF,Bidhannagar,KolkattaWest Bengal-700064	tapas@vecc.gov.in tapas.bandyo@gmail.com
13.	Kota	1. Shri T J Kotteeswaran	Site Director, Rawatbhata, Rajasthan site,PO Anushakti, via Kota, Rajasthan -323303	tjkotteeswaran@npcil.co.in
		2.Shri S.N.Tiwari	Officer Incharge, ESL, Rawatbhata, Rajasthan site PO:- Bhabha Nagar , via Kota Rajasthan -323307	sntiwari@npcil.co.in
14.	Kudankulam	1. Shri R.S.Sundar	Site Emergency Director, Kudankulam ,Tiruneveli Dist, Tamilnadu-627120	rssundar@kknpp.com
		2.Shri B. Vijay Kumar	OIC, ESL, KKNPP, Anuvijay, Township, Tiruneveli Dist, Tamilnadu-627120	vijayeslkk@gmail.com vijay@kknpp.com
15.	Nagpur (AMD)	1.Shri O.P.Yadav	Regional Director, Civil lines, AMD/DAE, Nagpur, Maharashtra-440001	rdcr.amd@gov.in
		2.Shri G.B.Rout	ERC Coordinator & OIC, Physics Lab., AMD/DAE, Civil lines, Nagpur-440001	gbrout.amd@gov.in
16.	Narora	1. Shri D S Choudhary	Site Director, NAPS Narora, Bulandshahr - 203389 (U.P.)	dschoudhary@npcil.co.in
		2.Shri Avinash Kumar	OIC, ESL, NAPS, Narora, Bulandshahr - 203389 (U.P.)	avinashkumar@npcil.co.in
17.	Shilong (AMD)	1. Shri SANDEEP HAMILTON	REGIONAL DIRECTOR NER Regional Center for Exploration & esearch,AMD/DAE, Nongmysong PO;Nonmyngsong, Shillong-793019	rdner.amd@gov.in

		2. Shri V. Rajagopalan	DEPUTY REGIONAL DIRECTOR,NER Regional Center for Exploration & Research,AMD/DAE, Nongmysong PO;Nonmyngsong, Shillong-793019	vrajagopalan.amd@gov.in
		3. Shri A.N.S.U. Muni Sankar	INCHARGE, Physics Lab.,NER Regional Center for Exploration & Research,AMD/DAE, Nongmysong PO;Nonmyngsong, Shillong-793019	munisankar.amd@gov.in ansumsankar@yahoo.com
18.	Tarapur	1. Shri Hemant Kumar	Site Director & SD, TAPS 3&4, Tarapur, Dist.-Thane, Maharastra-401504	kumarhemant@npcil.co.in
		2.Shri A Baburajan	OIC, ESL, TAPS Colony, TAPP (PO), Dist.-Thane, Maharastra-401504	ababurajan@npcil.co.in babu_aramana@yahoo.co.in
19.	Gandhinagar, Gujarat	2.Dr. Biswwanath Sarkar	Alternate Emergency Response manager, Institute of Plasma Research, Bhat Village, Near Indira Bridge, Ghandhinagar, Gujarat – 382428	bsarkar@iter-india.org sarkar@ipr.res.in
		1.Dr. Sudhirsinh Vala	Emergency Response manager, Institute of Plasma Research, Bhat Village, Near Indira Bridge, Ghandhinagar, Gujarat – 382428	sudhir@ipr.res.in sudhirvala98@gmail.com
20.	Mysore	1. Shri.Guha K.C.	Emergency Response Manager, RMP Colony, Narasimaraja Block, Flat No. 321, Hunsur Road, P.B.No.1, Yelwal, PO, Mysore-571130	guhakc@barc.gov.in
		2.Dr.A.Chandrashekar	Emergency Co-ordinator, RMP Colony, Narasimaraja Block, Flat No. 321, Hunsur Road, P.B.No.1, Yelwal, PO, Mysore-571130	chanarag@barc.gov.in chandrabasav@yahoo.co.in;

21.	Manaval-akurichi	1.Shri P.K.Jena	Head, IREL Manavalakurichi , Kanayakumari , TN 629252	irelmk@dataone.in head.mk@irel.gov.in
		2. K.Sreekumar	OIC,HPU,IRE Ltd, Manavalakurichi, TN 629252	hpuiremk@gmail.com srikumark@rediffmail.com
22.	OSCOM	1.Shri A K Mohapatra	Chief General Manager & Head, OSCOM, IRELtd, OSCOM, Chatrapur, Orissa-761045.	headireo@sancharnet.in head-ireo@irel.gov.in
		2. Shri Abinash Sahu	OIC, HPU, IRELtd, OSCOM, Chatrapur, Orissa-761045.	abinash_sahu31@yahoo.co.in
23.	Turamdih	1. Shri P.N.Sarkar	Shri P.N.Sarkar General Manager (O.P.) Uranium Corporation of India Limited Turamdih, P.O. Sundernagar Jamshedpur Pin-832107	pnsarkar@ucil.gov.in
		2. Dr. Rajesh Kumar	OIC HPU Unit, Turamdih PO Sundernagar, Jamshedpur Jharkhand-832107	rajesh.barc31@gmail.com

BARC visit of members from Ministry of Health and Family Welfare (IH Division) regarding Radio Nuclear Events, Expert Group discussion on draft Public Health Measures.

7. DISASTERS

INTRODUCTION

Multi-Hazard Vulnerability

India, due to its, physiographic and climatic conditions is one of the most disaster prone areas around the globe. Nearly 59 per cent of the landmass is prone to earthquakes ranging from moderate to very high intensity. More than 40 million hectares (12 per cent of land) is prone to floods and river erosions. Of the nearly 7500 km long coastline, close to 5700 km is prone to cyclones and tsunamis. Nearly 68 percent of the cultivable area is vulnerable to drought. Large tracts in hilly regions are at risk from landslides and some are prone to snow avalanches. Vulnerability to disasters/ emergencies of CBRN origin also exists. Heightened vulnerabilities to disaster risks can be related to expanding population, urbanization and industrialization, development within high-risk zones, environmental degradation, and climate change. (17)

DISASTERS

The UNISDR (2009) defines disaster:

A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

The DM Act 2005 uses the following definition for disaster:

"Disaster" means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be *beyond the coping capacity of the community of the affected area*."

Emergency - An emergency is a severe event, causes damage to infrastructure, economic and social structures, or human health, and requires external assistance.

"All disasters are emergencies but not all emergencies are disasters"

Natural hazards can be classified into five major categories as enlisted in Table no. 7.1

Table no. 7.1 Classification of Natural hazards

S. no.	Category	Events
1	Geophysical	Earthquake, Volcano, Tsunami
2	Hydrological	Flood, Landslides, Wave Action
3	Meteorological	Events caused by short-lived/small to meso-scale atmospheric processes (in the spectrum from minutes to days). Cyclone, Storm Surge, Tornado, Convective Storm, Extratropical Storm, Wind, Cold Wave, Derecho, Extreme Temperature, Fog, Frost, Freeze, Hail, Heat-wave, Lightning, Heavy Rain, Sand-Storm, Dust-Storm, Snow, Ice, Winter Storm, Blizzard
4	Climatological	Events caused by long-lived meso- to macro-scale processes (in the spectrum from intra-seasonal to multi-decadal climate variability. E.g. Drought, Extreme hot/cold conditions, Forest/Wildfire Fires, Glacial Lake Outburst, Subsidence
5	Biological	Epidemics: viral, bacterial, parasitic, fungal, or prion Infections, Insect infestations, Animal stampedes

Primarily disasters are triggered by natural hazards or human-induced, or result from a combination of both. Disasters are typically classified into distinct categories based on their origin. The following describes these classifications:

A. Natural Disasters

- Earthquakes
- Extreme Heat
- Flood
- Hurricanes
- Landslides
- Tornadoes
- Tsunamis
- Volcanoes
- Wildfires
- Winter Weather

B. Technological/Human-Made Disasters

- Radiation emergencies from nuclear blasts, nuclear reactor accidents, or accidental spills of radioactive material
- Radiation emergencies from nuclear blasts, nuclear reactor accidents, or accidental spills of radioactive material
  Bioterrorism
- Oil spills
- Bombing or destroying a nuclear reactor

C. Complex Emergencies

- War
- Famine
- Drought
- Conflicts
- Displaced Populations

DISASTER MANAGEMENT

Disaster management is a continuous and integrated process of planning, organising, coordinating and implementing measures which are necessary or expedient for the following:

1) Prevention of danger or threat of any disaster,
2) Mitigation or reduction of risk of any disaster or its severity or consequences,
3) Capacity-building,
4) Preparedness to deal with any disaster,
5) Prompt response to any threatening disaster situation or disaster,
6) Assessing the severity or magnitude of effects of any disaster
7) Evacuation, rescue and relief,
8) Rehabilitation and reconstruction

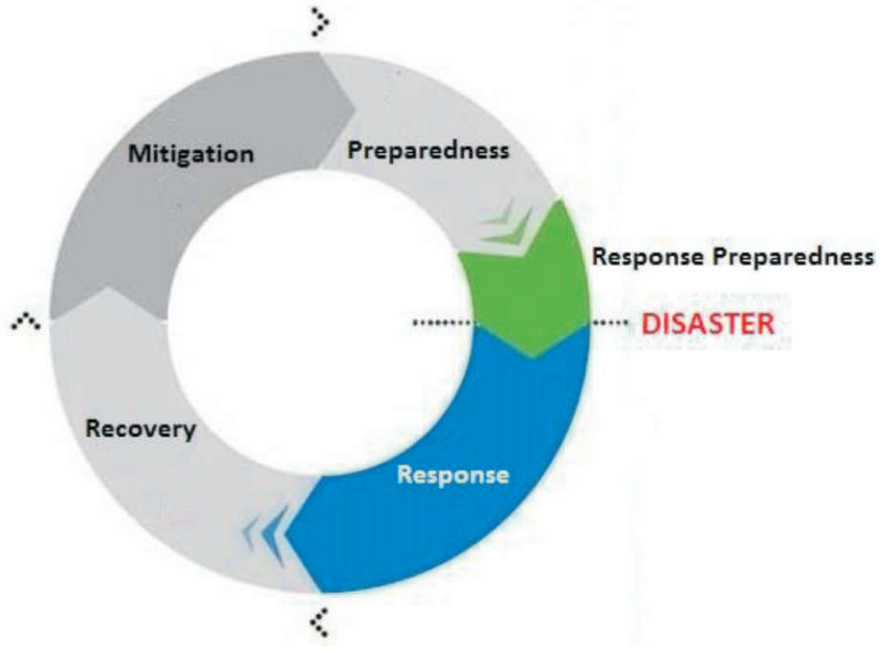


Figure no. 7.1 Disaster Management Cycle

1st Phase– Mitigation-

The mitigation phase is the sustained action or development of policies that reduce or eliminate risk to humans and property from a disaster.

During the mitigation phase, identified risks and population vulnerabilities are carefully reviewed to develop strategies to prevent reoccurrence of the similiar type of disaster in the future or limit the effect from such disasters. Existing preparedness plans are reviewed and revised to enhance the preparation efforts. There are few examples of activities that could take place during the mitigation phase are building or strengthening dams and levees, establishing better and safer building codes, purchasing fire insurance, and updating land use zoning. Though the sequence of events that take place following a disaster have a specific priority, many activities happen simultaneously. Similarly, some activities related to disaster response and recovery can extend for long periods. This is evident in continued efforts to manage the **Chernobyl Nuclear Power Plant disaster** that continues to plague the area over 30 years later with continued health risks and environmental cleanup.

2nd Phase -Preparedness –

The preparedness phase includes the development of plans designed to save lives and to minimize damage when a disaster occurs. Disaster prevention and preparedness measures should be developed and put in place long before a disaster strikes. Preparedness plans should be developed based on the identification of potential disasters and the related risks associated with these disasters. When possible, this should include hazard mapping to specify locations at high risk for specific disasters. The plan should include training of health personnel, community members, and other potential primary-responders, as well as establishing systems for communicating warnings to the community.

Strategies for evacuating at risk communities before impending disasters should be well thought out and communicated to community members. Weather patterns, geophysical activities, terrorist activities, industrial activities, wars, and other activities associated with a potential disaster should be monitored so that officials can anticipate impact, issue timely warnings and, when possible, evacuate at-risk populations. This phase should also include an inventory of available resources to respond to a potential disaster. An inventory will help to estimate the additional resources required and speed up the mobilization of resources following a disaster. Finally, partnerships should form in the preparedness phase to establish alliances, outline respective roles and define everyone's responsibilities.

3rd Phase -Response –

The response phase is the actions taken to save lives and prevent further damage in a disaster. This phase begins immediately after a disaster has struck. During the response phase, plans developed in the preparedness phase are put into action. While some disasters last only for a few seconds (e.g., earthquakes, explosions), others might last for several days, weeks, or even months (e.g., floods, droughts). The primary focus of the response phase is to provide relief and take action to reduce further morbidity and mortality. Such actions include providing first aid and medical assistance, implementing search and rescue efforts, restoring transportation and communication networks, conducting public health surveillance, and evacuating people who are still vulnerable to the effects of the disaster. Also during this phase necessary supplies, including food and water, are distributed to survivors.

4th Phase - Recovery –

As the immediate needs of the disaster are addressed and the emergency phase ends, the focus of the disaster efforts shifts to recovery. The recovery phase includes the actions taken to return the community to normal following a disaster.

Actions during this phase include repair and maintenance of basic health services, including sanitation and water systems; repair, replace or rebuild property; and the proper management of dead bodies. Proper care of dead bodies is necessary; it helps in minimizing the psychosocial effects on families. The management of dead bodies involves a series of activities that begin with the search for corpses, In situ identification of bodies, transfer to a facility serving as a morgue, delivery of the body to family members, and assistance from local health authorities for the final disposal of the body in accordance with the wishes of the family and the religious and cultural norms of the community. Documenting the cause of death, manner of death, and relationship to the disaster is important to better understand the human health effects of a disaster.

While many disasters happen suddenly with little or no warning (e.g., earthquake, tornado, landslide), others are preceded by warning signs (e.g., Tsunamis, hurricane, flood, draught). Complex disasters, such as famine, war, and global climate change can be slow to take effect and can extend over a long period. Role of public health experts or epidemiologists during disasters is the use of core public health capabilities to assess the needs of affected populations and provide timely and accurate health information to decision makers, and identify risk factors and improve prevention and mitigation strategies for future disaster.

Managing emergencies – through PH-EOC/SHOC

A public health emergency defined as an occurrence, or imminent threat, of an illness or health condition that poses a substantial risk of a significant number of human fatalities, injuries or permanent or long-term disability. Public health emergencies can result from a wide range of hazards and complex emergencies. Experience has shown that timely implementation of an Emergency Operations Centre (EOC) provides an essential platform for the effective management of public health emergencies. Public health emergencies involve increased incidence of illness, injury and/or death and require special measures to address increased morbidity, mortality and interruption of essential health services. For such emergencies, a multi-agency, multi-jurisdictional response is often required, working with the national disaster management organization. When normal resources and capacities are exceeded, support from outside the affected areas will also be required. External assistance could include national, cross-border, regional or international resources.

The Strategic Health Operations Centre (SHOC) EOC is a physical location or virtual space in which designated emergency management and response functions are performed, supported by appropriate legislation and regulations, and designed and resourced with sustainability in mind. SHOC plays a vital role in the coordination of information and resources for efficient and effective responses. SHOC may be a temporary facility, like field SHOC or may be established in a fixed location.

SHOC/ EOC aims to strengthen the public health preparedness and response to natural disasters and infectious disease outbreaks & chemical-biological-radiological-nuclear-explosive (CBRNE) emergencies (All Hazard approach) in state, district & sub district level. The SHOC/ EOC would be a centralized location for the public health response of state, district & corporation to collect, analyze and display epidemiology, laboratory, surveillance and rapid response team information and critical resources

deployed, in order to coordinate public health emergency response operations. Providing a single point of communication & coordination, the establishment of a centralized SHOC/ EOC will enhance state, district & corporation's capability to monitor health information, identify unusual health events and quickly respond to public health emergencies that affect life and property.

Purpose of SHOC/ EOC

The SHOC/ EOC are nodal point of a comprehensive public health emergency management response. Its purpose is to:

I. Collect, analyze, display, monitor, and disseminate public health emergency response data and information
   a. Sources: Epidemiological, laboratory, disease surveillance, Rapid Response Teams, POEs, GIS, broadcast and toll free call centres, print & electronic media scanning, etc.

II. Communicate, collaborate and coordinate response activities from a centralized location with intersectoral and interagency partners across international, national, state and district & sub district levels.

III. Identify, organize, deploy and track resources.

IV. Deploy Rapid Response Teams (RRTs) or Incident Management staff to the SHOC/ EOC and the field.
   a. Support the Districts during an emergency response.
   b. Contact tracing.

Advantage of SHOC/ EOC

- Interconnected SHOC/ EOC's at the national, state, and district & POE level allow for increased capacity to respond effectively to public health risks and public health emergencies of international concern and provide a streamlined notification process for the international community
- The SHOC/ EOC provides one central location for decision makers and key partners to meet and manage a public health emergency response and rapidly share information
- All data and information needed for executive response decisions are available in real-time.
- Standardized response plans and standard operating procedures can provide a roadmap for how SHOC/EOC can functions during an emergency response.
- A dashboard displaying routine and response surveillance data can help to develop a common operating picture during an emergency response
- Knowledge of critical resources and patterns of disease transmission will support the rapid response teams field response

An **Emergency Operations Center** (**EOC**) is a central command and control facility responsible for carrying out the principles of emergency preparedness and emergency management, or disaster management functions at a strategic level during an emergency, and ensuring the continuity of operation of a control room, political subdivision or other organization.

An EOC is responsible for the strategic overview, or "big picture", of the disaster, and does not normally directly control field assets, instead making operational decisions and leaving tactical decisions to lower commands.

The common functions of all EOC's is to collect, gather and analyze data; make decisions that protect life and property, maintain continuity of the organization, within the scope of applicable laws; and disseminate those decisions to all concerned agencies and individuals. In most EOC's there is one individual in charge, and that is the Emergency Manager.

The first most critical component of an EOC is **the individuals** who staff it. They must be well trained, and have the proper authority to carry out actions that are necessary to respond to the disaster. They also must be capable of thinking out of the box, and creating a lot of "what if" scenarios. The local EOC's function during an emergency is to support the incident commander.

The second most critical component of an EOC is its **communications system**. This can be from simple word of mouth, to sophisticated encrypted communications networks, but it must provide for a redundant path to ensure that both situational awareness information and strategic orders can pass into and out of the facility without interruption. For continuity of operations considerations, backbone components of the communications system are not normally located at the EOC. A number of EOC facilities are incorporating radio over IP technology to provide a coherent assembly of various radios, interoperability with various radio technologies, and integration with telephone systems.

Emergency Operations Centre- Uses principles of Incident Command System (ICS)

The Incident Command System, or ICS, helps to ensure integration of public health response efforts. ICS is a standardized, on-scene, all-hazards approach to incident management. It enables a coordinated response among various jurisdictions and agencies. It establishes common processes for planning and managing resources. It allows for the integration of facilities, equipments, personnel, procedures, and communications operating within a common organizational structure.

ICS was developed in the 1970s following a series of catastrophic fires in California. Property damage ran into the millions, and many people died or were injured. The personnel assigned to determine the causes of these disasters studied the case histories and discovered that response problems could rarely be attributed to lack of resources or failure of tactics.

ICS can be used to manage:

- Natural hazards.
- Technological hazards.
- Human-caused hazards.
- Planned events (Mass gatherings.)
- Biological threats
- Disease outbreaks

***(Incident**- An incident is an occurrence or event, natural or human-caused that requires a response to protect life or property)*

Incident Command System

What- Provides a consistent framework of managing emergencies.

Who- To enable central, state, district & local governments, private sector & NGOs to work in coordination. .

How to- prepare for prevent, detect, respond to, recover from, and mitigate the effects of incidents regardless of cause, size, location, or complexity.

Why- In order to reduce the loss of life and property, and harm to the environment.

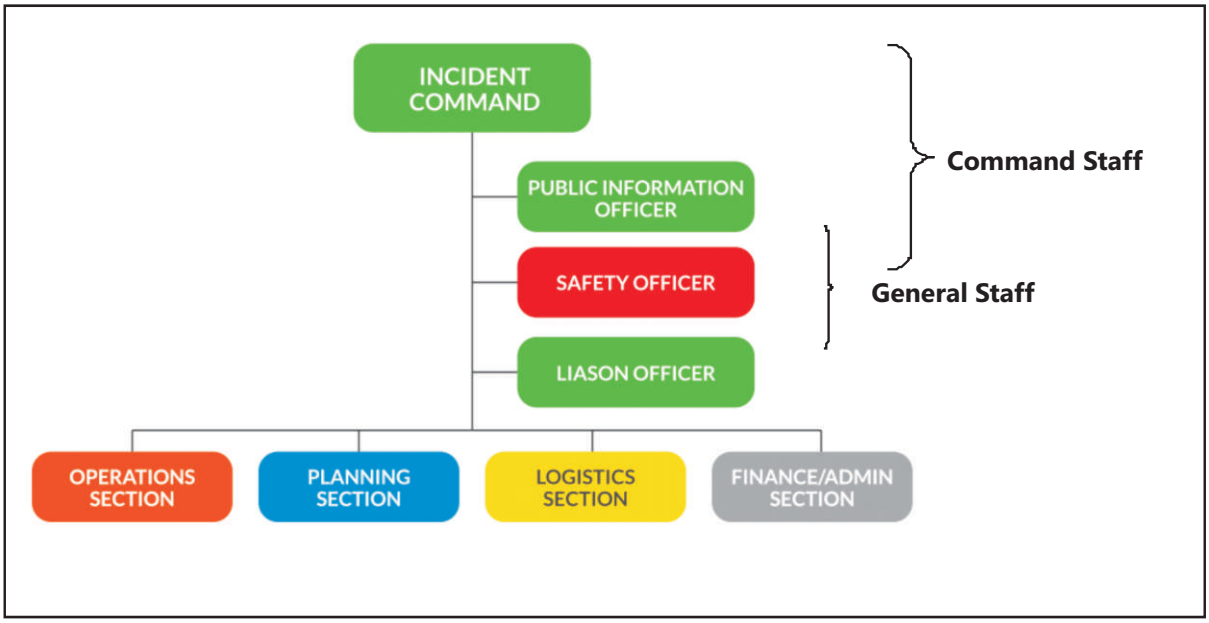
ICS helps to ensure:

- The safety of responders, experts, workers, and others.
- The achievement of response objectives.
- The efficient use of resources.

Without ICS?

- Lack of accountability, including unclear chains of command and supervision.
- Poor communication, due to both inefficient uses of available communications systems and conflicting codes and terminology.
- Lack of an orderly, systematic planning process.
- No common, flexible, predesigned management structure that enabled commanders to delegate responsibilities and manage workloads efficiently.
- No predefined methods to integrate interagency requirements into the management structure and planning process effectively.

Figure no. 7.2 Incident Command System



Command Staff:

a. Provides overall leadership for incident.
b. Responsible for all aspects of the response, including developing incident objectives and managing all incident operations.
c. Maintains awareness of Critical Information Requirements.
d. Determine incident objectives and strategy to achieve the objectives.
e. Establishing and maintaining liaison with other agencies participating in the incident.
f. Requisition for additional assets as and when required.
g. Ensure adequate health and safety measures are in place.

General Staff:

a. Responsible for all operations directly applicable to the primary mission of the response.
b. Responsible for collecting, evaluating, and disseminating the tactical information related to the incident.
c. Responsible for all financial, administrative, and cost analysis aspects of the incident.
d. Responsible for providing facilities, services, and materials for the incident response.
e. Ensures the staffs provide the IM updated estimates and plans for future actions.
f. Oversees the General Staff support sections.

Technical Unit Staff:

a. Oversees the Scientific/ Technical Response.
b. Advises the IM on scientific and health issues.
c. Defines qualifications for various types of staff that may be deployed to fulfil a mission assignment to assure that scientific qualifications are met prior to deployment.
d. Review media releases and other documents in the clearance process for scientific accuracy.
e. Receives reports of scientific information from SMEs and from field teams.
f. Provides additional health and science advice to the command staff as required.

Joint Information Center (JIC)

a. Develop material for use in media briefings.
b. Inform the media and conduct media briefings.
c. Manage media and public inquiries.
d. Coordinate emergency public information and warnings.
e. Monitor media reporting for accuracy.
f. Maintain current information summaries and/or displays on the incident.

Realisation of certain shortcomings in our response system and a desire to address the critical gaps led the Government of India (GoI) to look at the world's best practices. The GoI found that the system evolved for firefighting in California is very comprehensive and thus decided to adopt Incident Command System

(ICS). A comprehensive set of Guidelines has thus been prepared and is called the **Incident Response System (IRS)**. The Incident Response System (IRS) is an effective mechanism for reducing the scope for ad-hoc measures in response. It incorporates all the tasks that may be performed during DM irrespective of their level of complexity. It envisages a composite team with various Sections to attend to all the possible response requirements. The IRS identifies and designates officers to perform various duties and get them trained in their respective roles. If IRS is put in place and stakeholders trained and made aware of their roles, it will greatly help in reducing chaos and confusion during the response phase. Everyone will know what needs to be done, who will do it and who is in command, etc. IRS is a flexible system and all the Sections, Branches and Units need not be activated at the same time. Various Sections, Branches and Units need to be activated only as and when they are required.

The main purpose of these Guidelines is to lay down the roles and responsibilities of different functionaries and stakeholders, at State and District levels and how coordination with the multi-tiered institutional mechanisms at the National, State and District level will be done. It also emphasises the need for proper documentation of various activities for better planning, accountability and analysis. It will also help new responders to immediately get a comprehensive picture of the situation and go in for immediate action. The IRS organisation functions through Incident Response Teams (IRTs) in the field. In line with our administrative structure and DM Act 2005, Responsible Officers (ROs) have been designated at the State and District level as overall in charge of the incident response management. The RO may however delegate responsibilities to the Incident Commander (IC), who in turn will manage the incident through IRTs. The IRTs will be pre-designated at all levels; State, District, Sub-Division and Tehsil/Block. On receipt of Early Warning, the RO will activate them. In case a disaster occurs without any warning, the local IRT will respond and contact RO for further support, if required. A Nodal Officer (NO) has to be designated for proper coordination between the District, State and National level in activating air support for response.

Apart from the RO and Nodal Officer (NO), the IRS has two main components; a) Command Staff and b) General Staff as shown Figure no. 7.2

Incident Response Teams

Incident Response Teams are to be set up right from the State to the District, Sub-division and Block levels. The co-ordination process between the National, State and District has also been clearly described. Presently the process for the institutionalization of the system is going on through various sensitization and training programs launched all over the country by the NDMA. Up till now 30 Districts in 15 States have already been covered where 3115 officers have been given initial training and teams have been formed at different levels. This program has also been started in the Lal Bahadur Shastri National Academy of Administration and the Sardar Vallabh Bhai Patel, National Police Academy where up till now 1768 officers have been trained on the Incident Response System. (http://www.ndma.gov.in/en/irs-training/training.html)

EOC- FUNCTIONS

I-Information management:

- Speedy display of important data, graphs and pictures, and fast transmission of early warning and alert messages are necessary in order for stakeholders to make rapid decisions based on accurate information.
- Consolidate, analysis, and disseminate data on damage, loss and needs assessment.
- Information gathering and record keeping of emergencies and fatal incidents

II- Resource Management

- Prepare and update inventory of resources available for emergency response.
- Dissemination of validated information, and provision of support to stakeholders.
- Monitor emergency operations at various locations (Sectors) and communicate with District Command Centre.
- Facilitate coordination among primary and secondary Departments/Agencies.
- Requisitioning additional resources during the emergencies from district/state.

Flow of Information

Continuous flow of information to EOC is a very critical for operations-

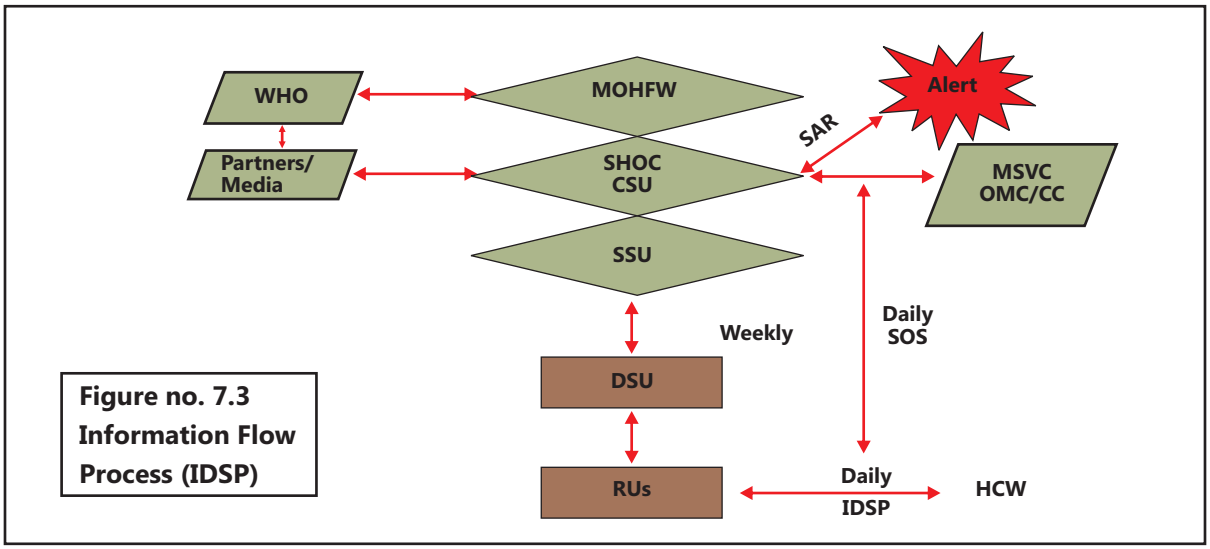


Figure no. 7.3 Information Flow Process (IDSP)

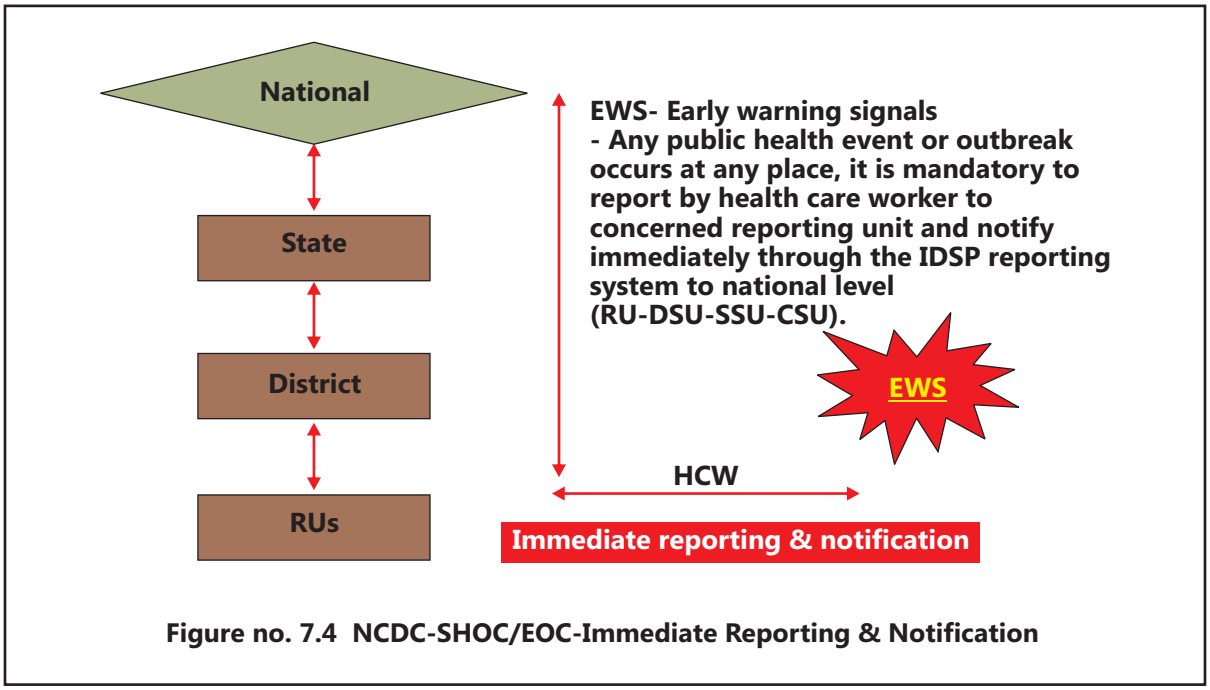


Figure no. 7.4 NCDC-SHOC/EOC-Immediate Reporting & Notification

Figure no. 7.5 NCDC-SHOC/EOC (Panoramic view)

Management by Objectives:

- ICS is managed by objectives.
- Objectives are communicated throughout the entire ICS organization through the incident planning process.

Steps:

The steps for establishing incident objectives include:

Step 1: Understand agency policy and direction.
Step 2: Assess incident situation.
Step 3: Establish incident objectives.
Step 4: Select appropriate strategy or strategies to achieve objectives.
Step 5: Perform tactical direction.
Step 6: Provide necessary follow up.

The EOC/SHOC brings together scientists and SMEs from different agencies/institutes to analyze, validate, and efficiently exchange information during a public health emergency and connect with emergency response partners.

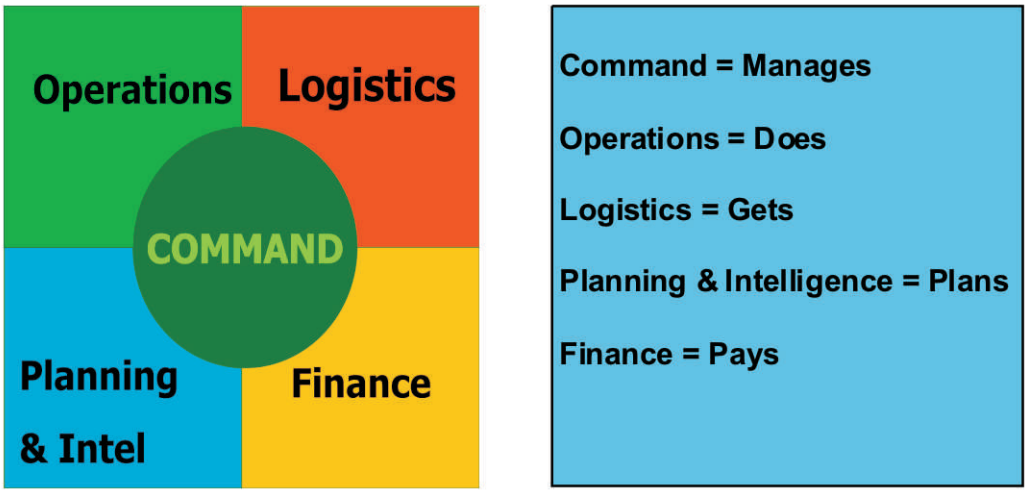


Figure no. 7.6 Incident Command and Control Structure

For a well coordinated response system there should be a clearly defined chain of command and organizational structure, effective resource management, and advanced planning are important aspects of an emergency response. In public health EOC typical terminology used for response is Incident Management System (IMS), it "manages not command" the response as in comparison to incident command system. An IMS is a standard structure based on ICS principles that is used in large and small-scale incidents at national, state, and sub district level. Public health agencies have adapted IMS principles in managing their responses to public health emergencies, which in addition to the command, operations, logistics, planning, and finance/administrative functions, also includes scientific/public health response roles.

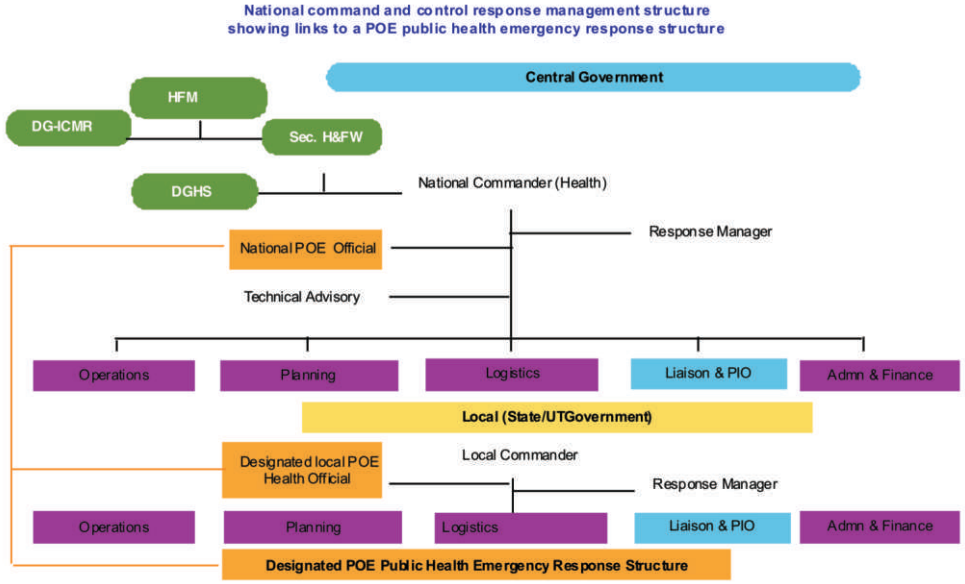


Figure no. 7.7 National Command and Control Structure (PoE)

A defined command and control structure to enables an efficient decision-making process. Distinctly defined functions are managed and coordinated by teams under the direction of an Incident Commander/Manager. In general, functions covered by a command and control structure. It may set community level priorities and certainly during the recovery phase may have more of a "direction and control" function once the response phase is completed.

Emergency Response Activation Levels

Level-I-The highest level of response reserved for critical emergencies. Response requires the largest number of staff possible to work 24/7 on the response.

Major event, Multiple sites, Regional disaster, multiple agencies involved, Extensive evacuations and Resource support required.

Level-II- (Partial) -Moderate event, Two or more sites, several agencies involved, Major scheduled event (e.g., mass gathering), Limited evacuations and Resource support required.

Level-III (Monitor)- Small incident or event, one site, Two or more agencies involved, Potential threat of Flood, Severe storm, Interface fire and Escalating incident.

During EOC/ SHOC should have the ability to rapidly transport life-supporting medications, samples and specimens, and personnel anywhere in the country around the clock within set timeframe of notification.

Conclusion: This brief overview of disaster and EOC/ SHOC gives an an idea to use ICS principles for managing public health emergencies in a scientific way.

7.1 CBRN EVENTS

Background

Recent efforts to improve preparedness & IHR core capacities in India, have included a focus on the potential for radiological, chemical, nuclear and blast injury events. Each of these types of incidents is associated with unique injury patterns and clinical management needs. The numbers of medical, nursing and paramedical personnel adequately trained to manage the medical consequences of radiological, nuclear, chemical and blast incidents are extremely low. The experience base is also shallow because of the relatively low incidence of exposures to many of these hazards.

Chemical, biological, radiological and nuclear weapons can produce mass casualties if not effectively disseminated, but have varying and different effects. Chemical weapons, predominantly man-made chemicals, require the largest amount of material to be effective and cause their effects in minutes to hours. Biological weapons made of naturally occurring pathogens require the least material to be effective, but generally have an incubation period of several days before symptoms show themselves. Radiological materials that can create a hazard with the potential to injure and kill personnel can come from any radioactive source. While nuclear detonations produce large amounts of radioactivity and a significant hazard, radiological attacks do not create a nuclear blast. Radiological weapons could contain virtually any type of radioactive material and disperse only the amount of material originally contained within the device. Sources of radiological material include medical and industrial equipment and waste and may originate in countries having insufficient control of these materials.

Treatment protocols for chemical, biological, Radiological & nuclear weapons vary by agent, ranging from weapons with effective treatment and prophylaxis to weapons which have neither known cure nor protection.

CBRNE weapons pose additional concerns beyond mass casualties. These weapons may contaminate the area in which they are used, emergency vehicles, and first responders. The wide array of potential symptoms from CBRN weapons makes identification of the causal agent difficult and complicates treatment. Additionally, public fears relating to disease and poisoning could increase the effect of CBRN attack, as worried, unexposed people request treatment from medical facilities. In extreme cases, public hysteria has been postulated as an outcome from mass dissemination. Several initiatives are underway to reduce the potential value of CBRNE weapons. One approach has been through funding significant increases in the public health system's preparedness and response capacity.

BOX NO. 7.1.1 CBRN EVENTS IN THE PAST

The recent catastrophic suspected chemical weapon attack in Syria and of September 11, 2001 the anthrax mailings have sensitized countries across the globe to gear up the capacity to be prepared for any such incidents.

In March of 2011, the Nation of Japan suffered a 9.0 magnitude earthquake that produced a tsunami. The earthquake and tsunami significantly damaged several nuclear power reactors along the east coast of Japan. The damaged reactors released radioactivity requiring the evacuation of residents within a 50-mile radius.

During April 2011, in India, 7 civilians were exposed to radiation inadvertently. This incident, in which radioactive scrap material found its way to a busy market in New Delhi, emphasizes community vulnerability to a wide range of threats from radiological incidents. More recently, the unintentional theft of a cobalt-60 medical therapy device in Mexico, reminded us of the challenges related to medical response to such incidents.

The 1984 Bhopal disaster in India, also known as the Bhopal Gas Tragedy was one of the world's worst industrial catastrophes. A leak of methyl isocyanate (MIC) gas and other chemicals from the Union Carbide India Limited (UCIL) pesticide plant, resulted in hundreds of thousands of people being exposed to the chemical along with a death toll that numbered in the thousands.

The results of these disasters highlight the need for adequately trained responders in the areas of radiological and chemical emergencies.

Over the past several years, many high-profile attacks in major metropolitan areas in India and worldwide (Mumbai, Delhi, Pune, Ahmedabad, Varanasi, London, Madrid etc.) have involved bombings in highly populated venues. Markets, restaurants, trains, buses and hotels are just a few of the types of places that have been affected with blast events. An increase in the number of trained medical personnel to manage the resulting blast injuries is acutely needed.

These and other disasters have exposed deficiencies in the organizational capacity and capability to respond effectively and efficiently to a multitude of public health issues and then manage the consequences in domestic and international environments.

Historically CBRNE is a mnemonic for Chemical Biological Radiological Nuclear and Explosive hazards or injuries. It replaces and expands the term used during the cold war NBC. Some of these agents were used or developed by the military like classic agents Nerve Agents, Sulfur Mustard, Lewisite. Others have dual use in industry as well like Chlorine and Phosgene as well as by the military. Some are single use like Nerve Agents that have no other industrial use. TICs and TIMs examples include industrial chemicals that are available in our cities and towns like ammonia or hydrofluoric acid or flammable chemicals like propane or gasoline. The term 'CBRN Defense' is used in reference to CBRN passive protection, contamination avoidance, and CBRN mitigation.

Chemical disasters are occurrence of emission, fire or explosion involving one or more hazardous chemicals in the course of industrial activity (handling), storage or transportation or due to natural events leading to serious effects inside or outside the installation likely to cause loss of life and property including adverse effects on the environment.

Biological Disasters

Biological disasters are scenarios involving disease, disability or death on a large scale among humans, animals and plants due to toxins or disease caused by live organisms or their products. Such disasters may be natural in the form of epidemics or pandemics of existing, emerging or re-emerging diseases and pestilences or man-made by the intentional use of disease causing agents in Biological Warfare (BW) operations or incidents of Bioterrorism (BT).

Nuclear or Radiological Disaster

When the impact of a nuclear or radiological emergency, caused by a nuclear attack (as happened at Hiroshima and Nagasaki in Japan) or large-scale release of radioactivity from nuclear/ radiological facilities (like that at Chernobyl in Ukraine) is very high, it assumes the dimension of a nuclear disaster leading to mass casualties and destruction of large areas and property. Unlike a nuclear emergency, the impact of a nuclear disaster is beyond the coping capability of local authorities and such a scenario calls for handling at the national level, with assistance from international agencies, if required.

A Nuclear and/or Radiological Emergency (NRE) is an incident resulting in, or having a potential to result in, exposure to and/or contamination of the workers or the public, in excess of the respective permissible limits.

7.2 MEDICAL RESPONSE DURING CBRNE EMERGENCIES

CBRNE incidents call for the decontamination, which entails immediate removal of the unabsorbed contaminant from the body of victim, followed by treatment of a significant numbers of casualties while ensuring the safety of the responder. The training through mock exercise needs to be conducted to hone skills and develop reflexes of the responders, so that they can promptly remove victim from the 'agent' source and also remove 'agent from' contaminated personnel. The key of success is swiftness and correctness. Other important commandments are as follows:

- Triage – prioritization patients based on clinical condition.
- Resuscitate and treat patients as per triage.
- Decontaminate the victims so as to prevent spread of contamination.
- Transport victims on priority as per triage classification.
- Re-triage constantly (a dynamic process) throughout all the phases of management.
- Only move the dead when it is affecting the response.
- Training, both theoretical and practical, with periodic refresher training

The NDMA is actively working towards institutionalizing an approach towards CBRN Disaster Management and has formulated valuable guidelines. These guidelines are available at following websites:

http://ndma.gov.in/en/ndma-guidelines.html
http://nidm.gov.in/books.asp

EMERGENCY RESPONSE

NDMA Control Room:
Phone – 011 26701728, 730
Fax - 011 26701729
Disaster Helpline - 011-1078

MHA Control Room :
Phone - 23093563, 23093564, 23093566, 23093571

8. REFERENCES

1. Indian Institute of Public Health (IN). Essentials of food hygiene-I. FSSAI: Hyderabad.
2. Foods Safety & Standards Authority of India (IN). Training manual for food safety Regulators, Volume 2. FSSAI: New Delhi; 2010.
3. MOHFW. Operational Manual for Implementation International Health Regulations at Airport and Ports. Draft.
4. INFOSAN Connecting Food Safety Authorities to Reduce Foodborne Risks. Available from: http://www.who.int/foodsafety/fs_management/infosan_brochure_en.pdf
5. WHO. Vector Surveillance and Control at Ports, Airports, and Ground Crossings. Geneva: World Press; 2016.
6. Directorate of National Vector Borne Disease Control Programme. Operational Manual for Integrated Vector Management in India. MOHFW. Available from: http://www.nvbdcp.gov.in/Doc/IVM10_March_2016.pdf
7. WHO. Guide to Ship Sanitation. 3rd ed. WHO press: Geneva; 2011. Available from: http://apps.who.int/iris/bitstream/10665/43193/1/9789241546690_eng.pdf
8. IHR (2005). Handbook for Inspection of Ships and Issuance of Ship Sanitation Certificates. WHO Press: Geneva; 2011. Available from: http://apps.who.int/iris/bitstream/10665/44594/1/9789241548199_eng.pdf
9. Taylor LH, Latham SM, Woolhouse ME (2001). "Risk factors for human disease emergence". Philosophical Transactions of the Royal Society B: Biological Sciences 356(1411): 983–9. doi:10.1098/rstb.2001.0888. PMC: 1088493. PMID 11516376.
10. Zoonotic Diseases of Public Health Importance. National Institute of Communicable Diseases. Zoonoses Divison. DGHS, MOHFW, GOI. New Delhi; 2005.
11. Kakkar M, Hazarika S, Zodpey S, Reddy K S. Influenza pandemic preparedness and response: A review of legal frameworks in India. Indian J Public Health [serial online] 2010 [cited 2016 May 26];54:11-7. Available from: http://www.ijph.in/text.asp?2010/54/1/11/70539
12. Ministry of Environment & Forests and Central Pollution Control Board. National Chemical Management profile of India. (Available from: http://www.cpcb.nic.in/upload/NewItems/NewItem_112_nationalchemicalmgmtprofileforindia.pdf)
13. National disaster management guidelines- Management of chemical (terrorism) disasters. New Delhi: magnum books private limited; 2009.
14. National Disaster Management Authority (IN). National Disaster Management Guidelines, Chemical Disasters (Industrial). New Delhi: Magnum books private limited; 2007.
15. Ministry Of Environment, Forest And Climate Change. CENTRAL CRISIS GROUP ALERT SYSTEM (As on 1 st June, 2016). Government of India: New Delhi; 2016.
16. Gupta A K, Nair SS. Training Module. Chemical (Industrial) Disasters Management. New Delhi: National Institute Of Disaster Management(Ministry Of Home Affairs); 2012
17. National Disaster Management Plan, 2016. A publication of the National Disaster Management Authority, Government of India. May 2016, New Delhi

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