

Important Elements of Disaster Management and Mitigation and Design and Development of A Software Tool

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Abstract ; - Natural Disasters causing damage to human life, property, infrastructure and economy has emerged as a global challenge. Requisite safety measures have to be provided for natural hazards. Prevention is better than cure. Once disaster occurred, it is very difficult to handle and control it. Hence proper planning shall always handle and mitigate the various kinds of disasters effectively, for which open, transparent and efficient systems have to be followed. There is a need for systematic identification, preparation, prediction, assessment, evaluation of disaster events and incorporation of mitigate measures. Disaster management is a sequential and continuous process planning. The important elements which are to be considered at all stages during the disaster management are disaster management system and standards (DMS)/ Indian Standard (IS) codes, disaster diagnosis, disaster resource planning (DRP), disaster impact assessment (DIA), investigation of disaster and hazardous risk assessment (IDHRA), onsite and offsite emergency planning, disaster management plans (DMPs), corporate disaster preparedness programmes , emergency response plans, identification of proactive measures (IPM), systematic measurement, resource evaluation and quantification, cost analysis, environmental impact assessment (EIA), feedback towards achieving the disaster control abatement and mitigation strategies, research and development, management innovations, loss assessment & prevention (LAP) measures , recovery, relief , reconstruction and rehabilitation (RRRR) activities, computer aided methods, state-of-art software on disaster management and enforcement of disaster compensation laws. The disaster management must also involve co-ordination activities about disaster events with all participatory sectors namely, all levels of central and state government, districts administration, municipalities, corporations, medical and health administration including industrial disaster and safety administration, occupational health hazard and safety administration, non-occupational health hazard and safety administration, communication services, geographical information system services, environmental remote sensing services, print and electronic media networks,, insurance services, social and community mobilization services, fire and explosion services, civil defense and home guards, police and paramilitary forces, armed forces, industrial security forces, border security forces , public and private sector industries, research and development organizations, non-government and voluntary organizations, environmental and ecological protection services, information and broadcasting services, construction sector, education and training sectors. The officials of the above sectors must be imparted specialized on-campus and off-campus training in the emerging areas of disaster management modules such as emergency preparedness plans, DMS, DRP, DIA, IDHRA, IPM, DMP, EIA, LAP training modules, RRRR modules, occupational, non-occupational health hazard, disaster investigation, risk assessment and EIA training modules including training in various computer aided and state-of-art software packages. In this research paper important elements of the disaster management for practitioners have been discussed.

Key-Words: - catastrophe, disaster, industrial, management, mitigation, natural, plans

1 Introduction

Every year in India, natural disasters kill thousands of people. Millions are rendered homeless; property worth millions of rupees is destroyed. Cyclones, earthquakes, hurricanes and other natural disasters also occur in other parts of the world quite often. Such disasters have killed an estimated 3.8 million people in the last two decades. Disaster is defined as

‘Catastrophe’ causing injury or illness simultaneously to at least 30 people who will require hospital emergency treatment. Disaster management is multi institutional approach, which must be involved, in advanced planning to tackle a disaster. Figure 1 shows the five-stage process of disaster management.

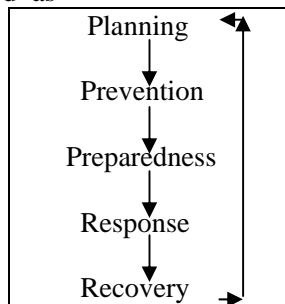


Figure 1 – Five stage process of disaster management

Only post-disaster relief is not a solution to the human suffering and economic and physical losses from natural disasters. A substantial reduction in the impact of natural disasters will be achieved through emphasis on pre-disaster activities including planning, prevention/disaster mitigation and emergency preparedness while sustaining and further improving post disaster relief and management capabilities. There is a need for continuous an innovative and creative approach based on the latest scientific and technical knowledge through the participation sectors of the society. To ensure success in disaster management, a

comprehensive emergency management plan should be developed. The disaster management is needed at all stages of a disaster that is during the disaster event, recovery phase for relief, rehabilitation and reconstruction or mitigation phase. Disaster management planning is a sequential and continuous process. Good planning requires diagnosis, resource evaluation and feedback towards fulfilling the goal of disaster reduction. Disaster management needs dedicated commitments by central, state and district levels. A structure with clearly defined authority and appropriate budget to maintain an effective disaster plan is needed.

2 Problem Formulation

2.1 Disaster Management – Definition And Basic Concepts

Disaster is defined as a sudden accident or a natural catastrophe that causes great damage or loss of life. Catastrophe causing injury or illness simultaneously to at least 30 people who will require hospital emergency treatment. That is an immediate patient load in emergency is greater than normal care for. Disaster is an unintentional and unplanned event, which includes significant

personal injury, death, or significant property damage.

Disaster is a dynamic mechanism that begins with the activation of a hazard and flows through the system as a series of events, in a logical sequence to produce a loss.

Disaster management is multi institutional approach and industry is one of the institution involved in advanced planning to tackle a disaster. Examples for disaster in India are Bhopal Gas Tragedy, Air India Jet (Kanishka) accident, Cyclone in southeastern coast.

Disasters can be classified as Natural Disasters and Man Made Disasters. Natural Disasters can occur due to Earth Quake, Volcanic Eruption, landslide and floods. Man Made Disasters are the result of various untoward incidents like chemical spills, toxic gas releases road accidents, fire and explosion, collapse of building, nuclear warfare, electrical shock etc.

Disasters can and do occur without warning at any time often with profound and sometimes catastrophic effects. Contingency planning and crisis action are as integral to disaster management. The ability to handle a disaster successfully is an important management discipline. It saves life, property and resources, relieves suffering, prevents escalation and collateral damage, underwrites job, businesses and financial assets, facilitates investigations, speeds recovery and return to the normality, and protects the environment.

In any disaster scenario, a business has three broad objectives.

To control the incident while continuing to conduct corporate activities with minimum disruption, and to return to normal as quickly as possible.

To ensure the health, safety and welfare of customers and staff, and to handle the next-of-kin of any casualties with optimum care and consideration.

To liaise with external agencies such as the emergency services, local authorities and the media, with proper understanding and to mutual advantage.

2.2 Disaster Management Cycle

Disaster management follows a logical, integrated and progressive sequence of activities- a cycle of preparedness and action. This disaster management cycle has four stages, risk reduction, readiness, response and recovery.

2.2.1 Risk Reduction

Risk reduction is the culmination of a three-part process that includes risk identification and assessment. The process is dynamic; the risks are monitored, updated and analyzed.

The likely hazards, vulnerability to those hazards and probable severity of the effects of any incident should it occurs, are first identified.

Thereafter, the immediate and cumulative risks, particularly to people, are assessed against pre-determined criteria. Safety priorities can then be defined and measures taken to eliminate, reduce or control the severity of those risks. Such measures are reinforced by legislation, code of practice and stringent operating procedures. Further safeguards are needed for residual risks.

2.2.2 Readiness

Readiness is the in-house insurance policy of disaster management and covers all preparedness and measures, notably emergency planning. It must include operational, logistical and human needs like warning system, communications, control structures, resources, causality procedures, media policy and welfare. A well conceived security plans based on sound intelligence, business acumen and common sense provides protection and ensures appropriate response to all insecurity problems.

2.2.3 Response

The core of the initial response to a disaster is provided by the emergency services and thereafter, depending on its nature and scale by the local authorities and voluntary and utility services. The common purpose is to save life and relieve suffering, and to save life and relieve suffering.

The common elements of response are :

- Identify the disaster and raise alarm,
- Notify the emergency services,
- Save life and treat casualties,
- Activate the emergency plans,
- Confirm communications are working,
- Establish control,
- Manage the developing situation.

2.2.4 Recovery

The last stage of the disaster management is recovery. It embraces the many activities needed for a rapid return to normality, both for those affected by the incident and those providing the recovery services. Many of these activities are determined during the readiness and their implementation begun at the response stage. Among the priorities to hasten business recovery are the restoration of essential services,

temporary or alternative premises, reconstruction of buildings, site re-occupation and insurance and financial reparations. Additionally, there may be investigations and inquires, and rehabilitation and aftercare to consider.

2.4 Risk

A measure of the probability and magnitude of potential injury or disaster damage. Hence, the product of the probability and the consequence of a disaster. It is related to the probability that frequency, intensity and duration of the stimulus will be sufficient to transfer the hazard from potential state to a loss.

Risk evaluation is the nature of risks.

Risk or danger arises out of hazards. Safety is freedom from risk to the level desired. Safety is achieved by making a system, a process etc., safer, or totally safe. Risk is the product of two functions that is probability of an event, which might occur, and severity of the event if it occurs. While analyzing risks, the severity of the event that might occur is more important as compared to the probability of the event that might occur.

In other words,

Risk = Probability of the event that might occur X severity of the event that might occur

In formula (I) the probability of each event that might occur may remain constant, whereas (ii) the severity of each of the event that might occur varies and therefore, when analyzing risks we are more concerned about the severity of the event that might occur and not the probability of the event that might take place.

2.4.1 Risk Assessment

This including quantitative and qualitative approach (QRA). Quantitative risk assessment refers to the three techniques 1. Maximum credible disaster and consequence analysis (MCDA), reliability analysis and risk elimination. Identification and evaluation of risks related to disasters, hazard sceneries for maximum credible loss events, consequences analysis for identified loss events, consequences for maximum credible loss scenario, preparation of damage contour diagrams, suggestion on

control measures for risk reduction and loss prevention.

2.4.2 Risk Management

It is the process of deciding what to do. It is to identify the disaster causes and hence identification and evaluation of risk related to disasters, natural calamities, public liabilities, suggestion on loss control measures evaluation of business interruption exposure, impact assessment, review of contingency plans, resulting in adequacy of the converge and suggestion an means for rationalization of insurance port folios.

To get ideas or safety proposals .

Acquisition and updating safety information.

Make periodic inspection of emergency systems

Observe that the personal following the safety measures

To provide reminders for individuals to be alert of safety practices

Risk Reduction

Risk reduction is the culmination of a three-part process that includes risk identification and assessment. The process is dynamic; the risks are monitored, updated and analyzed.

The likely hazards, vulnerability to those hazards and probable severity of the effects of any incident should it occurs, are first identified.

Thereafter, the immediate and cumulative risks, particularly to people, are assessed against pre-determined criteria. Safety priorities can then be defined and measures taken to eliminate, reduce or control the severity of those risks. Such measures are reinforced by legislation, code of practice and stringent operating procedures. Further safeguards are needed for residual risks.

2.4.3 Emergency Planning

Emergency plan is the cornerstone of preparedness, which should cover the readiness, response and recovery. The requirements for the emergency plan are:

Guaranteed communications, whatever the disaster, to ensure the speedy provision and flow of information for decision making.

A structure of well trained and highly motivated teams to provide direction and leadership and to control and manage the situation.

Apart from communications and the control structures, there are other planning considerations – external liaison, warning systems, evacuation, alternate premises, dealing with casualties, handling the media, preservation of critical records, restoration of essential services, welfare arrangements, insurance provisions and statutory duties.

In sum the emergency plan has to be simple, flexible and fully understood by the key participants- too much detail, pre-determined action or lack of familiarity could cause it to fail.

2.4.4 Validation And Training

The validation of an emergency plan and the training of personnel are to be executed.

The first step is to test the validity of the plan itself and thereafter to up-to-date it and other preparedness measures as necessary. The second step is to ensure that any staff involved in a disaster knows their roles are aware of those of others with whom they could be working. The third step is to make sure that those same staff acquire the expertise and confidence to perform their parts in the emergency plan, individually, collectively and as members of specialist teams. These objectives are best achieved by rolling training programmes that includes appropriate case studies, briefings and exercises.

Support at the top

The disaster management will be fully effective if it has the support of the chief executive. The chief executive should nominate a director with overall supervision and appoint a manager with direct responsibility for it. A policy and priorities should be published, achievable targets and objectives set, the means to measure and monitor performances introduced.

3 Problem Solution

3.1 Participatory Sectors of Disaster Management

Sector-1 Central Government Office

The central government has to establish Department of Disaster Management Research and Education (DDMRE under the a new Ministry of Disaster Management and Mitigation (MDMM). The role is to manage the

multi hazardous and comprehensive disaster management at national levels. There is a need to set up an autonomous body known as National Council of Disaster Management Research (NCDMR) under DDMRE. Peer working groups on disaster management at National level have to be set up and will investigate the national and state level disaster management action plans, policy planning, imparting education and training to officials of all participatory sectors of disaster management. A national level disaster advisory scientific and technical committees have to be set up which will analyze all elements of disaster management. Central government has to set an emergency response task force (ERTF) to work on various disaster mitigation responsibilities. NCDMR has to organize the disaster services week, exhibitions, seminars, training, disaster programmes, film and library services, setting up of disaster boards both at the national and state levels. Long term and short term proactive disaster measures should be taken take up at the national and state levels including preparation of emergency kits, hazard warning data sheets, evolving disaster safety standards.

Sector-2 ; State Government

The concerned state government needs to establish a Department of Disaster Management and Mitigation to formulate and implement the relief and rehabilitation actions, DMPs during the disasters in their respective States. Central and State government have to make a separated legislation and enact in law that the first level responsibility to handle disaster situations and incorporate the disaster mitigation measures are only with the concerned municipality and corporations. The Municipalities have to invite NGO's, national and international relief organizations to join in the efforts to reach the relief operations to the victims. The municipalities and district level administration have to take up quick actions in implementing all the governmental actions, DMPs and mitigation activities. Public service campaign is necessary to implement all safety aspects in respect of the disasters. The state government should make awareness of necessary legislations and medical surveillance through press and media.

The following are the role and functions are vested upon government and municipalities and public authorities as well as social and international organizations on disasters.

- 1.To investigate all the disaster events
- 2.To set up legal frame work on statutory and non-statutory sources and its enforcement
- 3.Research, development and testing of materials, assessment of safe working conditions
- 4.To establish the safety organizations and associations
- 5.To co-operate and co-ordinate all the action plans with the participatory sector authorities and people and community.
- 6.To render advises on education and training matters and impart education
- 7.To set up of a role state on disaster concerned
- 8.To incorporate the disaster mitigation measures

Sector-3 Health and Medical Administration

Health and medical care is a critical and immediate response sector. Hospitals dispensaries, nursing homes and clinics coming under central and state government, districts administration, municipalities, corporations, medical and health administration, private bodies including industrial disaster and safety administration, occupational health hazard and safety administration, non-occupational health hazard and safety administration. Systematic identification, preparation, analysis, evaluation, adequate planning and incorporating treatments must be carried out for 1. Medical First Responds (MFR), 2. Medical Assistant Teams (MAT), 3. Mobile hospitals, 4.Hospital preparedness for mass casualties, 4. Search 5. Rescue units, 5. Epidemic prevention, 6. Trauma counseling.

Healing touch is a socio-psychological approach to the medical response during the emergencies. Concept of healing touch is concerned to the humanitarian approaches through the trained doctors, nurses, auxiliary and supportive personnel. Well-planned orientation programmes have to be conducted throughout the centers towards the handling of disaster situations, which cause anxiety, depression, and psychological and physiological disorders in people. Systematic training procedures and systems have to be formulated on various aspects of reconstruction and rehabilitation of

people lives and communities during the post disaster periods. Mental health programmes have to be conducted throughout central, state and district centers. Well-designed course modules along with necessary instructional and training materials have to be prepared and distributed during the programs.

Sector-4 Communications Sector :

Communications are the information dissemination tool for effective disaster management, which have to be handed during the situations during the disaster preparedness and response period. The effectiveness in communications will be achieved through the open, transparent and efficient systems in public awareness, dissemination mechanisms / procedures/ systems / innovations and ideas. All India Radio and Do-ordarshan Kendra must periodically broadcast the disaster-concerned talks, interviews and discussions. The cost effective State-of- art communication systems need to be used covering rural and disaster prone areas. Appropriate training on communication facilities must be imparted to all participatory officials.

Sector-5 Electronic and Print Media

Electronic Media and Print Media is an important sector on disaster management . Its job to be the pre-disaster prevention/mitigation and preparedness activities through appropriate community awareness generation, coordinating with all levels of participatory sectors, disaster related publications, booklets, disaster information charts and data sheets have to be published by these media. Audio Visual aids on disaster management can be brought by the officials of government organizations, private industrial establishments and other social organizations. They must develop programmes to inculcate the disaster management by arranging suitable exhibitions, establishing through museums, advertising through media, holding workshops, observing disaster weeks and through other disaster related activities.

Sector-6 Police and Para-Military Forces

Police and Para Military forces sector play an important role in disaster situations. They have to maintain security, law and order at disaster sites. They prevent cognizable offences against property and material, human body and public tranquility. The police communication system is

made available for transmission and receipt of messages in connection with disasters. The police also regulate movement of victims, rescue and relief, medical assistance and supplies. The paramilitary military forces will provide additional assistance. Central industrial security force (CSIF) will handle the industrial disasters. Border security force (BSF) will handle the disaster situations in the border areas.

Sector- 7 Civil Defense and Home Guards

The Department of Civil Defense and Home Guards the organizations that will work during the disaster with specific tasks on disaster communication, rescue and casualty, depot, transportation, supply service and other basic welfare services. It seems this organization needs sufficient human power and trained workforce.

Sector- 8 Armed Forces

The role of Armed Forces in disaster management is to provide the emergency support functions and specific tasks on communications, search and rescue operations, health and medical facilities to the victims, transportation, power, food and civil supplies, public works, engineering, information and planning. The Armed forces must be given disaster specific training.

Sector-9 Fire and Explosion Services

The role of Fire and Explosion Service sector is to perform fire and explosion fighting service during the disaster stage. It is a preventive agency in urban and disaster prone areas. It has to provide basic search and rescue service including the coordination with participation sector authorities. Its role and responsibilities include fire and explosion prevention and control, identification of class of fires and investigation, implementing national fire codes, incorporating the statutory provisions for fire and explosion prevention, incorporation of fire protection systems, first aid and medical assistance etc.

Sector-10 Insurance

Insurance sector play an important role on disaster mitigation with specific approach on analysis of economic losses from natural disasters. There are insurance companies and agencies, which have to do the disaster, oriented insurance schemes and covers on insuring the people in the vulnerable urban and rural areas.

As regards during the earthquakes, storm, cyclone, typhoon flood, the insurance should cover the buildings and material damage. The central and state government have to support them. These agencies are skewed towards the urban areas for business but in the uncovered areas through pre-existing infrastructure like Post Offices, Local Bodies etc. it can be spread in the rural areas as well. There is need for policies for personal, property as well disaster oriented schemes. The entry of multi-national insurance companies in the Indian market has opened up new opportunities in this sector.

Sector-11 Geographical Information System (GIS)

Geographical information system uses geography and computer generated maps for integrating and accessing the location based information. GIS is a tool to be adopted during the disaster response time and preparedness stages. This is used for scientific investigations, resource management, disaster and development planning. Emergency planners have to calculate emergency response time during the disaster period using this GIS.

Sector 12 : Environmental and Ecological Protection Sector

Environmental and ecological protection sector has an important role in disaster management and mitigation. The environmental pollution and contamination can be reduced by taking steps to prevent, abate and by proper treatment while handling the disaster management. Environmental impacts assessment needs to be carried out to solve the environmental problems and to incorporate of the necessary mitigation measures with respect to the total environment. They need to guide the disaster personnel with respect to all the specific problems on environmental degradation, pollution, contamination and environmental management systems.

Sector-13 Environmental Remote Sensing (ERS)

Environmental remote sensing plays an important role in disaster monitoring and mitigation. This will help to; a) minimize the potential risks by giving early warning

strategies, (b) prepare and implement disaster developmental plans (DMPs), c) mobilize resources including communication and tele-medical services , (d) help in rehabilitation and post disaster reconstruction, (e) helps in evolving a suitable strategy for disaster preparedness and operational framework for their monitoring, identifying the gap areas and recommends appropriate strategies for disaster mitigation, (f) developments in space and ground segments.

Sector- 14 Social Work and Community Mobilization

Social work and community mobilization is the most important preventive mechanism during the disaster administration. There is a need to concentrate on community preparedness and other strategies such as hazards evaluation, risk assessment, disaster prevention, emergency planning and public information and awareness. This also includes the goals of national and state strategies on financial allocations, which are to be disaster specific, area specific and task specific, such as mapping missions, engineering of structures, disaster resistant building material, evacuation preparedness and community awareness.

Sector-15 Non-Governmental and Volunteer Organizations

Non-governmental and voluntary organizations are the participatory sector, which will ensure all the disaster activities including preparedness, relief and rehabilitation activities reach the people and community. There is a need for well coordination between NGOs and Government and also between the NGOs themselves and to all participatory sector authorities to bridge the wide gap.

Sector-16 Training and Educational Services

Training and educational service sector has to conduct various training programmes to all officials of the participatory sectors. The course modules must be designed to cover all the training aspects, emerging trends, case studies, demonstration trails etc. The training and educational sector shall motivate the participatory officials to utilize the training facilities in their parental organizations. These must be designed to motivate the disaster personnel in developing the mitigation plans. These programs must help them to understand

the legislation aspects, disaster identification, preparatory mechanisms, mitigation as well as essential emergency measures in the event of a disaster. The program must consist of talks, slide shows, film shows and case studies. All India coordinating training centers have to be started to impart on campus and off campus training in emerging educational opportunities and career development in the area of disaster / crisis management. They need to organize seminars, workshops on natural disasters and to start special certificate, diploma, degree and postgraduate degree programs in disaster management. Emerging trends on disaster management and mitigation aspects have to be included in the curriculum and syllabi in school and college levels. Continuing education programmes have to be started through the short term and long term modes on specific training on disaster management modules for working practitioners and to those personnel working in the sphere of duties related to the disaster management. Training should be imparted to specific disaster duties involved with all participatory sector officials working in all levels of central and state government, districts administration, municipalities, corporations, medical and health administration including industrial disaster and safety administration, occupational health hazard and safety administration, non-occupational health hazard and safety administration, communication services, geographical information system services, environmental remote sensing services, print and electronic media networks,, insurance services, social and community mobilization services, fire and explosion services, civil defense and home guards, police and paramilitary forces, armed forces, industrial security forces, border security forces , public and private sector industries, research and development organizations, non-government and voluntary organizations, environmental and ecological protection services , information and broadcasting services, construction sector, education and training sectors. The officials of the above sectors must be imparted specialized on-campus and off-campus training in the emerging areas of disaster management modules such as emergency preparedness plans, DMS, DRP, DIA, IDHRA, IPM, DMP, EIA, LAP

training modules, RRRR modules, occupational, non-occupational health hazard, disaster investigation, risk assessment and EIA training modules including training in various computer aided and state-of-art software packages.

3.3 Disaster Management Standards (DMS)

DMS is a systematic approach for managing the disaster issues. The essential characteristic of a DMS is that its various components interact to provide measurable information enabling continual improvements. The systematic approach means that the processes are stable and repeatable, yield more predictable outcomes and adopt new learning to continual improvement.

The standards which describe the elements of a management system that can be expected to deliver continually improving the performance. It can the participatory sectors in

- 1.Managing their interactions with the disasters in a more effective, systematic manner,
- 2.Saving money and staff time required to manage the disaster affairs,
- 3.Relating effectively to their communities,
- 4.Improving the image among various levels,
- 5.Engaging in a process of continuous learning,

There are standards required on disaster management systems to assist all the levels of management to assist in achieving the performance, enhancing internal management system efficiency, optimum utilization of resources and anticipating regulatory / legal requirements. The key systems components in DMS shall have to be:

- 1.A disaster policy statement
- 2.Planning process oriented towards integration of disaster events with the management
- 3.Organizational structure, role and responsibilities and accountability
- 4.Implementation systems and operational controls
- 5.Measurement and auditing systems
- 6.Systems for periodic management review of the DMS

3.3.1 Cost And Benefits of DMS

The actual benefits will depend on the degree to which management is willing to invest time and specific resources toward a full implementation of DMS.

Operational costs savings

Public participation and relations benefits

Community participation and relations benefits

3.3.2 Framework of DMS

The key elements of a DMS consistent with the requirements of the DMS specifications. The DMS framework has five major sections, which are organized with the plan, do, check, act, model, which are the planning process, disaster policy, checking and corrective action, DMS implementation and operation, and management review.

3.3.3 Disaster Management System (DMS)

The disaster management system should cover the following areas,

DMS –1: DMS Disaster management systems

The formal elements of a disaster management system includes disaster policies, planning, implementation, verification and management review

An organization structures, responsibilities and accountability

Implementation systems and operational controls

Measurement and auditing systems

Systems for periodic management reviews of the DMS

DMS code-2: General guidelines for developing and implementing DMS

DMS code-3: disaster auditing principles and guidance

DMS code-4: disaster auditing principles and guidance

DMS code-5: disaster-labeling guidance

DMS code-6: Life cycle assessment principles and guidance

DMS code-7: Terms and definitions

DMS code-8: Inclusion of disaster aspects in standards (Guide)

3.4 Disaster Resource Planning (DRP)

What is DRP?

Disaster resource planning is computer-aided method, which is software that helps to integrate nearly all the functions enabling to plan, track and see its Resources in the best possible way during its utilization. DRP effectively integrates

the islands of information with all participatory sectors during the disasters.

Why is DRP Required?

Speed of the business

Study of disasters

New realities

Approach to DRP Implementation - A Road Map

Road Map for successful implementation of DRP is

Clear Management commitments

Top class DRP leadership

DRP only after process improvement

Training to implementation task force and user group

Right choice of DRP packages

Four options for developing DRP Packages

Developing an own DRP package (in-house development)

Modifying and enhancing the capabilities of the existing system

Buying readymade package

Engaging a software company

Correct approach to ERP

The options are strategic decisions and need a substantial capital investment. Right option is to be selected only after evaluating the cost-benefit analysis.

3.5 Disaster Impact Assessment (DIA)

This need to be done for proposing the project plans, programs, projects and legislating acts.

DIA is the systematic identification of disaster elements, preparation of disaster statements, studying the existing disaster conditions, comparing with the standards, prediction and evaluation of potential impacts (effects) of projects, plans, programs, legislative actions and incorporating the mitigating measures relative to the disaster events. It is also a computer-aided method and modeling for monitoring and controlling the disaster situations.

Prediction and assessment of impacts have to be carried out through the following steps.

Identification of impacts

Preparation of description of existing resource conditions

Procurement of relevance quality and quantity standards

Impact prediction

Assessment of impact significance

Identification & incorporation of mitigation measures

3.5.1 Investigations for the Disasters

Disaster Investigation

The fundamentals of any disaster investigation will involve the following steps, which should be followed diligently:

i) Occurrence of disasters and locating the site

ii) Investigate as early as possible

iii) Preparing a detailed description of the disasters

iv) Accumulating relevant facts

by collecting evidence and fact analysis, namely,

1.Areas of the greatest damage,

2.Flow marks,

3. Samples of affected areas

4.Direction of disaster

5.Samples of post events

v) Investigating the facts and analyzing potential causes of disasters using the interview witnesses and examining the records

vi) Studying the system and operating methods relevant to potential causes of disasters.

vii) Locating the origin of disasters

viii) Identifying the most likely causes

ix) Reconstruction possibilities

x) Drawing up recommendations to eliminate recurrence of similar incidents.

It is important that the investigation style should be fact finding and not fault finding. Faultfinding method creates an environment that is not conducive to learning.

Proper disaster investigations help organizations use every disaster as an opportunity to learn how to prevent future disasters. In fact, investigation results are used to change the hazardous practices and procedures and to develop a safety system on a long – term basis.

3.5.2 Investigation Techniques

There are three levels of recommendations for preventing and mitigating disasters:

1.First Layer: Immediate technical recommendations

2.Second Layer: Recommendations to avoid the hazards

3.Third Layer: Recommendations to improve the Management System.

To further clarify this approach a set of questions can be developed to help the disaster

investigator find less obvious ways to prevent disaster. Team approach is preferable for investigations since it helps in a supportive and

synergistic way while questioning the personnel on different aspects.

Table-1 : Steps to be involved in investigation the disasters

Sl.No.	Step	Purpose
1.	Disaster Investigation Team	A team is chosen as quickly as possible. The experience and affiliation of the investigating team should be in proportion to the magnitude of the incident.
2.	Brief Survey	Make an overview survey (maximum of 1 hour) to understand the type and value of the information-needed to derive causes of the accident.
3.	Set objectives and delegate responsibilities	Based on steps (1) and (2), the objectives and sub-objectives of the investigation are defined by the investigation team. Responsibilities are delegated to team members with suggested completion time.
4.	Pre-incident facts	Pre- incident facts are gathered and organized. Flow sheets, procedures, photographs and data (interview or recorded data) are used.
5.	Disaster facts	Make detailed examination with photos, inspections, and interviews. Establish origin of disaster and facts relevant to layered causes and recommendations. Record extent of damage and hypothesize the sequences of events. Do not hastily hypothesize any cause/s of disasters while collecting the data for the disaster investigation.
6.	Research and analysis	Initiate research type experiments and analyze facts to clarify perplexing evidence.
7.	Discussion, conclusions and recommendations	Study the steps (2) to (6) to develop conclusions and layered recommendations.
8.	Report	Prepare disaster investigation report: Keep the report clear, concise, accurate and technical. Do not suppress key results.

3.5.3 Reporting of Disaster Investigations

There are different approaches to report the disaster investigation. A disaster investigation report is a major aspect of an investigation. In general, the format should be flexible and designed specifically to best to explain the process of the disaster. The format may include the following sections:

- Introduction
- Spot Description.
- Incident Description
- Investigation results
- Discussion
- Conclusion
- Layered recommendations.
- Investigation Checklist

Given below a list of the elements to consider while investigating the point of disaster origin.

Searching for the point of origin at a disaster scene is like piecing together a giant jigsaw puzzle.

Therefore we must examine each piece in context with the whole puzzle

Indicators are the visible pieces of the puzzle

Correlate and collate those indicators to fit known variables

Key pieces might be the unknown variables that may infer from known facts

Extraneous pieces must be eliminated to avoid confusion

Value and importance of each indicator might vary and be subject to change as examination proceeds

Each fact must be listed in its proper order of sequence to create a chain of evidence

Record all pertinent factors to enable the investigator to articulate the chronology of events

Success in finding the point of origin of disaster, will depend upon the ability

To correctly identify and interpret the indicators and fit them to the known facts

Developing a logical linear sequential pattern that can bring the investigator to no other point but the one he has designated.

3.6 Environmental Impact Assessment

Environmental Impact assessment: It is systematic identification and evaluation of potential impacts (effects) of proposed projects, plans, programmes, legislative actions, relative to physical –chemical-biological –cultural – socio economical components of the total environment.

Predictive and assessment of impacts:

Identification of quantity / quality impact of proposed project.

Preparation of description of existing resource conditions

Procurement of relevant standards

Impact prediction

Assessment of impact significance

Identification and incorporation of mitigation measures

3.7 Identification Of Proactive Measures (IPM)

Most of disaster can be prevented. As per the theory of “chain of injury occurrence and damage to property”, “(1) An injury or damage to property occurs only as the result of disaster (2) disaster occurs only as a result of natural, unsafe conditions or unsafe acts or both; (3) natural, unsafe conditions or unsafe acts exist only because of faults on the part of persons, failed proactive measures and system and procedure lapse.

The following are the proactive measures in Disaster Management

Use of safety practices, safety acts, safety conditions and proactive systems

Incorporation of proper safety training, safety design and proper design guarding

Incorporation of proper maintenance of safe conditions

Incorporation of proper working conditions

Use of safe construction practices

Incorporation of proper planning and designing (including structural designing) at the grass – root level).

Use of safe use of plant and machines

Adoption of Health, safety and environmental policy

Incorporation of proper layout and inter-facility distance

Adoption of safety operations, inspections, maintenance and audits

Incorporation of work permits systems

Implementation of Safety Committees

Incorporation of Alarm systems

Incorporating proper supervision, checking and inspection of the various construction practices/ processes relating to the properties.

Incorporating proper checking of the materials, so that sub-standard materials are weeded out.

Insisting the concept of safety management policy, safety week, safety slogans, safety campaigns, safety quiz etc.

3.8 Formulation of Safety Policies

Policies are the basic guidelines which dictates the thinking style as well as the actions to achieve the desired goals /objectives. 1. Principles, rules/norms have to be adopted by the management, 2.Target, authorities, norms and standards have to set, 3. Formation and functioning of safety committees.

Safety personnel, scope and responsibilities

To provide suitable base for coordination of safety activities in the various levels

To provide cogent, coherent and distinct objectives of goals

To provide fruitful cooperation to translate safety activities into action at all levels

To provide effective platform for initiation and motivation in the field of safety

Provide a course of action, which can ensure the accepted norms of safety are not violated.

Identification and Prediction of Hazard

Hazard is a chemical or physical condition that has the potential for injury or damage to the property. It is an event whose occurrence significantly increases the probability of occurrence of a disaster. A potential condition or

set of conditions, either internal and/ or external to a system , product, facility of operation, which when activated by a stimulus transforms the hazard into a real condition, or series of events which culminate in a loss (disaster). Hazard identification will permit mitigating measures to be included with minimal impact on cost and timing.

There are two basic approaches to hazard identification, evaluation and control, (1) adherence to good practice and (2) predictive hazard evaluation (PHE). The first one which consists of observing statues and recommended codes of practices. Checklist and reviews are two such procedures used to identify deviations from the accepted standards and good practices. The second one is the predictive hazard identification. When experience is lacking, as in the case of new procedures, PHE procedures may be adopted which involve safety survey, safety inspection, safety tour, safety sampling and safety audit.

- i) Safety survey is a detailed examination of a narrower field such as specific procedures.
- ii) Safety inspection is a scheduled inspection of a unit by disaster authorities
- iii) Safety tour is an unscheduled tour by the disaster authorities,
- iv) Safety sampling is a specific application of a safety tour/inspection designed to measure disaster potential.
- v) The safety audit examines and assesses in detail the standards of all facts and facets of a particular activity. The main elements of the safety audit are 1. Identification of possible loss producing situations, 2. Assessment of potential losses 3. Selection of measures to minimize the losses , 4. implementation of these measures, 5. Monitoring of the changes introduced. 6.Evaluation of injuries and hazards, 7. Checking adequate proactive arrangements, 8) Review of content of complaint with relevant to statutory provisions, 9) Disaster control measures, 10. onsite and offsite emergency plans, 11. Recommendations on safety and loss presentation measures. Hazard quantification is the frequency or probability of events with adverse or potentially adverse consequences

3.9 Cost Of Disasters :

It is absolutely necessary to do the cost analysis (COD)

Cost may be defined as the amount of expenditure incurred by the disasters.

The following incurred the investigation costs:

1. Cost involving the disaster investigation and reports

2. Cost of disasters due to proactive measures:

3. Cost involving the change of the hazardous system/practices/procedures to develop the safety system on a long-term basis

1. Material cost

Direct (money spent on saleable products)

Indirect (necessary for the production forces)

2. Labour Cost

Direct (wages, salaries)

Indirect (maintenance)

1. Medical treatments to the injured persons

2. Cost of medicines and medical aids

3. Average monthly wage

4. Compensation as part of the cost of the products

5. Compensate death due to the occupational disease

6. Inspection for the prevention of the accidents and occupational diseases

3. Expense costs

All changes other than those incurred on direct result of employing worker/-obtaining materials

Direct expenses

Cost of layout

Indirect expenses, Insurance premium

3.10 Measurement of Disaster and Resource Evaluations

Most statistical analysis of disasters is based on either frequency and severity or both.

Standard frequency rate represents the number of disabling injuries for given man-hours of exposure example, How many number of injuries

The standard severity rate is the total time charged as a result of lost time injury for a given no of man-hours of exposures, example how severe in terms of wages lost.

The following are the terms and formulae used in the disaster analysis:-

1. Frequency Rate (F.R.): The frequency rate is the number of disabling injuries per one million people hours exposed.

$$\text{Frequency rate} = \frac{\text{Number of disabling injuries}}{\text{Number of man-hours exposed}} \times 1000,000.$$

2. Severity Rate (S.R) the severity rate is the total number of days lost or Charged due to disaster per one million people hours exposed:-

$$\text{Severity rate} = \frac{\text{Days lost in a year due to disaster}}{\text{Number of man-hours worked}} \times 1000,000.$$

3. Frequency-Severity Rate (FSR): Frequency Severity rate is given as follows:
Frequency severity rate= Frequency rate x severity rate

Symbolically, F.S.R. = F.R. x S.R.

4. Frequency-Severity Indicator (F.S.I.) is computed as follows:-

$$\text{Frequency Severity Indicator.} = T = \frac{\text{Frequency Rate x Severity Rate}}{1000}$$

$$\text{Symbolically F.S.I.} = T = \frac{\text{F.R. X S.R.}}{1000}$$

3.11 Enactment Of Disaster Compensation Laws

The principle involved is that the people injured or disabled in disasters should be enabled, through proper medical treatment, to return to normal capacity as promptly as possible and, while incapacitated, should receive compensation as well as medical treatment aids should properly be borne by the public sector / municipalities. The laws generally provide that people injured in disasters shall be furnished the necessary medical treatment aids, and, in addition, compensation based on a percentage of their average weekly wages, payable periodically. Dependents of people killed are likewise compensated. There is a need for all States and the Districts must provide for compensation benefits in disaster case either by enlarging the scope of a separate compensation

law, by separate legislative enactment, or by judicial construction.

The enactment of disaster compensation laws must be applied to many jurisdictions by enforcing stringent provisions for the prevention of disasters. The enactment of compensation laws has increased materially the cost and insurance to public sector. The increased cost and the certainly with which it is applied have put a premium on disaster prevention work. This cost can be materially reduced by the disaster mitigation measures. Experience has shown that approximately 80 percent of all disasters are preventable.

3.12 Emergency Preparedness Plans (EPPs) and Emergency Control Centres (ECC)

Every disaster incident has a “coming about”, a “contending with ” and “normalization” phase,

and the time scales of the individual phases may greatly according to the type of disaster incidents. The alarm plan, the hazard prevention and normalization plans are the three phases in planning. The principle for the sequence of action is: to alert, rescue and contend with (the disaster incident). Figure- 2 depicts steps in preparing an emergency plan. This will guide how to prepare an emergency planning.

There is need to prepare the emergency plans and to establish the emergency control centers (ECC) mechanisms. The ECC is to locate in a position of minimum risk and with good access to all controlling systems. Emergency response team leader will coordinate all emergency activities from ECC.

ECC should be linked by phone to all essential points. It is necessary to raise the alarm when emergency occurs. The objective is to inform to the emergency services, threatened areas and threatened neighboring areas.

Elements of Emergency Plans

- 1.Communication and control system
- 2.Assigning key personnel or personal with specified responsibilities.
- 3.The work emergency procedures

4.Liaison with outside authorities and services in cooperation with outside services

5.Public relations including media

Objectives of Emergency Plan

1.To minimize loss of life, injury and environmental change

2.To hasten the process of controlling and containing the incident

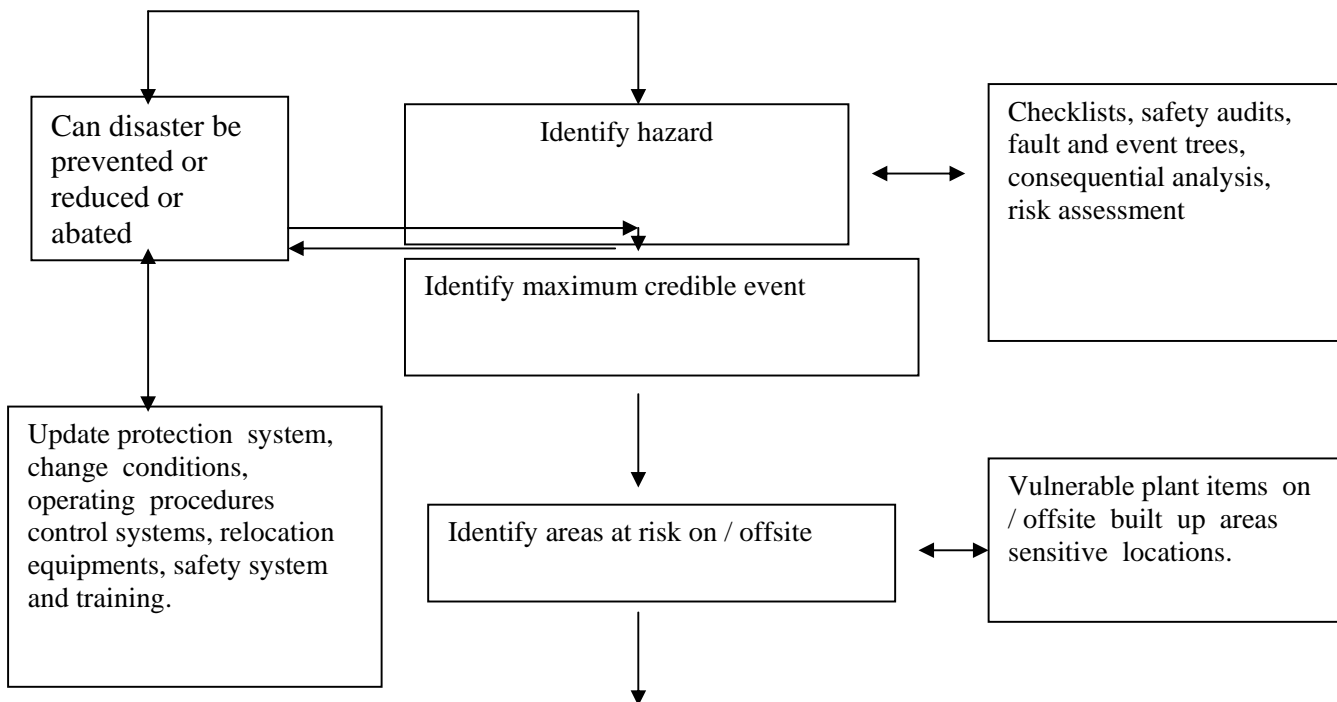
3.To facilitate co-ordination of external authorities and service

4.To establish the system for flow of information during the emergency and preservation of relevant data for subsequent investigation.

3.12.1 Preparation of Onsite Emergency Plans

The occupier shall prepare an onsite emergency plan detailing how major disasters will be dealt in on- site during the emergencies This plans shall include the name of the person who is responsible for safety on the site and name of those who are authorized to take actions in accordance with plans in case of emergency.

3.12.1 Steps involved to prepare the Emergency Plan



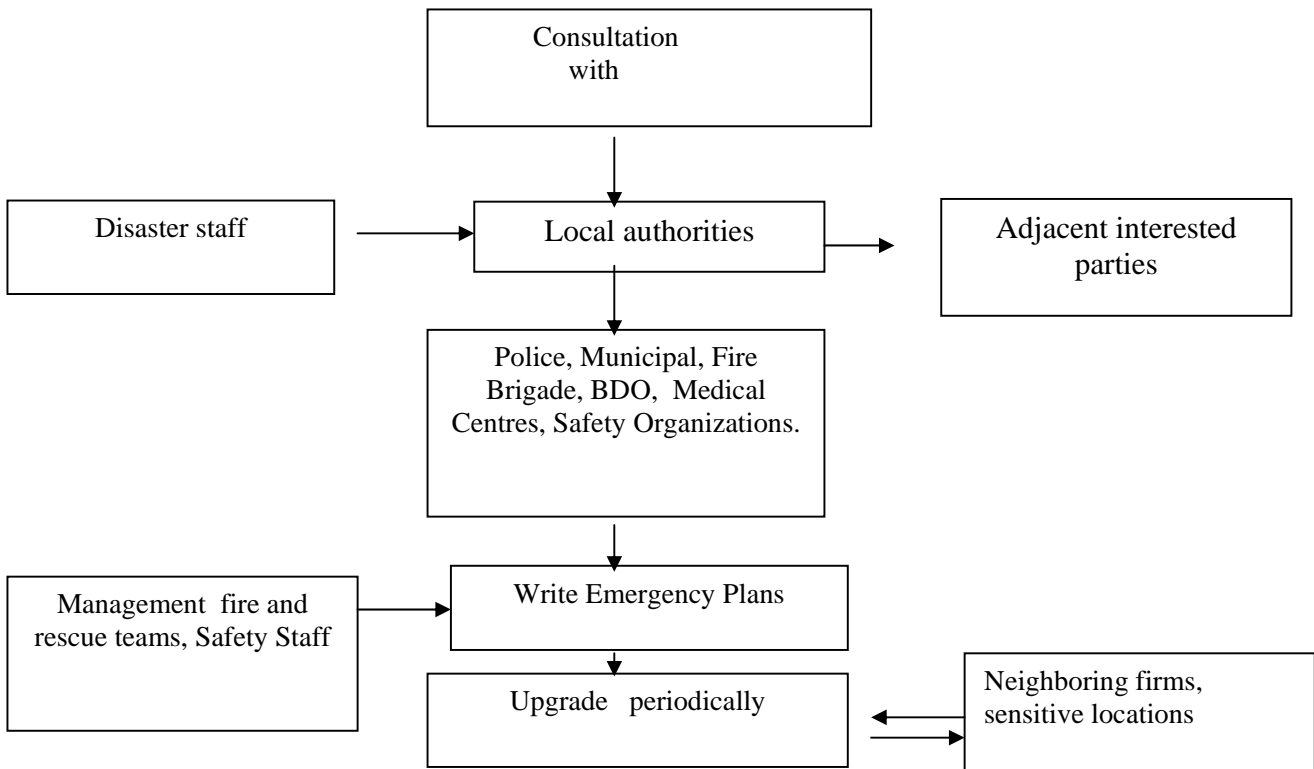


Figure 2 - Guidelines for preparing an emergency plan

3.12.2 Preparation of Offsite Emergency Plans

It shall be the duty of the district collector or the district emergency authorities designated in the state government has to prepare and keep up-to-date an adequate off-site emergency plan. Information must be given about the person liable to be affected by the disasters.

Legal Basis –Responsibilities

There must be enactment in the constitution that the legislation concerned to the disaster management and mitigation are the responsibilities of the Government that is public sector. As per this legislation, emergency planning for the disasters and other events is the responsibility of the local municipalities. Emergency plans have to be drawn which will form a part of the municipality hazard and disaster prevention planning which must include the natural disasters like earthquake, flooding, fire and explosion, gas clouds, war, plane crash. The

information procedure for disaster incidents is to submit the detailed reports about the serious disasters , serious failures and disturbances of the shortfall regulation to the local municipalities through the state department of disaster management.

3.12.3 Hazard Prevention Plans

The ingredients of success in hazard prevention are reliable early detection, careful planning, efficient personnel, adequate technical facilities, problem-free communication and proper training of all persons concerned.

Disaster Medical Alarm Plan

The medical alarm plan provides speedy and efficient medical care for insured people. There need to be trained first aid at the scene of the disaster, adequate doctors, first aid men, and casualty wards. Figure 3 depicts the alarm plan. ;

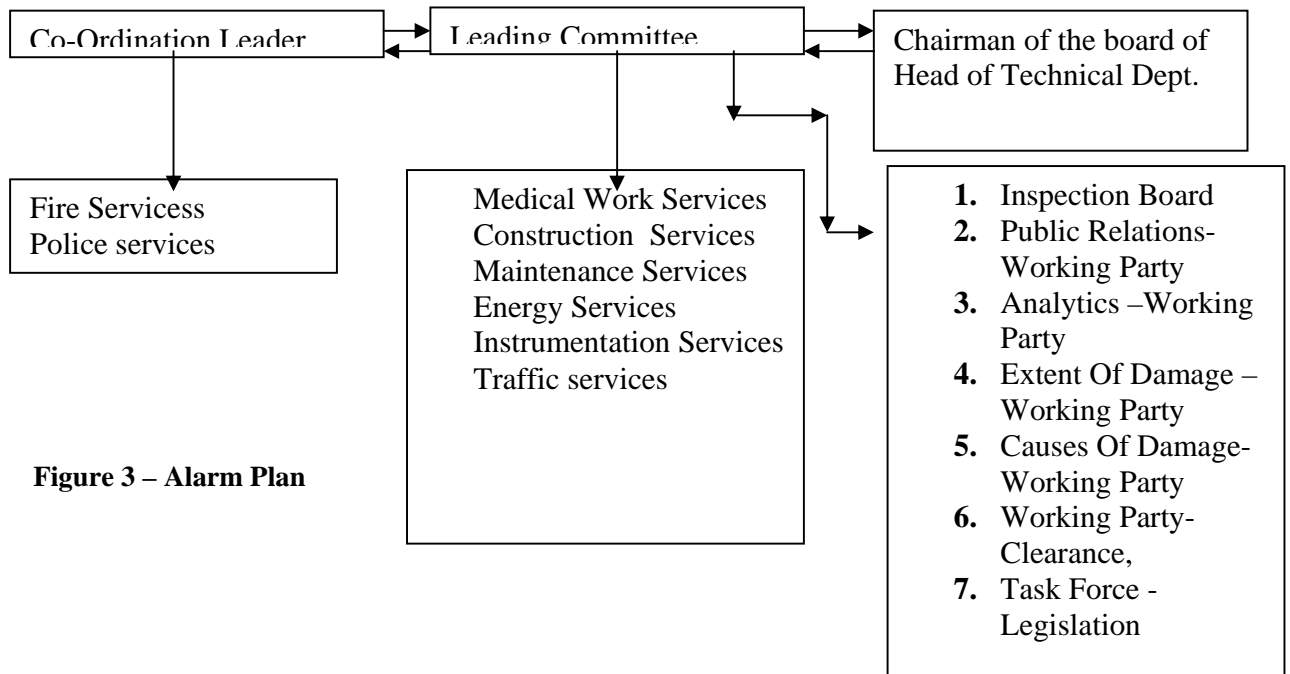


Figure 3 – Alarm Plan

The disaster site must have a medical service equipped with required ambulances, disaster trailers that can quickly reach the hospitals in the surrounding. There should be large rescue section necessary medical aid and prepared dressing material must be available. Dressing material for some 50000 injured people has to be kept ready in sterile packs. Then training of the first aid laymen, of the first aid men and of the doctors has to be there to administer efficiently the first aid in a reliable and effective manner. Proper and speedy internal and external communication is a crucial prerequisite to successful hazard prevention.

3.12.4 External Emergency Planning

The municipality is responsible for external hazard and disaster prevention planning. The plant alarm and hazard prevention plans take into consideration all possible incidents involving damage, which may occur, even though very seldom. This plant planning is subject to consultation with the municipality. All alarm and hazard

prevention plans are accessible to the competent authorities at any time.

Normalization Plans

Normalization plans are first drawn up accurately in connection with a specific incident. Clearing which can take a long time must be carefully prepared and planned. The investigation of damage and causes begins during the “contending with “ phase. Measures follow from the results of investigations, which prevent a repetition of the incident. As soon as the incident has been dealt with, preparing for the resumption of disaster site activity generally makes a start.

3.12.5 Alarm Plans For the Incidents Involving Special Damage

Alarm plan must contain data with respect to the Important telephone numbers, plan with central and peripheral zone, list of all sites which are located in central and peripheral zone and the names of the most important people, and their telephone numbers.

3.12.6 Medical Aspects Considered During The Disaster

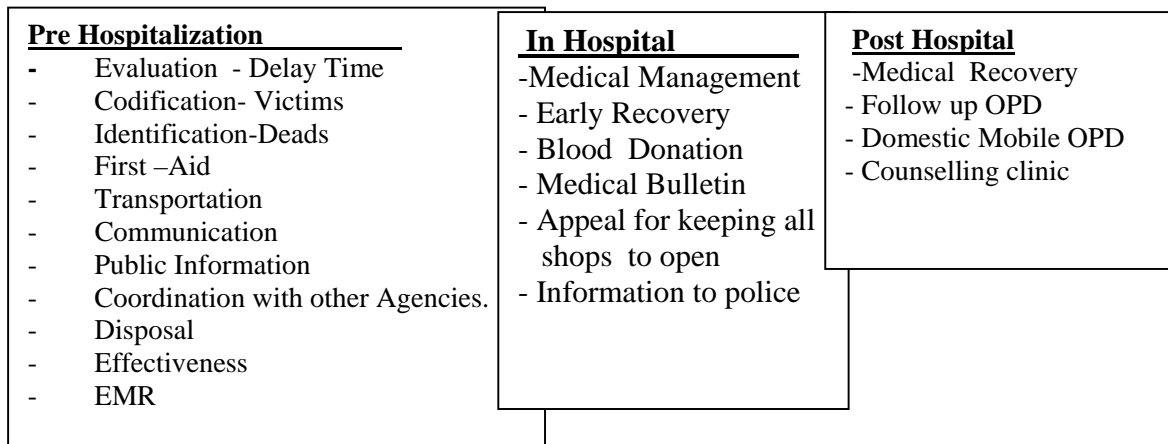


Figure 4 – Medical aspects to considered during the Disaster

3.12.6.1 Post Disaster Management System

Post Disaster Management System	
Post Disaster Management	
Public Health Rehabilitation	
Control of Endemic - Water borne	
Food Borne	
Emergency Planning – Pre Disaster	
On Site Planning	Off Site Planning
- Rescue	Casualty
- First Aid	Hospital
- Evaluation	Standard TMT Guide
- Disposal	Trauma Team Information System
- Transportation	
- Guidelines Preparation	Facilities
- Education/ Training	Drugs/ Anti Dotes
- Crash Team or Trauma Team (TMT)	
- Alarm System	

Figure 5 - Post disaster management

3.12.7 Corporate Disaster Preparedness Programme

The emergency response plans (ERPs) provide a structure for managing large-scale emergencies/disasters. The major objectives of the corporate disaster plan are:

- 1.To protect life, safety and health of staff and customers.
- 2.To establish priorities for utilization of Internal resources, which consist of personnel, talent and materials.
- 3.To protect property and assets.
- 4.To be as self-sufficient as possible for at least 72 hours after an event.
- 5.To resume business as soon as possible to minimize risk exposure and financial loss.
- 6.To constitute emergency response teams (ERT),

The ERT will render assistance including first aid, fire suppression, damage assessment

- rescue and communication.
7. To impart life safety training

Life safety training, which includes fire safety, bomb threat and earthquake preparedness. Is provided to all employees. Personalized slide shows are given to high-rise building occupants and video tape provided to smaller branches. An employee Emergency Procedures

brochures will be developed for building occupants. First aid and cardiopulmonary resuscitation courses are offered to employees including emergency response team members. In addition, earthquake preparedness brochures for home, workplace will be provided to the people.

8. Emergency Supplies: Emergency supply kits with food, water, first aid and survival supplies such that the occupants to be self-sufficient. Food supplies include high-energy food packets, which require no cooking, a three-day supply is provided for each person. Each supply kit contains essential first aid bandages and supplies. Other survival equipment must include radio, candles, rope, tools, goggles, etc.; the supplies are utilized and managed by the emergency response teams who are responsible for their storage and security.

4 Conclusion

Natural Disasters causing damage to human life, property, infrastructure and economy has emerged as a global challenge. To know what the “cause of natural disaster ” is we must analyze the situation, the set of conditions in nature, which are invariably accompanied by some change, whether or not these conditions are within man’s control. Many hazards are fairly obvious,

but identification of all the likely hazards is important in developing an effective safety program. Develop a safety plan before any work is started. Requisite safety measures have to be provided for natural hazards. Prevention is better than cure. Once disaster occurred, it is very difficult to handle and control it. Hence proper planning shall always handle and mitigate the various kinds of disasters effectively, for which open, transparent and efficient systems have to be followed. There is a need for systematic identification, preparation, prediction, assessment, evaluation of disaster events and incorporation of mitigate measures. The important elements which have been discussed in this manuscript and to be considered during any disaster management are disaster management system and standards (DMS)/ Indian Standard (IS) codes, disaster diagnosis, disaster resource planning (DRP), disaster impact assessment (DIA), investigation of disaster and hazardous risk assessment (IDHRA), onsite and offsite emergency planning, disaster management plans (DMPs), corporate disaster preparedness programmes , emergency response plans, identification of proactive measures (IPM), systematic measurement, resource evaluation and quantification, cost analysis, environmental impact assessment (EIA), feedback towards achieving the disaster control abatement and mitigation strategies, research and development, management innovations, loss assessment & prevention (LAP) measures , recovery, relief , reconstruction and rehabilitation (RRRR) activities, computer aided methods, state-of-art software on disaster management and enforcement of disaster compensation laws. The disaster management must also involve co-ordination activities about disaster events with all participatory sectors. Necessary on campus and off campus training and education have to be imparted to the officials of the participatory sectors. While we incorporate the rehabilitation and reconstruction, we must utilize the information technology for making use of the design, material, construction,

supervision of earth-quake-resistant buildings, eco-friendly construction technologies, and quality assurance mechanisms by following the bye-laws, regulations, national building codes, safe construction practices, safety acts and safe conditions. Rehabilitation and reconstruction training modules need to be prepared.

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