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High Powered Committee on Disaster Management

Workings of the High Powered Committee in a span of two years concerned itself with the entire issue of disasters and disaster vulnerability for natural and manmade hazards. HPC was a first concerted effort in the country and it evolved through its adoption of a participatory approach. It identified various disasters and grouped them into five sub-groups considering the related nature of disasters.

High Powered Committee on Disaster Management

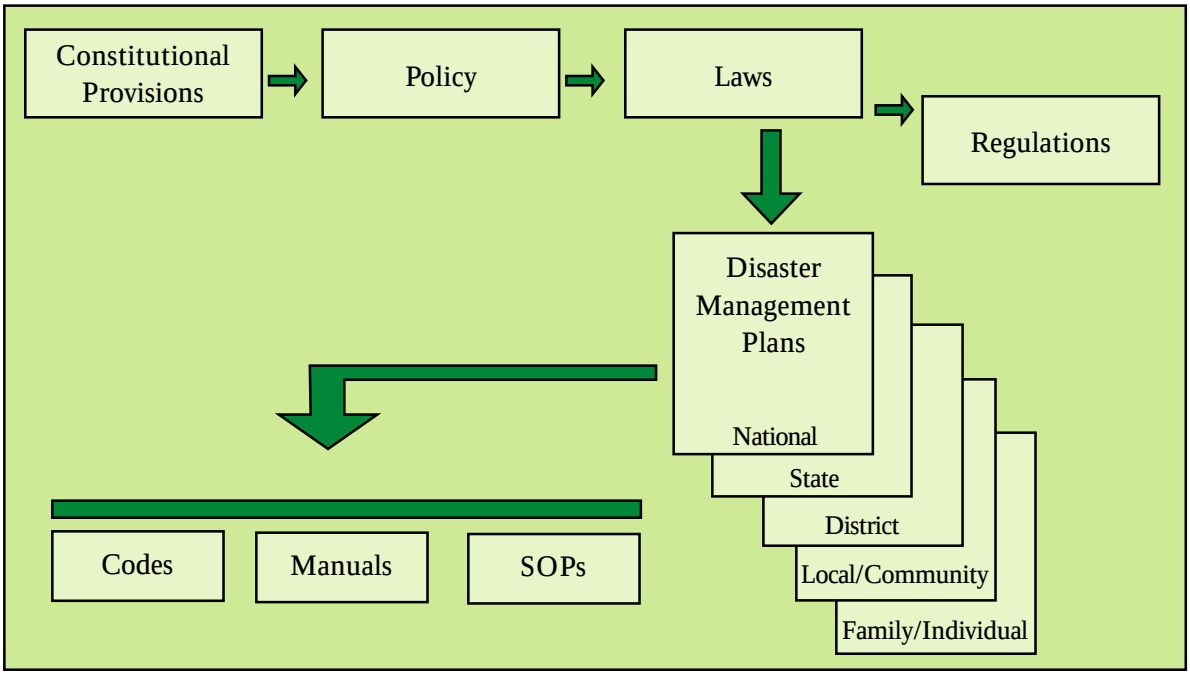
Mandate, Terms of Reference

The HPC was constituted in August 1999 under the Chairmanship of Shri J.C. Pant. HPC members were drawn from the Ministries, States, NGOs and experts drawn from relevant fields. It was a first attempt in India towards drawing up a systematic, comprehensive, and holistic approach towards disasters. (Refer Annexure 1: Order for Constitution of HPC).

The original mandate of the HPC was confined to preparation of management plans for natural disasters only. However, it was expanded to include man-made disasters and towards developing an effective plan of action that would encompass disasters of all origins. (Refer Annexure 2: Order for Enhancement of Terms of Reference).

The Terms of Reference of the HPC were subsequently enlarged to include non-

Conceptual Framework of HPC Mandate



natural or man-made disasters also with the approval of the Prime Minister vide order dated April 17, 2000. Representation from concerned Ministries dealing with industrial, nuclear, biological, chemical disasters were ensured by inclusion of experts from these Ministries.

The enhanced Terms of Reference of the HPC are as follows:

(i) To review existing arrangements for preparedness and mitigation of natural and man-made disasters including industrial, nuclear, biological and chemical disasters.

(ii) Recommend measures for strengthening organizational structures, and

(iii) Prepare model plans for management of these disasters at the National, State and District levels.

Certain important aspects considered by the HPC were:

(i) Measures for efficient forecasting and warning systems

(ii) Existing systems of response mechanism in the wake of natural and manmade disasters at all levels of government and steps to minimise the response time through effective communication and measures to ensure adequacy of relief operations

(iii) Development programs related to mitigation of disasters in different areas and priorities and strategies for inclusion of disaster reduction components in the ongoing plan/non-plan schemes

(iv) Measures for intensive training for building up of human resources to improve disaster awareness and capabilities

(v) Public awareness programs to build up society's resilience to disasters

(vi) Pro-active measures for disaster preparedness and mitigation - administrative, financial, legislative and techno-legal

(vii) Measures and programs to harness state-of-the-art information technology for effective communication network

(viii) Networking mechanisms by government and NGOs

(ix) Updating of codes, manuals, disaster management plans, items of relief, norms of assistance to State Governments

(x) Examining Construction practices/ codes, and mechanisms for hazard zonation surveys

(xi) Structural measures for disaster mitigation and preparedness - improving the design of check dams, raising and relocation of flood prone villages, renovation and desiltation of ponds, improved emergency drainage systems

(xii) Any other matter incidental or related to natural and manmade disasters.

Approach and Concerns

HPC adopted a strong process oriented and participatory approach involving different cross-sections of the society at all levels such as NGOs, media, governments at all levels as against an academic and technical approach.

In preparation of State and District Level Plans, the focus has been towards facilitating the States and Districts to prepare their own area specific disaster plans incorporating local characteristics. HPC has also suggested to States that State and district plans need to have a component of providing help to neighboring states and districts during disasters.

The establishment of the HPC for the formulation of disaster management plans for the country has been done with the idea to assess the present codes, manuals, plans and the working of the various agencies and departments and avenues for improvement. The need for an effective disaster management strategy to lessen disaster impact was felt in many quarters. The effort of the HPC was not to develop a plan de novo but to ensure its constant consolidation, upgradation, updation and rehearsal.

The contents of the document looks into all possible areas that need to be addressed and worked on in the face of future disasters and their impending impact. Contributions from all possible corners be it the government departments, ministries, the non-government organization working at the grassroots level and the community involvement in the entire process is imperative to the successful implementation of disaster management plans so formulated.

Methodology

The HPC and its various committees have had more than 49 meetings till date since inception and deliberated on various facets of disaster management planning in the country. These meetings included consultations with Relief Commissioners of all states, NGOs, media, ICSSR Institutions, Scientific & Technical Research Institutions etc. Thirty odd disasters were identified by the HPC for planning. These disasters have been categorized into five groups depending on generic considerations and various departments/ministries dealing with various aspects. Five sub-groups were constituted to discuss and deliberate on the preparation of Disaster Management Plans pertaining to their areas of concern. Besides these subgroups and State level subgroups set up to work on model State Disaster Management Plans, a number of parallel activities were taken up, such as preparation of the Source Book on District Disaster Management, NGO consultations, Relief Commissioners' consultations, three training programs etc. The HPC submitted two interim reports in July 2000 and subsequently in February, 2001.

For the formulation of disaster management plans for the country as a whole, a number of deliberations and consultations were held with the agencies belonging to various sectors such as

government agencies, non-government organization, national as well as the international aid agencies at timely intervals. With the result it led to the formation of disaster management plan that is comprehensive and one that looks into not only natural but also man made disasters. Intensive research and documentation has been carried out detailing out relevant information from all possible areas that could be tapped in crises situation.

Lessons Learnt during the course of HPC

During the tenure of the HPC, many unprecedented events led to new concerns and lessons that needed to be incorporated in the planning process. Following the Gujarat Earthquake of Jan 26, 2001, recommendations on a Quick Response Mechanism/system was also solicited from HPC.

Also, as per recommendations of the Eleventh Finance Commission, the HPC was requested to deliberate and advise on the concept vision and structure of the proposed National Centre for Calamity Management (NCCM).

Some of the other important lessons learnt during the deliberations were:

- that the report should include not only natural disasters but man made disasters as well.
- that the tasks performed by and the role of non-government organisations is extremely beneficial for downscaling the impact of disasters.
- that there is a need for monitoring and evaluation of the tasks being performed by various agencies at regular intervals.
- that disaster mitigation and preparedness be given top priority.

Key Considerations

In light of revisions made to the original Terms of Reference and the lessons learnt during its tenure, some of the key considerations that guided the development of final recommendations for the HPC were:

1. Revision of existing system of response mechanism in the wake of natural and manmande disasters at all levels of government and introduction of steps to minimise the response time through effective communication and measures to ensure adequacy of relief operations.
2. Development programs related to mitigation of disaster management in different areas and priorities and strategies for inclusion of disaster reduction components in the ongoing plan/non-plan schemes have to be considered.
3. Measures need to be introduced for intensive training for building up of human resources to improve disaster awareness and capabilities, and also public awareness programs to build up society's resilience towards disasters.
4. Pro-active measures for disaster preparedness and mitigation - administrative, financial, legislative and techno-legal
5. Measures and programs to harness state-of-the-art Information Technology for effective communication network. Networking mechanism by Government/NGOs. This would also improve advance warning systems against disasters.
6. Review of Global Best practices including study of the UN System and the Disaster Preparedness and Response mechanism of several countries.

Disasters identified by the High Powered Committee

I. Water and Climate related disasters

1. Floods and Drainage Management
2. Cyclones
3. Tornadoes and Hurricanes
4. Hailstorm
5. Cloud Burst
6. Heat Wave and Cold Wave
7. Snow Avalanches
8. Droughts
9. Sea Erosion
10. Thunder and Lightning

II. Geologically related disasters

1. Landslides and Mudflows
2. Earthquakes
3. Dam Failures/ Dam Bursts
4. Mine Fires

III. Chemical, Industrial and Nuclear related disasters

1. Chemical and Industrial Disasters
2. Nuclear Disasters

IV. Accident related disasters

1. Forest Fires
2. Urban Fires
3. Mine Flooding
4. Oil Spill
5. Major Building Collapse
6. Serial Bomb Blasts
7. Festival related disasters
8. Electrical Disasters and Fires
9. Air, Road and Rail Accidents
10. Boat Capsizing
11. Village Fire

V. Biologically related disasters

1. Biological Disasters and Epidemics
2. Pest Attacks
3. Cattle Epidemics
4. Food Poisoning

Even after enlistment and deliberations over thirty odd disasters, there were further suggestions for inclusion of more types of disasters such as civil strife, communal violence etc. However, the members were of the view that it was not possible to make the list exhaustive, but the basic condition of it having been designed to cater to all major categories of disasters should suffice for the purpose of the HPC. The HPC felt that the systems developed based on these listed types of disasters, further classified into five groups should suffice in catering to any additional types of disasters that may emerge.

The HPC and various sub-groups formed by it carried out a number of national and regional level consultations to create and disseminate opinions, views and recommendations that could be incorporated in disaster management planning process. Inputs from such consultations have contributed to the main body of thought created by HPC for the country.

Setting up of Sub-Groups

Sub-Group I - Water and Climate Related Disasters

The Sub-Group on Water and Climate Related Disasters, set up by the HPC, looked into a wide variety of meteorological, hydrological and climate phenomena that pose a threat to life, property and the environment. The hydro-meteorological hazards include Floods and Drainage Management, droughts, cyclones, tornadoes, hurricanes, hailstorm, cloudburst, snow avalanches, heat & cold waves, sea erosion, thunder and lightning. The spatial and temporal scales of these hazards vary widely

from short-lived, violent phenomena of limited extent to large systems. These events can subject large regions to disastrous weather phenomena like strong winds, heavy flood-producing rains, storm surges and coastal flooding, heavy snowfall, blizzard conditions, freezing rain and extreme hot or cold temperature conditions for periods of several days.

The application of meteorological, climatological and hydrological knowledge in the area of disaster management has a very significant role to play in the assessment of risk, land-use planning and the designing of structures which greatly contribute to disaster mitigation. The classical forecasting and warning role, the provision of warnings of impending severe weather, extreme temperatures, droughts or floods, contribute to preparedness. Updated warnings, forecasts, observations and consultations with emergency and relief agencies contribute to the response phase. Finally, special forecasts and other advice assist recovery operations. Natural hazards such as floods, extreme temperatures, high winds and droughts may cause or exacerbate other disasters. These include the possible risks of wildfires, insect and pest infestation, toxic gas releases, oil spills and nuclear accidents. Therefore, the provision of meteorological advice and products such as trajectory forecasts or advice based on dispersion modelling can represent a valuable contribution to addressing other non-hydrometeorological hazards.

Having realised that using traditional engineering methods it is not possible to control floods completely, non-structural measures aim at reducing flood damage by involving people.

Floods and Drainage Management

Floods are characterised as long, short or no warning. The main season for floods in India is the south-west monsoon period of June to September though floods occur in some parts of the conutry in the pre-monsoon season (March-May) and post-monsoon season (October-December) also. While heavy rainfall on successive days in the upper catchment of a river basin is the main cause of the flooding in rivers, there are some hydrological aspects too, which aggravate the flood situation. Where there are poor drainage conditions, heavy rainfall results in local accumulations of the water resulting in local flooding. The inadequacy of the carrying capacity of the river channel is accentuated by erosion and silting of the riverbeds. The Central Water Commission has established Flood Forecasting Centres (FFCs) in all major river catchments of India covering 62 major inter-state river basins with 132 water level forecasting stations and 25 inflow forecasting stations. Hydrological and hydro-meteorological data from nearly 700 stations in these river catchments are being collected and analysed, and flood forecasting and warning messages are issued, generally 24 to 48 hours in advance.

The problem of flood management revolves around two aspects - structural measures and non-structural measures. Having realised that using traditional engineering methods it is not possible to control floods completely, non-structural measures aim at reducing flood damage by involving people. Long-term measures are execution of watershed management and major flood control works such as raising of flood control structures, land-use regulations, evacuation, emergency equipment, strengthening of forecasting, monitoring and warning system and public awareness. Medium term measures are bank protection, river training and anti- erosion works. Short-term measures are assessment of vulnerability of the flood control structures, strengthening the existing embankments and other flood control works; cleaning, de-silting, flood plain zoning, mapping, etc. There is a need to ensure that all village Panchayats have dug up the village ponds, and encroachments on ponds/ tanks or natural drainage channels are removed well before the onset of monsoons.

Suggestions for Removal of Gaps/ Constraints in the Present System

- There are areas where flood forecasting services, number of observation sites and forecasting stations may be increased.
- Reservoirs should have appropriate reservoir regulation policy consistent with management of risk to the downstream areas.
- Modern sensors and telemetry equipment, which can automatically record and transmit data, can be tried in areas prone to flash floods or for vital systems.
- Integrate the forecasting/warning with mitigation system.
- Prepare inundation maps of flood prone areas.
- Proper documentation of significant floods incidents.
- All developmental activities in flood plains must be compatible with the flood risk involved.

Future Requirements in Flood Disaster Mitigation

- Satellite based remote sensing facilities available in the country are presently not used for best advantage in flood management/ disaster mitigation measures.
- Better transport and communication facilities for the flood affected areas.
- Making people aware of the flood risk through appropriate programmes.
- Imparting training keeping in view the requirements of functionaries at various levels and educate people living in the flood prone area.
- Traditional knowledge and wisdom be supported by scientific management measures for disaster mitigation efforts.
- Role of NGO and people's participation is an important aspect.
- Support from local media in organising disaster management activities.

Droughts

Any lack of water to satisfy the normal needs of agriculture, livestock, industry or human population may be termed as a drought which could be classified as Meteorological, Hydrological or Agricultural drought. In general the major areas liable to drought are usually well known, periods of drought can be prolonged and there is long warning time. The primary cause for the occurrence of drought is the deficiency of precipitation. The major part of the country except Tamilnadu receives bulk of the annual precipitation during the southwest monsoon period June to September. October-December constitute the main rainy season for Tamilnadu. Winter precipitation is significant in Jammu & Kashmir, Himachal Pradesh and West Uttar Pradesh hills and its abundance or deficiency constitutes the level of stream flow in the following season.

Drought Management is generally by focus on employment generation, water conservation and power supply, standing crop saving and public distribution supplies of essential commodities.

Substantial areas of our country periodically experience droughts leading to considerable loss of agricultural production and livestock wealth besides causing misery to people inhibiting these areas. Drought management generally focusses on employment generation, water conservation and power supply, standing crop saving and public distribution supplies of essential commodities. The long-term solution of drought problems usually rests with national governments and involves major policy decisions. The prediction of drought is carried out mainly based on rainfall predictions. These are long range rainfall prediction, medium range rainfall prediction and short range rainfall predictions. Crop yield predictions are carried out based on rainfall and crop condition information received by the State agriculture department

and are compiled at national level by Department of Agriculture and Co-operation. Remote sensing data provides major input to all the three types of rainfall prediction.

An early warning of drought is basically linked to existing on-farm operations in case of agricultural droughts and local water utilisation pattern in case of hydrological drought. India Meteorological Department responsible for rainfall monitoring in the country has meteorological observatories at each district head quarters and observe the weather information on daily basis. In addition to rainfall monitoring, agro-meteorology wing of IMD generates weekly aridity anomaly maps for the country. Monitoring the water levels in all the medium and major reservoirs are carried out daily by the State irrigation departments and Central Water Commission. Each State Directorate of Agriculture has a well-established system to closely monitor sowing operations from village level to district and State level. Currently the district authorities assess damage with inadequate data on crop area and yield forecast. A unique feature of the Indian effort is spatial monitoring of drought conditions at the level of sub-district units. Programmes to combat or restore ecological balance through soil and moisture conservation on watershed basis have been in operation for almost two decades. In addition, the construction of major and medium scale dams to ensure irrigation and drinking water contributed to a large extent towards mitigation of drought in the country.

Special Problem Areas in Disaster Management of Droughts

- Response requirements may be extensive and prolonged, thus involving major commitment and expenditure.
- Prolonged drought may undermine self-reliance of affected communities, thus making it difficult to withdraw disaster management assistance.
- Logistic requirements may exceed in country capability, particularly if large inputs of outside (international) commodities are involved.
- Rainfall and other agromet data being monitored is inadequate in certain agro-climatic divisions to meet demands of drought monitoring. Space borne measurements integrated with computed aridity anomaly based on field measurements of rainfall and crop calendars are required.
- While new technological options are emerging as use of satellite data, modelling etc there is no operational procedure currently to forecast the impending drought conditions with respect to area of impact, extent and duration.

It is also recommended that besides drought management, efforts on drought mitigation need to be emphasised.

Cyclones

Tropical cyclones form in the warm tropical oceans where the sea surface temperature is at least 26°C. They may last with destructive power for two weeks or more where a large open sea is available. In the Bay of Bengal and Arabian Sea around India, their normal life span may extend up to 4 to 5 days. The long term average annual frequency of tropical cyclones in the north Indian Ocean (Bay of Bengal and Arabian Sea) is 5.6. The frequency is four times more in the Bay of Bengal than in the Arabian Sea. The storm surges are by far the greatest killers in a cyclone. As a result of storm surge, sea water inundates low lying areas of coastal regions causing heavy floods in the coastal areas, eroding beaches and embankments, destroying vegetation and reducing soil fertility. Very strong winds may damage overhead installations, dwellings, communication systems, trees, etc., resulting in loss of life and property.

IMD has a well-established and time-tested monitoring and forecasting organisation for tropical cyclones. A good

network of meteorological observatories is operated by IMD for monitoring of cyclone development and movement. The conventional observations are supplemented by observational data from polar orbiting and geostationary satellites. INSAT imageries are obtained at hourly intervals during cyclone situations, which have proved to be immensely useful in monitoring the development and movement of cyclones. IMD issues cyclone warning messages on the location, intensity and probable track from 6 cyclone warning centres located at Calcutta, Bhubhaneswar, Chennai, Mumbai, Vishakpatnam and Ahmedabad. In addition to existing mode of dissemination of cyclone warnings through high priority telegrams, telephone and telex/telefax by I.M.D., a new scheme, Cyclone Warning Dissemination System (CWDS) using INSAT has been implemented on an experimental basis for coastal areas of South Andhra Pradesh and North Tamilnadu in December, 1985 by establishing 100 CWDS Receivers. This scheme was made operational during cyclone season of 1986-87. The most essential aspect of the disaster management of tropical cyclones is the availability of warning information at critical times. The INSAT system could be very effective in monitoring the cyclone movement and assessment of its intensity.

Most of the coastal states have implemented cyclone distress mitigation measures. Shelters have been constructed in the coastal areas. Cyclone warning and dissemination systems have been established for dissemination of cyclone warnings for the areas prone to cyclones. However the main problem areas are the following:

Meteorological services: The observational network on the high seas and along the coastline are inadequate. Satellite systems with multi-channel image capabilities of higher resolution would improve current techniques of analysis and forecasting. Deployment and networking of Doppler Radar would facilitate improvement in analysis and prediction of cyclones. Communication problems between IMD and users at critical times need to be streamlined. Improvement, augmentation and networking of tide-guage to capture storm surges.

Inter-agency coordination be formulated between different departments/agencies of Central and State Governments, and State agencies and public.

Management system: A good network of motorable roads should be constructed in all vulnerable coastal areas to facilitate quick evacuation and supply of relief. Schools and hospitals may be built on the super highway and these may be used as a cyclone mitigation measures. All Government officials in the cyclone prone areas need to be trained in cyclone preparedness activities and relief works. There is a need for greater support to fisherman as they go for fishing at the time of cyclone with the hope of getting a big catch of fish, which is their livelihood.

Local Severe Storms

Local severe storms are small-scale disturbances that form due to strong convective motions in a moist and unstable atmosphere, and originate from well-grown cumulonimbus clouds. Thunderstorms occur in different parts of India during different seasons but widespread thunderstorm activity all over the country occurs during the hot weather period, also known as the Pre-monsoon period, from March to May. Some parts of the country experience thunderstorms during the monsoon season also from June to September. During the post monsoon season (October & November), thunderstorms occur in association with cyclonic storms and depressions mostly over peninsular India. Thunderstorms producing hail are known as hailstorms. The size of hailstorms may vary from less than a

centimetre to about 5 cm or more in diameter. A series of thunderstorms along a line often extending hundreds of kilometre is known as a squall line. The squall lines are therefore more severe convective phenomena than an isolated thunderstorm.

Another type of severe convective phenomena is the duststorms/sandstorms that occur over Northwest India during hot weather period. These are basically dry thunderstorms in which the strong downdraft from a Cb cloud raises loose dust or sand from the ground and reduces the visibility to almost zero. The most destructive meso-scale convective phenomenon which builds up in a thunderstorm is the tornado. Tornadoes are extremely severe vortices of very small dimensions occurring in association with intense and large Cb clouds or cyclonic storms. The visible symptom of a tornado is a funnel shaped cloud tapering from the base of a thunderstorm. It sometimes touches the ground and causes extensive damage along its path. The diameter of the tapering end touching the ground may vary from less than a meter to a few tens or hundreds of meters. With the available network of meteorological observations, it can hardly be detected. Its life cycle is from a few minutes to a few hours. It has not been possible to measure the meteorological parameters associated with tornadoes due to the above limitations. The exact cause of the tornado formation is not yet fully understood. The wind speeds can be as high as 400 to 500 kmph. The entire disturbance moves at a speed varying between 100 to 150 Kmph. In view of its severe intensity, it has a high potential for destruction. The most probable regions of tornado occurrence in India are Assam and adjoining states, West Bengal, Orissa and Gangetic plains, Punjab and Haryana.

There is a need to proceed from hazard assessment to vulnerability analysis and ultimately generation of earthquake risk maps/ figures

The entire life cycle of local severe storms from birth to dissipation is only a few hours. The severe storms being small in size with a short life span often escape detection on a synoptic weather chart with the existing network of observatories and frequency of observations. Special observing aids and techniques of detecting are necessary in addition to the routine weather charts. The advance warning of tornadoes is a difficult task. The radar comes in quite handy for tornado monitoring and warning. Unless the warning of tornado occurrence is disseminated to public at large, due to its short life, adequate steps cannot be taken by public to get away from the path of tornado. Various State Governments in the target region have promulgated building laws which specify design of houses capable of withstanding tornado fury.

Heat and Cold Wave

The human body is acclimatised to a particular combination of temperature and humidity. Long exposure to extremes of cold or heat may lead to severe thermal strain and ultimately to death. This needs monitoring of daily minimum temperature in winter and daily maximum temperature in summer. During March to July, normal temperatures over most parts of India are very high. Any abnormal increase leads to disastrous consequences. In each season we may expect two or three hot spell with temperatures much above the normal. Similarly, during the period November to March, when the winter is in full swing, two to three cold spells may be experienced. Both the hot and cold spells appear to migrate from one area to another, though their movement is not systematic. The heat and cold spells are called heat waves and cold waves respectively, though they have nothing in common with wave motion as is normally understood. Widespread heat waves normally occupy about 10 percent of the Indian land mass. Generally they develop over northwest India and north Pakistan and extend towards east and south.

Sub-Group II - Geological Disasters

Geologically related disasters deal with earthquakes, landslides, mudflows, sea erosion, dam bursts and dam failures, and

mine fires. More than half of the area of the country lies in high to moderate seismic zones that could have damaging seismic intensity. The areas affected by landslides are also wide spread in the Himalayas.

This National Plan highlights the national strategies for preparation, mitigation and response. They act as broad policy guidelines for disaster management efforts.

The plan on Geological Disasters includes:

(i) prevention plan of inter-state and sub-continental features,

(ii) prevention strategy of inter-state and international issues,

(iii) mitigation plan of inter state and sub-continental features,

(iv) mitigation strategy of inter state and inter national issues,

(v) preparedness plan at the national level, and

(vi) SAARC and international initiative in this regard.

The occurrences and current status of various geological disasters caused by earthquakes, landslides and mud flows, dam break/ dam failures and mine fires have been presented together with mitigation and response plans to cope with such disasters. A plan to mitigate and minimise the destructive geological hazards of natural disasters like earthquake, landslide & mudflows, dam burst and mine fires has been drawn. The Disaster Mitigation Plan is in two parts - Mitigation Plan and Response Plan. The details of these plans are also proposed for other geological hazards. The various levels of Trigger Mechanism are also specified.

For an effective Disaster Mitigation Plan hazard assessment, vulnerability assessment and risk assessment, prevention, preparedness activities have to be strengthened. The emphasis is made on Disaster Prevention, Mitigation and Preparedness Plan for effective Disaster Management in addition to a sound Disaster Response Plan. Disaster mitigation contributes to lasting improvement in safety and is essential to integrated disaster management.

Earthquakes

Although occurrence of an earthquake cannot be predicted precisely in terms of time or place, yet the seismic zones are very well drawn and careful planning, design and the appropriate measures can minimise the damaging effects. Earthquake is an unavoidable unpredictable infrequent phenomenon. Its parameters are its location, its destructive energy and the depth of its focus below ground level. Earthquakes destroy buildings and infrastructure with secondary effects, i.e., fires, embankment failure, release of poisonous gases, release of nuclear radiation, liquefaction etc. and the losses may some times be much more than as a direct consequence of earthquakes itself. Earthquake disaster mitigation planning must take both the primary and secondary effects into consideration.

People must be educated about the dangers and how to minimize them if not avoid them altogether if an area is identified to be having landslide activity of mass movements/ destruction.

Earthquake Disaster Mitigation

For effective earthquake disaster mitigation, the pre-earthquake phase needs to be utilised for planning and implementing preventive measures on the one hand and working out preparedness activities on the other. Earthquake in itself is not a disaster. Disaster is caused due to failure of man made structures, lack of preparedness and awareness. So far, earthquake disaster mitigation efforts are mostly reactive. Disaster prevention, mitigation and preparedness are better than disaster response. The first step towards the direction of disaster preparedness is risk assessment. There is a need to proceed from hazard assessment to vulnerability analysis and ultimately generation of earthquake risk maps/figures.

Earthquakes are being monitored by India Meteorological Department, Survey of India, National Geophysical Research Institute, Department of Earthquake Engineering, University of Roorkee and several other academic and research organisations. Macro level map has been prepared which helps in classifying the country into the earthquake hazard zones. The Vulnerability Atlas gives State and district-wise hazards to buildings and other infrastructure due to natural disasters. The disaster can be made much worse due to the vulnerability of the community itself. Vulnerability assessment of buildings, structures/infrastructure, lifelines, economy and people is to be undertaken.

Earthquakes occur repeatedly at irregular time intervals and with varying intensities in certain part of the earth, known as seismic belts, which, according to present hypotheses, lie on peripheral contacts of large tectonic plates of the earth's crust. Prevention is by permanent protection including engineering and other physical protective measures combined with appropriate non-structural measures for reducing damage and distress, and also legislative measures controlling land use and urban planning. The major preparedness activities are: developing damage scenarios, disaster mitigation cells for selected urban areas, and reducing vulnerability of existing infrastructures.

Earthquake Response Plan

The emergency measures of evacuation, search, rescue and relief form important action plans in disaster management. Once disaster occurs, disaster management machinery should plunge into action in rescue and relief operations. The Trigger Mechanism is a vital part of preparedness plan whereby the receipt of a signal of an impending disaster would simultaneously energise and activate the mechanism of response and mitigation without loss of crucial time. Other aspects are Rapid Damage/Loss Assessment for Emergency relief, documentation of damages and losses and reconstruction.

Gaps/Limitations

A strong R&D base of earthquake engineering in the country is required with research infrastructure and trained and highly skilled manpower. The gaps can be filled by honest evaluation of the status of earthquake engineering in the country vis-à-vis others prone to earthquakes. A significant improvement in R&D activities and additions to manpower in teaching and research institutions in the area of earthquake engineering is required. This will enable us to be in a position wherein a strong earthquake risk reduction programme can be launched. The strategies for disaster prevention and mitigation need to focus on:

- Creating policy supports at national, state and local levels.
- Improving public awareness and human resource development
- Strengthening of institutional infrastructure.
- Developing and implementing engineering interventions and improving regulatory mechanisms for effective response.
- Strengthening of R&D and technology transfer.
- Creating financial supports for disaster prevention and mitigation.

Landslides and Mudflows

Landslides and other mass movements can be predicted and the damage minimised or even averted with proper and systematic studies and with the adoption of remedial measures. The mass movements occurring with fast speed are more dangerous, e.g., rock falls, since very often these occur without any warning or signs of distress. However landslides, land subsidence and creep are relatively slow processes and precautionary

measures can be adopted in time to reduce the quantum of damage. Landslide studies are still being conducted in a somewhat disparate fashion by various scientific agencies. Cloudbursts and flash floods accompanied by heavy rainfall are the main cause of landslides in India. In the mountainous terrain such as the Himalayas, the landslides caused are due to structural features, geomorphic aspects or the relation of slope with major fabric of rock mass. The natural damming of rivers by landslides is a significant hazard in many areas.

Landslides and Mudflow Mitigation and Response Plans

Measures of landslide control are avoidance, surface drainage, sub-surface drainage, supporters, excavation, river structural work, vegetation, blasting and hardening. Hazard identification, mapping and assessment to identify the existing or potential landslides using various techniques are important and involve zonation and risk evaluation.

Each mass movement requires different site specific strategies. However, for minimizing the incidence of landslide and other mass movements some general suggestions including geotechnical survey, Landslide Hazard Zonation maps, involvement of people, basic knowledge, and education are the key issues. People must be educated about the dangers and how to minimize them if not avoid them altogether in an area that is identified to be having landslide activity of mass movements/ destruction. Priorities of R & D in this case are prediction of landslides, development of improved mapping, models of landslide processes, design of land use patterns, landslide control measures, and development of reliable risk assessment frameworks.

Dam Bursts/Dam Failures

A dam burst releases large quantities of water causing disastrous damage to downstream installations, disrupting socio-economic activities causing loss of life with adverse ecological and environmental impacts. The frequency of dam failures has markedly decreased in the recent past. The structural stability of a dam can be threatened by floods, rockslides, landslides, earthquakes, deterioration of the heterogeneous foundation, poor quality of construction, differential settlement, improper management, and acts of war. Three types of earth embankment problems commonly found are seepage, slope stability and vegetation outgrowth. Available studies indicate that extreme floods and uncertain geologic setting are the principal causes of dam breaches. Furthermore, the earth fill dams have been involved in the largest number of failures, followed in order by gravity dams, rock fills, and multiple and single arches.

Preparedness on Disaster due to Dam Failure

The failure of dams causes economic losses that transcend immediate property damages and loss of life. Predicting the consequences of dam breach is the primary step in dam safety programme. Preparation of inundation maps under postulated failure can be made a statutory requirement. However; disaster planning, compensation for loss, and penalties should also receive legislative attention. Dam safety program should consist of evaluation of hydrologic, subsurface, hydraulic, and stability conditions.

Prevention and Mitigation of Disaster due to Dam failure

Programs of disaster management/mitigation encompass a wide range of options ranging from issuance of flood warnings to reduction of flooding to actual evacuation. The effectiveness of these programs depends, to a large extent, on the accuracy of flood forecasting and management and cooperation between the public and respective

While for Disaster Warning System some experimentation has been done with the continuous monitoring systems of gases and temperature, there is practically no general prevailing disaster warning system in the Indian coal fields in respect of mine fires.

responsible agency. A comprehensive program for dam-disaster mitigation should encompass dam safety evacuation before as well as during a flood, forecasting and warning, and flood emergency preparedness. It is important that dam safety be periodically checked and rectified if required.

Mine Fires

Mine fires are caused due to spontaneous heating of coal and carbonaceous matter in the rocks. In coal mines the fires could be underground fires which have remained underground or may become surface fires, fires in coal benches in open cast mines, fires in overlying rock mass, fires in overburden dumps or fires in coal stacks. Such fires in the coalfields not only consume huge quantity of coal but also do not permit exploitation of coal in adjoining areas and in underlying coal seams. Combating mine fires, specially the underground fires that have remained underground and those that have become surface fires, is a costly proposition. The Trigger Mechanism should aim to prevent any further occurrence of the fires and quick liquidation of the existing fires.

The information needed during preparedness is: zonation of existing coal mine fire affected regions, modelling/ simulation of potential land subsidence and related impact, assessment of loss of property/energy; for warning/prediction it is real time monitoring of coal fires, prediction of spread and depth, pollution extent; for relief it is delineation of affected areas, ways to arrest spread of fire, support to affected population, and for rehabilitation it is long-term measures to control spread, awareness creation among public, relocation of affected people. Mine Fire Hazard Assessment is by mine fire monitoring, hazard estimation and mapping. Mining situations which may lead to development of the mine fires have been outlined and Coal Mining Regulations, 1957 and subsequent circulars amply provide for the safeguards against mine fires. While for Disaster Warning System some experimentation has been done with the continuous monitoring systems of gases and temperature, there is practically no general prevailing disaster warning system in the Indian coal fields in respect of mine fires.

The Directorate General of Mines Safety (DGMS) examines from all considerations each and every application for underground and surface mining and wherever necessary imposes conditions that require preparedness for taking actions in the case of occurrence of the mine fires, specially in the underground mines. The R&D activities in relation to mine fires address prevention and preparedness. Post disaster actions in respect of mine fires depend upon the type and location of fire. The most important fires are the ones that occur in the underground workings. The short-range and long range actions have been listed.

The strategies for disaster prevention in respect of the mine fires should be viewed and developed from the following considerations:

1. Prevent spreading of existing fires and their mitigation.
2. Integrate preventive measures in mine planning and design.
3. Provision of periodical technical audit of mines in order to check deviations from the planned activities.
4. Create a fire mitigation fund for meeting the expenditure on the mitigation of existing fires.
5. Permit mines to sell reclaimed land at prevailing rates to recover the costs of reclamation and development of land. This may require some amendments in the Land Acquisition Act.
6. Evolving a scheme of reward and punishment for prevention,

safeguarding and mitigation of mine fires.

7. Development of a catalogue of fire related characteristics of coal seams in Indian coalfields.
8. Development of a catalogue of details of mine fires prevailing in the Indian coalfields and actions being taken for their mitigation.
9. Assessment of potential fire areas in existing mines and suggesting preventive measures.
10. Strengthening R&D facilities at research and educational institutions.
11. Strengthening mine fire wings of the coal companies.

There are certain limitations in taking up mine fire management programme which need to be overcome through:

- Operational use of high technology (satellite/aerial data) for monitoring and estimation of extent and depth.
- Accelerating response time to meet needs of decision-makers.
- Mapping of fire-prone areas and appropriate planning
- Development of new tools such as thermal inertia mapping and AR interferometry for accurate information of fires.

The following recommendations are being made for the implementation of strategies for prevention of mine fires:

1. A comprehensive compendium of precise and accurate details of all existing mine fires in the Indian coalfields be prepared.
2. A workshop be organised with experts who should interact with the officials of the mining companies.
3. In the entire mining project proposals and related environmental management plans (EMPs), prevention of fire should be specifically addressed.
4. A comprehensive compendium on details of existing underground mines and open-cast mines be prepared coal field-wise so that the existing situation can be assessed for future occurrences of mine fires and hence implementation of preventive measures may be carried out.
5. Although a large number of claims have been made by R&D and educational institutions towards breakthroughs for mitigation and prevention of mine fires, a consolidated statement is not available. Hence, it will be advisable to direct the institutions to develop a compendium of achievements so far for the benefit of the industry.
6. The R&D and educational institutions may be directed to conduct studies addressing the problems faced by the mining industry in a time bound manner.
7. A high-powered committee comprising of real mining, mine fire, subsidence and environmental experts be formed to assess and oversee the actions being taken by the concerned agencies.
8. All the details be placed on a dedicated web-site with provision for continuous updating.
9. Wherever surface is likely to be affected by subsidence and their impacts with chances of fires, construction activities should not be permitted.
10. Actions should be initiated to relocate settlements from the coalfields that are threatened by mine fires.

The signal mechanism has been designed to minimise the response time when a disaster strikes and to ensure smooth and reliable flow of information while disaster management procedures are underway

Sub-Group III - Chemical/Industrial/ Nuclear Disasters

The Sub-Group, set up by the HPC, covered Chemical & Industrial Disasters, Forest Fires, Oil Spill Fires, Mine Fires and Nuclear Disasters. In the area of organisational structure and the mode of response activation an Integrated Crisis Management Plan (ICMP) has been evolved based on a synthesis of different approaches and on the Crisis Alert System established for chemical accidents. The Standard Operating Procedure (SOP) of the ICMP is based on the Trigger

Mechanism i.e. a chain of response actions is triggered off as soon as a disaster is reported. As per the SOP, different emergencies have to be scaled and the response would be based on the level of the triggering event. SOP also lays down a uniform Crisis Management Plan to help the Government Authorities to act more efficiently and promptly to any impending and occurring disaster in India and its neighbouring areas.

Activities related to emergency management involve co-ordination of planning and response actions within the "ICMP Authorities", with Central and State government, international bodies, and other governmental and non-governmental entities in times of emergencies and activation of those entities.

Modification and review of the existing Disaster Management Plan was carried out for the six Central Government departments/ ministries.

A standard ICMP was presented, taking chemical emergencies as an example, the format of which can be adopted by each of the six Central Government departments/ ministries.

The plan has been designed by evolving the following:

Review of the DMP Submitted by the Six Ministries/Departments

A detailed review of the existing Disaster Management Plans (DMP) as submitted by the different government ministries/ departments has been carried out. A gap analysis of the available DMP's has been conducted to ascertain the amount of missing or required information in the DMP's submitted.

Identification of Triggering Incidents/ Events

The triggering events have been identified, taking chemical emergencies as an example, based on the documents made available. This list is not an exhaustive one and needs to be completed by the respective department.

Classification of the Disasters Based on their Magnitude

Disasters have been classified into three groups based on their intensity or magnitude (Level 1, Level 2 and Level 3). The classification has been made with the philosophy that for Level 1 emergency, the District Emergency Response Group would be able to take control of the situation. For a Level 2 scenario the State Emergency Response Group would be activated and for a Level 3 disaster, the National Emergency Response Group comes into the picture. It has been assumed that we are dealing with offsite emergencies, which call for action from the district emergency authorities or higher level authorities.

Identification of Signal/Warning Mechanism

A proper warning mechanism lays the foundation for any good crisis management plan. The signal mechanism has been designed to minimise the response time when a disaster strikes and to ensure smooth and reliable flow of information while the disaster management procedures are underway. An emergency activation pathway has also been provided to delineate the alert mechanism.

Establish Organisational Structure for Disaster Management

A general Command & Control Structure (CCS) has been established for effective response in the event of a disaster. The CCS has been identified for all the three levels of disasters.

Phase-wise Identification of Emergency Response Activities

The overall response to a disaster has been split into three phases i.e. pre-emergency/ Phase I, emergency/Phase II and post-emergency/Phase III.

Identification of Authorities/Team Members and their Response Time

The general authorities and emergency group team members have been identified who will be responsible for carrying out the specified activities, taking chemical emergencies as an example. This exercise has been carried out for all three levels of disaster management. The response time allotted to each of the authorities have also been mentioned. The specific authorities can be identified only after consultation with the respective ministries/departments.

Fixing Roles and Responsibilities

After identification of the relevant authorities, emergency group team members and the disaster management activities, the general roles and responsibilities of the authorities have been depicted, taking chemical emergencies as an example. Again, the exact roles and responsibilities of the specific authorities can be identified only after consultation with the respective ministries/ departments.

Developing Incident Specific Emergency Procedures

After identification of the specific disasters/ events, response procedures to combat impending/occurring disasters have been developed. These responses are specific actions to be taken in case a particular type of disaster occurs or is about to occur. This section has to be completed in consultation with the six ministries/departments.

Establishing Communication Network

The basic communication network for the disaster management groups has been identified. This has been fixed keeping in mind the necessity for quick and reliable communication network. This has been done for all the three levels of disasters.

Classification of Disaster

ICMP calls for classification of disaster, for prompt activation of the Alert and Notification system, to determine which level of notification/response has to be applied. The three levels for classification of disaster are:

Level 1: Potential Emergency Situation

Level 2: Limited Emergency Condition

Level 3: Full Emergency Condition

Emergency Management by:

- The Signal /Warning mechanism
- Emergency Activation Pathway to trigger response activities
- ER Command Structure: Incident Controller and Emergency Response Group
- Emergency Control Centres

It lays down details of Action on Site and Centre of Emergency Action. The appropriate actions include important aspects such as Evacuation; Access to records; Communication; Public relations; Rehabilitation, etc. The Centre for Emergency Action should be located in the immediate vicinity of the scene of the accident and act as the common point of co-ordination for the first response team's personnel as also for communication to the Incident Controllers and others. Once declared by the respective Incident Controller, the emergency conditions will continue in the area until the same is withdrawn by the declaring authority.

ICM Plan Preparation, Training, Testing and updation

At the district level, once the ICMP requirement is established and the risk assessment made, a planning team would be convoked, which shall be multi-disciplinary in nature, involve persons concerned with emergency management, experts in the field of safety and persons who hold responsibility for emergency management in the area. It is extremely important for response personnel to be trained at regular intervals on technical aspects and emergency management. Those

involved in planning and preparing for emergencies must undertake periodic exercises to test the plan. Based on the analysis of the trials, the plan is updated.

Sub- Group IV - Accident Related Disasters

The Response Plan for Accident Related Disasters covers air accidents, boat capsizing, building collapse, electric fires, festival related disasters, forest fires, mine flooding, oil spills, rail accidents, road accidents, serial bomb blasts, urban fires and village fires. The need for vulnerability analysis of each individual type of accident is emphasized. Response action is the phase on which chances of survival of the victims depend. Actions to be immediately taken include:

i) Informing the nearest traffic police station/post through passing vehicles on either side

ii) Look for and rescue the injured or those still trapped inside

iii) Arrange for transporting the injured to the nearest medical centre by first available means

iv) Place dead bodies on one side to avoid obstructions

v) Traffic control should be organized locally using available manpower to avoid traffic jams

vi) Discourage people from crowding near the accident spot

vii) Prevent people from looting goods from the accident site.

The basic responsibility for undertaking rescue, relief, evacuation, rehabilitation measures, rebuilding of structures in case of accident is that of District Administration under District Collector.

Immediate Actions to be taken at organizational level are:

i) The State Police authorities are required to assist in rescuing persons in the accident or those affected as a result of the accident.

ii) The entire site of the accident area, including wreckage trail shall be immediately cordoned off and guarded by police including protection and safe custody of accident involved debris, personal belongings, documents, etc. and dangerous goods which may be present.

iii) Officials designated to handle Press shall keep in mind that only factual information is made available to the press. They should not pass on any information that could lead to panic, speculation or even distortion.

iv) They should avoid spending too much time in handling different sections of the press, electronic media, and answering individual queries from each one of them throughout the day. For this purpose fixed time slots should be decided upon for press briefings, which could be 2-4 times a day at nominated place and time and for a specified duration.

v) Establish information centers at pre-designated locations for giving details of the accident and answering public queries etc. Telephone numbers of all such information centers should be given wide publicity in electronic media. These information centers should have details regarding total number of persons involved, their names, nature of injury, present location and current status, number of persons likely to be still trapped inside, total number of crew members, dangerous cargo, etc.

vi) The medical examination, post mortem examination shall be arranged by the police authorities.

Under long-term action, causes of all accidents should be investigated and report made public in a time bound manner. All recommendations made in such reports and accepted by the Government both Central and State must also be implemented within a fixed time frame. Accident inquiry reports should not be permitted to be closed unless and until recommendations made are accepted and fully implemented.

Responsibilities of the Central Government, State Government, Local Government, NGOs and other national and international agencies need to be clearly laid out. There should be contingency plans prepared to manage such disasters, and personnel must be designated to manage the situation and to keep the plans updated. There should be manuals clearly laying down duties and responsibilities of role-players. The process of setting up and manning of control rooms must be clearly laid out.

Sub-Group V - Biological Disasters

Disasters related to this sub-group are biological disasters and epidemics, pest attacks, cattle epidemics and food poisoning. Our response mechanism to diseases which are forgotten or considered as conquered as well as the vulnerability of the population even to infections which respond favourably to most of the widely available anti-microbial agents such as plague needs to be strengthened. We have virtually no infrastructure, tools or expertise to contain them. Handling exotic pathogens warrants suitable infrastructure, notably, high containment laboratories of bio-safety level 3 and 4; recruitment of highly committed, dedicated and trained professionals; continuous availability of diagnostic reagents; enhancement of skills at various echelons of health professionals in early identification of such infections, investigation of outbreaks and institution of specific control measures. The impact of Transboundary Animal Diseases (TAD) causes constant loss to livestock production directly but also inhibits investment in the stock of higher productive potential and production system. India is currently following the eradication program for rinderpest.

The disease burden due to communicable diseases in India is perhaps the highest in the World. Scarcity and poor water management across the country gives rise to various water borne infections and also provides suitable environment for vectors of a large number of diseases. At present the public health infrastructure in India is inadequate to sense early warning signals of outbreak of an epidemic and to respond in time.

Considerable infrastructure in the form of institutions and laboratories of excellence have been created in our country since Independence. However, efforts to consolidate their strengths and harness their expertise towards the national cause of containment of known communicable diseases have been minimal. No mechanism exists by which their services can be utilised in the wake of a threat by a communicable disease. Current system of surveillance and mechanism to control the outbreak of endemic diseases are through the National Programme for Surveillance of Communicable Diseases.

Action Plan for Disaster Management could be dealt effectively only if there is a disaster plan well integrated in the system and there is mechanism of post disaster evaluation. Disaster Stage actions needed is for Public Health Control Measures. Post disaster stage evaluation is most important step in disaster management in order to rectify deficiencies in management and to record the entire operation for future guidance.

Post disaster stage evaluation is most important step in disaster management in order to rectify deficiencies in management and to record the entire operation for future guidance.

Planning

Short term planning would involve early detection of a crisis situation caused by

micro-organisms within existing resources and infrastructure. A long term plan would be put into operation as soon as the existing inadequacies are overcome. New infrastructure that need to be created are containment laboratories with adequate bio-safety measures. Existing technical expertise and infrastructure in large number of laboratories across the nation can easily be harnessed towards the national cause. It is proposed that at least 10-12 such laboratories on regional basis can network to provide support to efforts in detecting and containing diseases of international public health importance.

Modalities for undertaking epidemiological investigation are by initial and preliminary investigation by local public health officials, specialised investigations by rapid response teams and identification of early warning signals.

Recommendations

A national policy and action plan is required to be formulated to meet these ever-growing challenges. The following broad issues are being suggested:

1. Establishment of a national high level intersectoral committee.
2. Quick response medical teams.
3. Surveillance and rapid response activities.
4. Strengthened surveillance.
5. Efficient functioning of surveillance machinery.
6. Developing more effective international surveillance networks.
7. Ensuring the ready availability of professional expertise and support personnel needed to better understand, monitor, and control emerging infections.
8. Identification of endemic areas for different diseases with seasonal variations through charts and maps by the State Health Authorities.
9. Laboratory support to diseases of international public health importance.
10. Developing infrastructure for BSL3 and BSL4 laboratory support within the country.
11. Creating a network of national laboratories that can provide support for early diagnosis of these infections and harness the expertise available.
12. Improving laboratory capabilities to identify and characterise pathogens.
13. Ensuring timely development, appropriate use, and availability of diagnostic tests and reagents.
14. Developing and evaluating new diagnostic tools.
15. Networking of laboratories within the country, with other countries on bilateral basis.
16. Recruitment of professionals for maximum containment laboratories.
17. Upgradation of skills of professionals by providing state of the art training and establishing a public health laboratory training programme.
18. Ecological studies to understand dynamics of disease transmission.
19. Dissemination of information to general public and professionals.
20. Stockpile antimicrobial agents and biologicals.
21. Promoting and encouraging R&D.
22. Availability of safe drinking water.
23. Enforcement of preventive measures to ensure unadulterated and hygienic food.
24. Funds for prompt medical assistance from the Central Government.
25. Establishment of a Control Room in National Institute of Communicable Diseases.