DISASTER RESPONSE IN INDIA : AN OVERVIEW

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Be it an `act of God' or `act of Man', a mindboggling spectrum of disasters wreak havoc in the Indian subcontinent.

Disasters are either natural, such as floods, droughts, cyclones and earthquakes, or human-made such as riots, conflicts, refugee situations, and others like fire, epidemics, industrial accidents, and environmental fallouts. Often, the difference between them is marginal.

Globally, natural disasters account for nearly 80 percent of all disaster-affected people. The insurance industry estimates that natural disasters represent 85 per cent of insured catastrophe losses globally. In 1996, 40 million disaster-affected people depended on humanitarian assistance, a 60 per cent increase over the average figure of 25 million in the 1980s. In the first half of this decade, over US$ 30 million was spent on humanitarian assistance. The average cost of natural disasters over the past 25 years stands at over US$ 87 billion a year. The average amount spent on humanitarian response in US$ 3 billion a year. Compared to expenditure global military spending is around US$ 780 billion.

The disturbing fact is that even in a region like South Asia, where poverty, deprivation, and death due to disasters are a common enough feature of life, India remains the worst-affected country. In fact, the frequency of all categories of disasters, varying from epidemics to road accidents and perennial droughts and floods, is escalating, resulting in a multifold growth of injuries, disabilities, diseases, and deaths, disrupting life-supporting systems, and adding to the health, social and economic burden of an already impoverished people.

In India, between 1988 and 1997, disasters killed 5,116 people and affected 24.79 million every year in India. In 1988, 9,846 people died and 34.11 million people were affected by disasters. Experience and study tell us that the actual figures greatly exceed the documented ones.

Classification of Disasters

Definitions and categorization of disasters vary according to geosectors, the geographical and social settings in which they are located. Every new disaster adds a dimension to human suffering. The realities that confront disaster-affected communities in developing countries often challenge conventional Western academic definitions.

In the absence of `official' definitions, observations from the field suggest that disasters be classified under three broad categories : natural, human-made, and other disasters. Amongst these, there are the major disasters and the minor

disasters. It is not just the damage-destruction potential that defines a disaster as major or minor : categorization under the former may just be result of being comparatively will discussed and reported by the media. For a large number of people in several states of India, the distinction is academic: for them, most disasters are major and occur constantly.

Policy Disasters

Yet another category, including situations such as a lack of rational policies to restrict the sale of hazardous and harmful drugs, free sale of tobacco and liquor, banned pesticides, and excessive displacement of people by development projects, consists of disasters caused due to negligence on the part of the policy-makers.

This classification is purely for logistic and explanatory purposes. For example, in 1996 the flood-accumulated water in the Western desert state of Rajasthan became an ideal breeding ground for mosquitoes. This ignited vector proliferation, leading to a malaria epidemic out-break. Amplified by a systemic failure, the epidemic took a heavy toll, far more than that of the flood disaster itself. The actual reason lay elsewhere than in just the quantum of rainfall, which had been undoubtedly relatively higher: it was the way in which civic structures that had come up (violating basic laws) in the past two decades amplified the flood.

Similarly, in some drought affected pockets in Orissa, acute flood shortage and malnutrition was to blame, despite a relatively good harvest. The reasons were linked to the people's interaction with the market, and exploitative trade and business practices.

Similarly, the policy changes that weakened the public health system has been blamed for the re-emergence of many epidemics such as tuberculosis, which kills one Indian every minute.

Often, certain policies expose some groups of people to greater vulnerabilities and amplify the impact of disasters: an irrational drug policy that permits dumping of hazardous and dangerous products, for instance, causes irreversible terratogenic impacts and magnified health problems. A lack of policies to contain the unrestricted sale of tobacco and liquor has led to a global calamitous situation. Each year, tobacco causes 3.5 million deaths worldwide, or about 10,000 deaths per day. One million of these deaths occur in developing countries. By 2020, it is predicted that tobacco will become the leading cause of death and disability, killing more than 10 million people annually, thus causing more deaths worldwide than HIV, tuberculosis, maternal mortality, motor vehicle accidents, suicide, and homicide combined.

India has one of the highest rates of oral cancer in the world. Tobacco-related cancers account for about 50 per cent of all cancers among men and 25 per cent among women. Oral cancer accounts for one-third of the total cancer cases, with 90 per cent of the patients being tobacco-chewers. Clinical observations in some regions reveal that over 60 per cent of heart disease patients under 40 years of age are tobacco users and over 50 per cent of cancer patients aged 41-60 years are smokes.

Disasters and Human Misery

Natural resources and inanimate energy are increasingly regarded as affected with a public interest.

Stuart Chase

The most important understanding that has informed this debate is that disasters occur when hazards and threats of hazards, natural and human, impact on the vulnerabilities of an area/region and its people.

Within these parameters, vulnerable groups face greater suffering. Vulnerabilities are essentially `a set of prevailing or consequential conditions composed of physical, socio-economic and/or political factors which increase a community's susceptibility to calamity or which adversely affect its ability to respond to events'. Certain groups of people are more vulnerable to a number of natural and human-made disasters compared to others. What extends the length and intensity of their sufferings is if these vulnerable people happen to live in regions that are disaster-prone.

The vulnerability of a region is a complex phenomenon: simply put, it is defined as the influence on it by a heterogeneity of social , political, and economic factors. This is what makes it imperative that we focus on these factors that render populations susceptible and locate disasters in specific and broader, socio-political contexts.

While natural events of devastating magnitude continue to impact differently in different parts of the world, even a cursory examination of history shows that vulnerability to disasters has always been exacerbated in the developing countries. The developing world's poor and certain ethnic groups suffer human and property loss unimaginable to the rest of the world, and their capacity to recover swiftly is limited by the very factors that caused the impact in the first place.

The 1993 Marathwada earthquake in India left over 10,000 dead and destroyed houses and other properties of 2,00,000 households. However, the technically much more powerful Los Angeles earthquake of 1971 (taken as a benchmark in America in any debate on the much-apprehended seismic vulnerability of California) left over 55 dead.

The 1991 Bangladesh cyclone destroyed and damaged more than a million homes and totted up a damage bill of US$ 1.8 billion. Hurricane Mitch in 1998 in the Honduras killed 5,642 people and destroyed about 1,00,000 houses. The 1996 cyclone along the east coast state of Andhra Pradesh in India killed 1,077 people and damaged public buildings worth over US$ 139 million. In contrast, Hurricane Andrew that struck Southern Florida in 1992 killed 41 people and caused damage worth $20 million in Florida itself.

In the space of one month in 1997, more than 1,000 fires in parts of Southeast Asia raged through 3,00,000 to 10,00,000 hectares and caused damage estimated at US$ 4.5 billion. The pall of smoke caused enormous health and safety problems in Indonesia and its neighbours, particularly Singapore and Malaysia, besides forcing the closure of airports and causing maritime accidents.

In such critical and unanticipated situations, a lack of infrastructure and capacity and high vulnerabilities not only amplify the toll, in terms of both life and material, they also hamper and decelerate recovery.

When Central Europe was flooded extensively in 1997, the unprecedented downpour that lasted for two weeks from July 5 onwards hit the Czech Republic and Poland badly. More that 100 people were killed, and tens of thousands made destitute. In total, 1,60,000 people had been evacuated from their homes in Poland, and another 50,000 in the Czech Republic.

In contrast, Germany was able to mobilize resources more rapidly to deal with the floods, compared to the cash-strapped Czech and Polish governments which seemed, at times, to be struggling and failing to prevent flooding, organize relief efforts, and marshal funds. In Poland, the government's defeat in the following parliamentary elections was linked to the public perception that it had handled the disaster disastrously.

The Socio-Political Context

Such indulgences are denied to the citizens of disaster-affected developing nations vis-à-vis their governments. Developing world governments rarely indemnify their inadequate or bungled disaster responses. This act of omission has behind it, in no mean part, bad informational and logistical machinery, and a lack of analysis of the causes of the shortcomings.

In a society where gender, caste, religious, regional, and class differentials are extremely pronounced, and differences, entitlements, and obligations along the same differentials are clearly defined and observed, human-made disasters tend to occur frequently and often with great intensity.

The socio-political, economic, and ecological context defines the vulnerability of different groups of people to negative impacts from natural and human-made events. The social position and importance of different ethnic, caste, and gender groups in society determines entitlements and actual access to resources, support, and services. The political participation, access to information, governance, and accountability principles and practices; the economic entitlement and distribution of resources and the ecological impact of nature imply a complex interaction of factors within society that determine how human beings anticipate, face, and emerge out of natural and human-made disasters.

Within these topographical specifics, the worst affected are the poor and marginalized sections and communities. Vulnerability to disasters is visibly a function of poverty – of social and economic disempowerment, which is in turn exacerbated by disasters. In the process of aggravating already existing vulnerabilities, disasters create new ones.

The political dimensions to many disasters and emergencies and multifarious. Some of them are extremely complex and unnecessarily tragic. In India, they include the communal riots in the wake of the Babri Masjid demolition, unabated violence against Dalits, alleged state excesses in Punjab, the sub-ethnic North-East tangle, and others.

Second, it is possible to identify why and how certain groups are susceptible to disasters in particular regions. The fact that we knew that the maximum number of human casualties resulting from disasters between 1960 to 1980, for instance, were in developing countries like Bangladesh, Nicaragua Ethiopia, Peru and India could well have dictated the world's disaster response.

Factors Accentuating Vulnerabilities Gender Issues

There will never be a generation of great men until there has been a generation of free women – of free mothers.

Henrik Ibsen

South Asia is `fast emerging as the poorest, the most illiterate, the most malnourished, the least gender-sensitive – indeed the most deprived region in the world'. This is a damning statement. Gender roles refer to the set of traditional practices of women and men which vary according to culture, ethnic identity, race, class and age. Gender roles and relations the world over are constantly changing, at variable rates and in diverse ways in different cultures and social groups, influenced variously by global and local economic and cultural trends.

Women are particularly vulnerable because they have fewer resources in their own right and under their own control. They assume additional and often entire responsibilities like caring for children, the elderly, and the sick. They have no permanent place in decision-making systems and they suffer traditional, routine, and gratuitous gender-biased oppression.

By virtue of their lower economic, social and political status, women tend to be more vulnerable to disasters. Reports from many disaster-affected parts of India reveal that even when women have had access to cyclone (or community) shelters, they have had to work harder than usual, and in defiance of their own safety imperatives, to gather fuel wood for cooking. Their special health needs, in fact especially those of pregnant and lactating women, are ignored.

The various general economic activities undertaken by the government and NGOs have not had any significant impact on women. Even the nuances of development tend to bypass or sideline them altogether. The allotment of sites for the construction of houses, for instance, is invariably in the names of husbands and sons. Even after 20 years of the 1977 AP cyclone, many older women find themselves without shelter. Women heading their households often miss out on the employment opportunities provided and created during the relief and rehabilitation phase, adding the burden of finding work for themselves to their existing disaster-exacerbated responsibilities.

During floods, and inordinately large number of deaths due to drowning tend to occur amongst women and children. Younger women face destitution ; there are more than occasional stories of their being forced into prostitution in towns and cities. Older women turn to begging and to charity, often a one-way descent into patronized dependency. Traditional anatomy conspires against women in disaster situations in many ways: during cyclones, for instance, women are often put at risk when their long hair get entangled in bushes and flotsam, and their sarees restrict their movements.

Agencies tend to be mirror images of the world outside. An evaluation of the 1996 cyclone response in AP homed in on the gender-insensitivity of one of the relief agencies, manned by an all-male relief group. Despite the agency having handed out all food provisions to the disaster-affected, including dry ration and fuel, cooking was an impossibility : women complained that they had been given no cooking utensils. The agency had overlooked that crucial aspect. Food distribution systems are, undoubtedly, most effectively managed by women, a fact that must be recognised at the relief logistics planning stages.

Women relief workers sense the not-so-obvious modes of trauma among the affected women. In a recent study on the long-term psycho-social consequences of 1996 AP cyclone, the authors note that the gender equations of the relief team influenced the affected women's interest. As divorce rates increased after the cyclone, many women began consuming alcohol. Suicide rates, especially among women, increased. Had there been more women relief workers, this disturbing trend could have been exposed, if not reversed, in time for adequate intervention. Only such an active involvement of women can ensure gender-sensitive interventions.

Therefore, in a post-disaster scenario, it is vital to ensure that :

* Particular attention is paid to women's views in the assessment stage.

* Women's actual responsibility in domestic (in terms of household subsistence, health, and child care) and production and economic activity beyond the subsistence level are taken into account in determining the consultation process.

* Women representatives are included at all levels of planning, decision-making, implementation, and evaluation.

* The particular constraints faced by households maintained by women are taken explicitly into account in designing and implementing relief programmes.

* Special attention is provided to unaccompanied women, lone parents, and widows. Issues of legal, sexual, and physical protection are properly identified and addressed.

Gender awareness helps to identify not only the different needs of women and men during disasters, but also their capacity and responses to change. Women themselves underestimate the enormous range of burdens they bear ; they may harbour negative images about themselves and be unused to perceiving of themselves as strong and effective survivors, managing a wide spectrum of household and social responsibilities. For intervention planners, it is extremely important to put a deliberate effort into ensuring women's participation so that they benefit equally with men.

Process of Marginalisation

In India, the vulnerabilities are inextricably linked to certain processes of marginalisation that protect the interests of particular groups and areas at the cost of others. The nature and direction of economic development followed over the past 50 years has been unsuccessful in expanding, or even distributing, social opportunity across the country. While discernible progress may have been achieved in science and technology, agriculture, transportation, and communication, poverty, illiteracy, and deprivation continue to besiege a large number of Indians. The basic needs of a large proportion of India's population are not satisfied. At least one-third of India's 961 million people in 1997 lived in poverty. One-third of adult males and two-thirds of adult females (aged 15 years and above) were illiterate. Two-thirds of India's children aged 0-4 years were malnourished.

Several states and regions in the country, such as Bihar, Orissa, Uttar Pradesh, Rajasthan, and several other pockets have higher levels of poverty than the national average. Poverty is also widespread in areas more prone to natural disasters -- flood-prone areas such as north Bihar, east Uttar Pradesh, and north Bengal, and in drought-prone areas such as Rajasthan, Marathwada, and north Karnataka.

Almost 40 percent of India's population is left with little choice but to depend on an already depleted ecological base. En masse movements of people in search of livelihood have
proved to be both ecologically unsustainable as well as ethnically destabilising. It is today well established that this, aggravated by desperate (forced) migration, is one of the root causes of riots and civil conflicts in various parts of India. The country has also seen ethnic polarisation in several areas. Conflicts along caste, religious, and ethnic lines have assumed an endemic nature.

In north-east India, however, which has been a disturbed area since Independence, the core of the conflict was, and remains, economic. Caught in the web of natural resource exploitation conditioned by the market forces, the resource base of the general population has withered, while a small minority that has utilised its capacity to effectively deal with the market has prospered.

In the wake of the consequent discontent, there has been a growing realisation that some `natural disasters' may indeed be precipitated by human activities : recurring floods and droughts, for instance, precipitated by the unrestricted felling of forests, serious damage to mountain ecology, overuse of groundwater, changing patterns of cultivation, etc. The spate of
landslides in the Himalayas in recent years can be directly traced to the unchecked exploitation of forest and mountain vegetation and networks of roads that have been indiscriminately laid in the name of development.

In Punjab, highly chemicalised canal irrigation has led to large-scale salinisation and water-logging as well as groundwater contamination. In

other parts of India, mega-development projects like dams displace millions of people from their homes, and submerge tens of thousands of fertile soil and forest acreage. In a parallel development, many of these large dams, with their massive reservoirs, may have induced or enhanced seismicity in quake-rocked areas such as Koyna in Maharashtra 1967.

Disasters have come to stay in the forms of recurring drought in Orissa, the desertification of swathes of Gujarat and Rajasthan where economic depredations continuously impact on already fragile ecologies, and environmental degradation in the upstream areas of Uttar Pradesh and Bihar. Floods in the plains are taking an increasing toll of life, environment, and property -- amplified by a huge population pressure. there is an underlying, if camouflaged, relationship between human activity and what are ostensibly natural disasters (although earthquakes and cyclones may evade a simple, linear causality).

In almost perfect step with all this, the post-Independence pattern of industrial development has led to the severe concentration and localization of industries in certain areas. With the simultaneous shrinking of opportunities in other regions, especially in rural India, these areas have become magnets for legions of people, which has, in turn, resulted in
the chaotic growth of massive urban conglomerations that are ill-equipped to deal with exponential population accumulations.

At the same time, there have been scant and maladroit attempts at regulating the character of haphazard industrial development in order to make it more ecologically sustainable and less susceptible to accidents and disasters. The legal frameworks that exist, or have been recently forged, are neither strong enough nor supported by adequate institutional and implementary set-ups resulting in disasters like the Bhopal Gas Tragedy and the more recent accident at the Vizag. Steel.

Furthermore, the burgeoning urban centers are becoming so overcrowded and ghettoised as to be increasingly unmanageable. A traditional failure of urban India's local bodies and other institutional set-ups has been their inability to fulfill their mandates, exposing their jurisdictions to major disasters like epidemics, fires, and gas leaks. An increasing influx of migrants, people displaced from lands and livelihoods in rural and tribal areas by development projects and market forces, within the context of increasing unemployment and social tensions, has turned them into ethnic and communal tinderboxes.

An understanding that is reflected in the expansion of the disaster management continuum of the UN General Assembly Resolution 46/182 on Emergencies to include sustainable development is that reducing the susceptibility of populations to disasters is inextricably linked to social and economic development. A study conducted by the UNDP in the 1980s which focused on disaster mitigation efforts in Bangladesh, Ethiopia, and Ecuador concluded that disaster preparedness and prevention is most effective only when it is built into the larger scheme of sustainable development that enhances social opportunity and
economic growth.

Relief and Rehabilitation

But development is, by definition, a long-term process, and it was occasionally argued that the immediate might sometimes be sacrificed in the interests of posterity. In most quarters today, the importance of providing immediate relief to the disaster-affected is a bedrock principle. in that sense, it is undeniable that following several considerable disasters in India, civil society and, to an extent, the State, have responded, occasionally swiftly and comprehensively, with rescue and relief operations.

For example, the September 1993 Marathwada earthquake involved a plethora of actors : local people, civil society groups, national and international NGOs, religious groups, state and Central government agencies, the military, and the civil defence forces. Relief activity pulled into its spin-top politicians and government ministers, including the Prime Minister.

However, the experience in Marathwada and other places in India showed that the involvement of local people and civil society groups in rescue and relief was not a clearly defined process. It exhibited that the government views rescue and relief work as a piecemeal business, as the responsibility of its revenue department and public support is not factored into it. In the absence of a well-defined procees of involving people, spontaneous involvement has often gone undirected and is viewed as obstruction by the authorities. the overall perspective of the administration is to view people as passive recipients of government largesse rather than as valuable partners in dealing with disasters.

But rendering people passive does not diminish their desire to participate. Since their legitimate role in disaster relief has not been acknowledged and sought, they throng disaster sites only to be accused of being spectators disturbing lifesaving operations. Providing legitimate space for them to play a meaningful role would significantly improve post-disaster recovery initiatives. Relief is no substitute for people-oriented actions.

The state has never disputed that the people affected by disasters are entitled to relief ; but entitlement is not a right. Its response is an administrative one, undertaken when there is government sanction. Relief work is still considered a short-term, supportive measure. The most critical needs of recovering pre-disaster living standards remain unattended.

Thus relief activity is rarely programmed to address the issue of vulnerability. The capacity of the people to withstand the impact of repeated drought and flood is weakened despite relief, leading to long-term impoverishment. Often enough, the provision of relief on a dependable, annual basis has been transformed into a business opportunity for a small group of people, establishing it as a pattern in almost all areas prone to regular droughts, floods, heat waves, and riots. When the relief turns into business, the incentive to view relief in a development mode hardly remains in the interest of the dominant stakeholders.

The situation regarding rehabilitation is far more alarming. First, the inability to programme relief as development opportunity means that initiatives to assist the affected people to regain sustainable livelihoods are rarely

undertaken. Second, while the Indian public views the provision of relief as a collective responsibility, it considers rehabilitation and development as the responsibility of the government, of the affected individuals, and of their families.

After the initial shock of the realisation of the considerable suffering, disasters do not retain the attention of the unaffected for very long. This rapid turnover of attention is a hazard in itself in a country moving from one disaster to another in quick succession. Often, the disaster-affected are left to fend for themselves once the initial, reflexive phase of relief, delivered by the State and by `God-fearing citizens', is over. the strategy and process of disaster response is rendered almost invisible once the `news value' and high profile visits drop. The protracted disablement that disaster-affected communities and individuals suffer, the reasons behind the disabilities, and ways to overcoming them only occasionally come into focus.

This is a self-defeating proposition. While the regenerative capacity of the affected is eroded through the successive impacts of floods and droughts, the government has no self-enforceable mandate to provide rehabilitation. It expects the affected to benefit from its regular welfare and development initiatives. Collective experience indicates, however, that the government's routine programmes are difficult to access, and when they are, they fall woefully inadequate. It thus becomes vitally important for measures and attempts at recovery to help the affected people to not only refurbish themselves, but also deal with the new vulnerabilities and circumstances beyond their control that the disaster created.

Effective rehabilitation is the only machinery with which these vulnerabilities, both recurring and created afresh, can be dealt with. Insulation from life-threatening situations is an inarguable right that goes beyond governmental dispensation : it is an integral part of the country's developmental and welfare goals.

Everything points to one truism : Rehabilitation itself is part of Disaster Management, which is a larger strategic approach to disasters that transcends a reactive response. It has so far been virtually non-existent in India and is only now beginning to be accepted as an important area in the domain of public policy. It is small wonder, therefore, that while the Marathwada earthquake was endowed with a rehabilitation policy, those affected by the later Uttarkashi earthquake, or the even more recent Jabalpur earthquake were not so fortunate. The current tentative rehabilitation strategy at best limits itself to reconstruction and relocation of the affected populations, and even that is non-participatory and poorly implemented. Such
measures almost always leave the affected communities as, if not more, vulnerable as they were and lead to both debilitating dependency and unfocused development.

This does not imply that people comprehensively crumble under the impact of disasters. Contrary to portrayals in the media, they try to cope and such adversity often increases cohesiveness within the community.

This ability to not merely attend to their immediate imperatives but also to chart their own ways out of adversity and restore their lives and livelihoods is a

foundation on which a long-term and sturdy survival process can be built. As a plinth, there is almost everywhere in the country a wealth of traditional knowledge and practices regarding warning signs, a cartographic knowledge of safe and unsafe areas, survival methods, and traditional forms of insurance built around kinship and families.

Rehabilitation Policy

To understand is hard. Once one understands, action is easy.

Sun Yat-Sen

The collation of knowledge and the management of its mobilisation are, therefore, essential to the success of any programme for disaster mitigation, relief, or post-disaster rehabilitation. Programme implementation hinges upon the extent to which the key actors within the programme work out their respective mandates with integrity. The structure and process of decision-making, devolution of powers and responsibilities, extent of teamwork, flow of information and communication between and within various levels of the programme implementation apparatus, and personnel needs and strengths are some of the crucial variables in implementation.

Extensive and clear dissemination of complete information about all the components of the rehabilitation programme amongst all the key actors, especially the line department staff, is vital to effective implementation. In purely logistical terms, a disaster area is like a war zone. Since action is based on information, the lack of it can, and does, translate into serious mistakes in the field, spreading confusion and introducing ambiguity where there is none.

The rehabilitation policy must therefore be transparent, concise, and precise. It must necessarily incorporate within it a strategy for constant and wide-band dissemination of information regarding every aspect and component among key actors. The line department functionaries need to be continuously informed of any changes or additions to the policy or guidelines. If necessary, communication experts or consultants must be taken aboard the project management for this very purpose.

It would be socially and technically appropriate to disseminate information through local and popular languages. Of optimal effectiveness, and worth the expense, would be handbooks/manuals/handouts or any other relevant medium, which clearly spells out all the relevant information in necessary detail. Besides, regular updates and publishing of new and amended guidelines in the local press would admirably serve the purpose that reams of educational material might not. A network of information centres could be set up at strategic locations within the affected area where functionaries as well as concerned and affected people could have assured access to all the latest and detailed information regarding the rehabilitation measures.

Even an optimally designed rehabilitation programme has to be translated into practice by people who are vulnerable to not only typically human failings and frailties but also to the pit-falls and tribulations that disasters can place in front

of them. Before embarking on a rehabilitation project, it is vital that a comprehensive but rapid assessment of the human resources available be undertaken. This should:

* Examine the broad profiles of the project personnel in the light of programme and policy.
* Identify special training needs.
* Identify the demands that the rehabilitation programme will make on the project personnel.
* Identify the potential weaknesses and strengths of the available human resources.
* Outline new/additional staffing needs.

There are at least four key areas in which training needs are crucial :

* Community participation
* Damage and loss assessment
* Vulnerability analysis
* Identifying key needs, especially of vulnerable groups like widows, orphans, women, children, the disabled, the aged,. etc., particularly with respect to health, psycho-social and livelihood factors.

A rehabilitation policy poses some extraordinary demands on project personnel. Often, responsibilities gallop while the time-bound nature of the rehabilitation work piles pressure upon pressure on them. Compact multidisciplinary work teams could ease a large part of the physical and psychological stress, or distribute it, even if it were to mean additional personnel temporarily drafted in or deputed from other institutions and departments.

Corporate sector-voluntary sector-government partnership

This is a subject of considerable, but delicate, urgency. In contrast to the people's reactions, the relief and rehabilition process that followed the Marathwada earthquake holds out many lessons in the adject quality of NGO and donor agency participation. In this scenario, the oft-mentioned startegy of merely throwing open th doors to private agencies will only add to the babble and chaos that characterises a post-disaster situation. Even as the extensive participation of non-governmental organisations is sought, it is necessary that the modalities of ensuring the quality of the participation be built into the rehabilition programme.

The role of the corporate sector NGOs ans donor agencies needs to be clearly defined. One way of doing this is, with their consultation, to identify areas of their strengths and the components and sub-components of the rehabilitation policy where they can render the most support. these could include training project staff, information dissemination, programme monitoring, housing, and social and economic rehabilition measures.

The roles, responsibilities, and powers of the agencies must be delineated to the clearest and maximum extent possible. Furthermore, while unequivocal criteria and guidelines need to be developed to avoid unnecessary distortions that

may arise due to differences in substance and approach among the NGOs, they, in turn, must be given adequate room to explore and innovate.

The agencies must submit a time-bound plan of action, outline their approach unambiguously, clearly defining their specific roles, articulating a programme management strategy, and must establish that they have the necessary resources to see things through.

The mandates of NGOs and donor agencies need to be crystal clear to the three key stake-holders : the community, the government, and the NGO/donor agency itself. Following the Marathwada earthquake, the absence of such clarity resulted in NGOs abandoning the programme at various stages, in an imperception that their role was over. NGOs and donor agencies also prescribed, and fulfilled, very limited mandates for themselves.

The work of NGOs and donor agencies in disaster situations revolves around a plethora of factors, ranging from funding to their relationship with the government agencies, their capacities (which are often fluid), personnel, and community response and support, and they themselves contribute to their precariousness of presence within the programme. The net result is that the targeted people and community are often left knee-deep in quicksand and the government cries foul.

The suggestion that the government, the corporate NGO/donor agency and the community endorse a tripartite agreement, binding on all three parties, that clarifies the mandate of the NGO and outlines specific roles and responsibilities, has considerable merit. This may also be a useful strategy in community participation but will need promotion within the community for a truly consensual mandate.

This also demands the mutual formulation of some criteria on the basis of which the most appropriate NGO partners can be approached and selected. This mechanism will not only help the government prioritise its own work in the area, it will render the NGO more accountable, and ensure that the people are not short changed.

The lack of trust and transparency between NGOs, the government and the private sector can be only minimised by working together. Secondments of key staff on rotation and concentrating on disasters and grants may help afford a better understanding of other constituencies, strengthen ties, and provide a clearer picture of field-level realities and capacities. Such transparency will restrain unwarranted allegations, promises, and claims.

Creating participatory spaces

Although community participation is now widely acknowledged as critical to disaster response and preparedness, very little effort is made to clearly delineate what community participation means, or to define and articulate the approach to community participation. There are multiple notions of community participation that very from the community accepting a programme imposed upon it from the outside and implementing it, to the community assessing its own

needs, planning the action, mobilising resources, and dealing with the crisis on its own initiative.

A question central to the issue is whether consulation means participation. Repeated and token use of the terminology has devalued it. Participation has come to mean so many things. Participatory approaches range from token consultation with affected people, through hasty data gathering techniques such as rapid rural appraisal, to more participatory appraisal methods, and finally to much more inclusive participatory processes which involve locally-affected groups not just in planning, but also in negotiation, implementation, management, monitoring, and evaluation. Full participation implies that the local communities actually have control of the processes and resources and can veto options that do not suit their interests, and thus implies negotiated settlements in which they are able to secure outcomes that are acceptable to them. Obstacles to effective participation exist not only in the procedures and prejudices of government and voluntary sector agents, but also in the legal situation of the peoples concerned. Indigenous affected peoples, particularly women, Dalits and tribals are especially at risk from ineffective participation procedures due to the lack of recognition of their rights and to the prejudice and cultural gulf between them and the decision-makers.

A study of people's perception of their participation during the Maharashtra Earthquake Emergency Rehabiliation Plan observes that `at the village level people viewed participation as a range of activities which included information dissemination, consultation and negotiation (with the engineer), influencing the directives of the programme to better suit their needs (relocation of communities near wadas) and, finally, active participation in the decisionmaking related to the building and repair of their homes with the financial assistance of the Government Project -- supplemented in some instances with their own funds.'

Evidently, in the absence of a clearly defined community participation strategy, participation came to mean consultation. A range of options was placed before the people, essentially having to do with various aspects of construction and/or repair, from which they were asked to choose. People increasingly felt that while their role was to contribute to making decisions on house design, layout, and other related issues, the primary responsibility for reconstruction/repair lay with the state or the NGOs/donor agencies.

Disaster preparedness and response : Holistic work

Disaster response and preparedness is most effective when it is built into development programmes. In the long run, disaster mitigation could be implemented at minimal cost by incorporating them into development programmes. The expenditure on disaster mitigation would, over time, reduce the potential losses disasters cause.

But this is a far cry in, particularly, the poorer nations within the developing world - despite the fact that considerable advances in information and communication technologies enable rapid processing of complex data and its efficient transmission across vast distances.

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NATURAL DISASTER MANAGEMENT IN INDIA

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Introduction

The unique geoclimatic conditions of the Indian sub-continent make this region among the most vulnerable to natural disasters in the world. Disasters occur with amazing frequency and while the community at large has adapted itself to these regular occurrences, the economic and social costs continue to mount year after year.

The Indian subcontinent is highly vulnerable to drought, floods, cyclones and earthquakes, though landslides, avalanches and bush fires frequently occur in the Himalayan region of northern India. Of the 31 States/Union territories in the country, 22 are disaster-prone.

Floods and Earthquakes

Among all the disasters that occur in the country, river floods are the most frequent and often the most devastating. The cause for floods is chiefly the peculiarities of rainfall in the country. Out of the total annual rainfall in the country, 75 per cent is concentrated over a short monsoon season of three to four months. As a result, there is a very heavy discharge from the rivers during this period causing widespread floods. As much as 40 million hectares of land in the country has been identified as flood-prone. An average of 18.6 million hectares of land is flooded annually. Floods are caused mainly in the Ganga-Brahmaputra-Meghna basin which carry 60 per cent of the nation's total river flow.

Earthquakes are considered to be one of the most dangerous and destructive natural hazards. The impact of this phenomena is sudden with little or no warning, making it just impossible to predict or make preparations against damages and collapses or buildings and other man-made structures. About 50-60 per cent of total area of the country is vulnerable areas are generally located in Himalayan and sub-Himalayan regions, and in Andaman and Nicobar Islands.

Droughts and Cyclones

Drought is a perennial feature in some states of India. Sixteen per cent of the country's total area is drought-prone and approximately 50 million people are annually affected by droughts. In fact, drought is a significant environmental problem too as it is caused by a less than average rainfall over a long period of time. In India, about 68 per cent of total sown area of the country is drought-prone. Most of the drought-prone areas identified by Government of India lie in the arid, semi-arid and sub-humid areas of the country.

India has a very long coastline of 5700 Kms which is exposed to tropical cyclones arising in the Bay of Bengal and Arabian Sea. The Indian Ocean is one of the six major cyclone-prone regions of the world. In India, cyclones occur usually between April and May, and also between October and December. The eastern coastline is more prone to cyclones as about 80 per cent of total cyclones generated in the region hit there.

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Natural Disaster Management at International Level
The United Nations Initiative

Natural Disasters are global phenomenon and strike regardless of any national boundaries or socio-economic status of the region. This has led to a strong international fraternity defined at the highest level by several UN Bodies. Interestingly, the United Nations declared the decade from 1990 till 2000 as the International Decade for Natural Disaster Reduction (IDNDR). The objective of the IDNDR is to reduce through concerted international action, especially in the developing countries, the loss of life, property damage and social and economic disruption caused by natural disasters.

As per the plan of the IDNDR, by the year 2000 all countries should have(1) comprehensive national assessments of risks from natural hazards, with these assessments taken into account on development plans; (2) mitigation plans at national and/or local levels, involving long-term prevention and preparedness and community awareness; and (3) ready access to global, regional, national and local warning systems and broad dissemination of warnings.

The last major conference of the IDNDR program was held in Yokohama in May 1994, where a plan of action for disaster reduction, called the `Yokohama Strategy' was evolved. The Yokohama strategy gave guidelines for natural disaster prevention, preparedness and mitigation. India was an action participant in the said conference and in the formulation of the guidelines. By doing so, it has recognized the need for further improvements in its disaster management mechanism and to develop a strong political will by way of a sound national policy in this regard.

Natural Disaster Management in India

India is a parliamentary democracy with a federal structure. An integrated disaster management mechanism exists within government framework. The essential responsibility of disaster management lies with the State Government where the disaster has occurred. However, in the event of disasters which spread over several states and assume uncontrollable proportions, the Central Government may be required to supplement appropriate measures in the fields of rescue, relief and preparedness. At the Central level, the National Crisis Management Committee(NCMC) oversees all disaster related efforts. The NCMC comprises the nodal ministry and other support ministries. For natural disasters, the nodal ministry is ministry of agriculture.

In the past, the government response to natural disasters has improved in terms of its effectiveness. This is chiefly due to the emergence of well-organized administrative machinery, presence of Relief Manuals at district level, predetermined allocation of duties and recognized public-private partnerships. However, absence of an integrated policy at national level has led to overlooking of some of the vital aspects of disaster management. As such, presence of a policy helps clearly define the government's basic approaches on a continuing basis. It provides for an appropriate legislation and associated regulations in this regard, besides providing an overall national competence and self-reliance vis-a-vis international initiatives.

Administrative Structure at Central Level

In the federal set-up of India, the responsibility to formulate the Government's response to a natural calamity is essentially that of the concerned State Government. However, the Central Government, with its resources, physical and financial, does provide the needed help and assistance to buttress relief efforts in the wake of major natural disasters, The dimensions of the response at the level of Central Government are determined in accordance with the existing policy of financing the relief expenditure and keeping in view the factors, like: (1) the gravity of a natural calamity; (2) the scale of the relief operation necessary, (3) the requirements of Central assistance for augmenting the financial resources at the disposal of the State Government.

Agriculture Ministry---The Nodal Agency

The Department of Agriculture and Co-operation (DAC), in the Agriculture Ministry, is the nodal department for all matters concerning natural disasters relief at the Centre. The National Contingency Action Plan (CAP) facilitates launching of relief and rescue operations without delay. The CAP identifies initiative required to be taken by various Central Ministries, and Public departments in the wake of natural calamities, sets down procedures and determines the focal points in the administrative machinery.

In the DAC, the Relief Commissioner functions as the nodal officer to coordinate relief operations for all natural disasters. The Central Relief Commissioner receives information relating to forecast of the natural calamity from the Director General, Indian Meteorological Department from the Central Water Commission on a continuing basis. Agriculture Department monitors the developments taking place and provides the necessary inputs through the Agriculture Secretary to the Agriculture Minister, Prime Minister and the Cabinet.

The entire network of natural disaster management at Central level and the interaction pattern among various functionaries during the emergency period is shown:

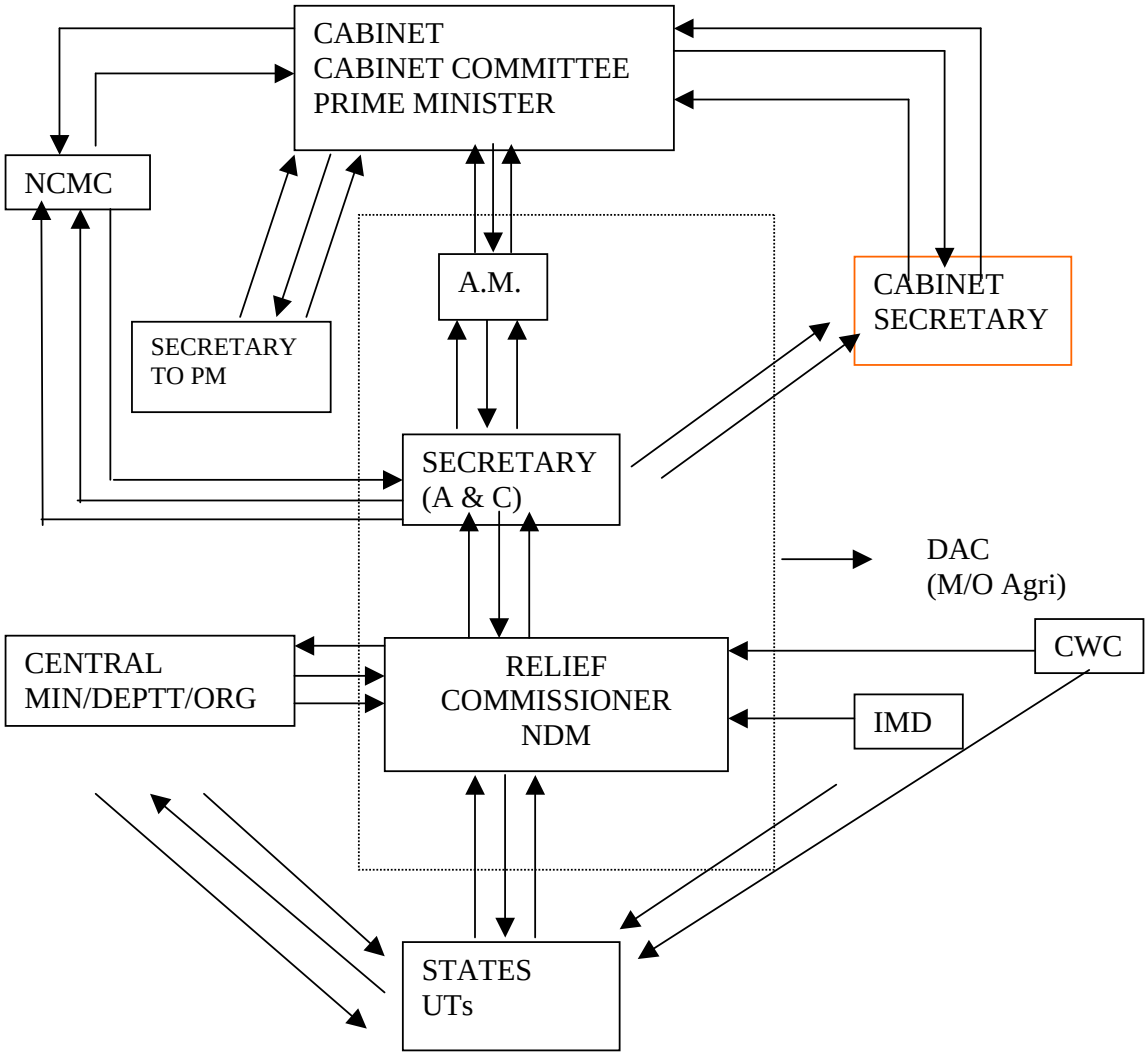

Fig. 1. Natural Disasters Inter-Action Pattern at Central Level.

IMD	: Indian Meteorological Department
CWC	: Central Water Commission
NCMC	: National Crisis Management Committee
A.M.	: Agriculture Minister
P.M.	: Prime Minister
A. & C.	: Agriculture and Cooperation
N.D..M.	: Natural Disaster Management
D. A. C.	: Department of Agriculture & Co-operation

Committees at National Level

Working of various other committees at the national level for disaster management is discussed in the following paras.

Cabinet Committee

The cabinet may set up a committee for effective implementation of relief measures in the wake of natural disaster. The secretary in the ministry of agriculture acts as the Secretary of this committee. In the absence of such a committee, all matters related to the relief shall be reported to the cabinet secretary.

National Crisis Management Committee (NCMC)

Under the chairmanship of cabinet secretary, the NCMC has been constituted in the cabinet secretariat. The other members of this committee include the secretary to prime minister, secretaries of ministry of home affairs, defence, research and analysis wing and agriculture and co-operation along with Director, Intelligence Bureau and an officer of cabinet secretariat. The NCMC gives direction to the crises management group as and when deemed necessary.

Crisis Management Group (CMG)

A group under the chairmanship of the Central Relief Commissioner, comprising senior officers drawn from various ministries and other concerned departments, reviews every year contingency plan formulated by central ministries/departments. It reviews various measures required for dealing with a natural disaster, and coordinates activities of the central ministries and the State governments pertaining to disaster preparedness and relief and obtains information from nodal officers on measures relating to the above. The joint secretary (NDM) and Additional Central Relief Commissioner is the convenor of CMG. The CMG meets every six months.

Financial Arrangements

The Centre plays a major role as far as mobilization of financial resources are concerned. The policy and arrangement for financing state governments to provide relief and rehabilitation measures in areas affected by natural calamities are governed by the recommendations of the finance commissions on the subject made from time to time. The scheme in force for the period 1995-2000 is based on the recommendations of the Tenth Finance Commission. Under the present scheme, a Calamity Relief Fund (CRF) has been constituted for each state with contribution from the Central and State Governments to undertake relief and rehabilitation measures. The annual allocations of the CRF to the various states are based on their trend of expenditure on natural calamities during the past ten years. The central share of CRF is released to the state governments in four equal quarterly installments. As recommended by the Tenth Finance Commission, a committee of experts and representatives of the states has drawn up a list of items, expenditure on which alone will be chargeable to the CRF. A state level committee headed by the chief secretary decides the norms of assistance under each of the

approved schemes. The norms so fixed could be modified by the Ministry of Agriculture, if these are significantly out of line.

In addition to the CRF, a National Fund for Calamity Relief (NFCR) has also been constituted to deal with calamities of rare severity. NFCR is available with the Government of India with an allocation of Rs.700 crore for the period 1995-2000. The fund if managed by the National Calamity Relief Committee, which is a sub-committee of the National Development Council, headed by the union agriculture minister. In normal circumstances, the state governments are required to undertake relief and rehabilitation measures utilizing the annual CRF allocations. They can, however, seek additional assistance from the NFCR in the event of calamity of rare severity.

Administrative Structure at State Level

As pointed out earlier, the central government only supplements the efforts of the state governments. The state governments are autonomous in organizing relief operations in the event of natural disaster and also long-term preparedness/rehabilitation measures.

The states have Relief Commissioners, who are in charge of the relief measures in the wake of natural disasters in their respective states. In the absence of the Relief Commissioner, the Chief Secretary or an officer nominated by him is in overall charge of the relief operations in the concerned State.

The Chief Secretary is the head of the State Administration. The state headquarters have, in addition, a number of Secretaries who head the various departments handling specific subjects under the overall supervision and coordination of the Chief Secretary. At the level of the state government, natural disasters are usually the responsibility of the revenue department or the relief department. While important policy decisions are taken at the state headquarters by the cabinet of the state headed by the chief minister, day-to-day decisions involving policy matters are taken or exercised by the secretary in the department.

States Crisis Management Group

There is a State Crisis Management Group (SCMG) under the chairmanship of Chief Secretary/Relief Commissioner. This group comprises senior officers from the departments of revenue/relief, home, civil supplies, power, irrigation, water supply, panchayat (local self-government), agriculture, forests, rural development, health planning, public works and finance.

The SCMG is required to take into consideration the infrastructure and guidance received, from time to time, from Government of India and formulate action plans for dealing with different natural disasters.

It is also the duty of the Relief Commission of the state to establish an emergency operation Centre as soon as a disaster situation develops. Besides having all updated information on forecasting and warning of disaster, the Centre would also be the contact point for the various concerned agencies.

Administrative Structure at District Level

States are further divided into districts, each headed by the District Collector (also known as the District Magistrate or Deputy Commissioner), who is the focal point at the district level for directing, supervising and monitoring relief measures for disaster and for preparation of district level plans.

The Collector exercises coordinating and supervisory powers over functionaries of all the departments at the district level. During actual operations for disaster mitigation or relief, the powers of all Collector are considerably enhanced, generally, by standing instructions or orders on the subject, or by specific Governments order, if so required. Sometimes, the administrative culture of the concerned state permits, although informally, the Collector to exercise higher powers in emergency situations and the decisions are later ratified by the competent authority.

A district is sub-divided into sub-divisions and tehsils or talukas. The head of a sub-division is called the Sub-Division Officer (SDO) while the head of a tehsil is generally known as the tehsildar (talukdar or manlatdar in some states). Contact with the individual villages is through the village officer or patwari who has one or more villages in his charge. When a disaster is apprehended, the entire machinery of the district, including officers of technical and other departments, swings into action and maintains almost continuous contact with each village in the disaster threatened area. In the case of extensive disasters, like drought, contact is maintained over a short cycle of a few days.

The various measures undertaken by the district administration area are discussed in the following paras.

Contingency Plans

At the district level, the disaster relief plans are prepared which provide for specific tasks and agencies for their implementation in respect of areas in relation to different types of disasters.

A contingency plan for the district for the different disasters is drawn up by the Collector / Deputy Commissioner and approved by the state government. The Collector / Deputy Commissioner also coordinates and secures the input from the local defense forces unit in preparation of the contingency plans. These contingency plans lay down specific action points, key personnel and contact points relating to all aspects.

District Relief Committee

The relief measures are reviewed by the district level relief committee consisting official and non-official members, including local legislators and members of the parliament.

District control Room

In the wake of the natural disaster, a control room is set up in the district for day to day monitoring of the rescue and relief operations on a continuing basis.

Coordination

The Collector / Deputy commissioner maintains the close liaison with the central government authorities in the districts, namely army, air force and navy, ministry of water resources , etc, who supplement the effort of the district administration in the rescue and the relief operations.

The collector / Deputy Commissioner also coordinates all voluntary efforts by mobilizing the non-government organizations capable of working in such situations.

The entire hierarchy, right from the central government (the department of agriculture and co-operation in the ministry of agriculture and irrigation) to the district level, and even the sub-divisional / tehsil level, is connected with a telecommunication system. The normal mode of telecommunication is overland telephone and telegraphy, but in the times of stress and if there is breakdown of the overland system, radio communication is restored to. The wireless network is generally run and maintained by the police organisation in the country.

Besides the district officials , a host of other bodies too supplement their efforts in disaster situation - particularly the armed forces and the non-government voluntary organizations.

The role of the armed forces

The armed forces of the country have played a vital role during disaster emergencies, providing prompt relief to the victims even in the most inaccessible and remote areas of the country. The organizational strength of the armed force with their disciplined and systematized approach , and with their skills in technical and human resource management make them indispensable for such emergency situations.

Besides, when disaster are spread over large areas , it is usually beyond the capabilities of the administrations to organize the relief activities , the armed force then called in to organize the relief measures.

Related to the efforts of the armed forces, are the civil defense and home guard organizations are voluntary in nature and character and come in handy during emergency situations like natural disaster. A network of these is now found all over the country. Their aim - while not actually taking part in actual combat operation , like in army - is firstly to save lives , to minimize damage to property , and to maintain continuity of production . thus ,while disaster situation often lead to chaotic condition where rescue and relief work is severely affected , these organizations are able to coordinate and support efforts in a disciplined manner ,so that both the army and the district officials are to carry out their respective activities efficiently .

The Role Of Non-Government Voluntary Organizations

Emerging trends in managing natural disaster , have highlighted the role of non- governmental organizations (NGOs) as one of the most effective alternative means of achieving an efficient communication link between the disaster management agencies and the effected community . many different types of NGOs are already working at situation level as well as grassroots level. In typical disaster situation , they can be of help in preparedness , relief and rescue , rehabilitation and reconstruction , and also in monitoring and feedback.

The role of NGOs is a potential key element in disaster management The NGO is a potential key element in disaster management. The NGOs operating at grassroots level, can provide a suitable alternative as they have an edge over governmental agencies for invoking community involvement. This is chiefly because, the NGO sector has strong linkages with the community base, and can exhibit great flexibility in procedural matters vis-à-vis the government.

Based on the identified types of NGOs and their capabilities, organized action of NGOs can be very useful in following activities in different stages of disaster management.

TABLE 1
ORGANIZED ACTIVITIES OF NGOS AT DIFFERENT STAGES OF DISASTER MANAGEMENT

Stage	Activity
Pre-Disaster	Awareness and information campaigns Training of local volunteers Advocacy and planning
During Disaster	Immediate rescue and first-aid, including psychological aid, supply of food, water, medicines, and other immediate need materials ensuring sanitation and hygiene damage assessment
Post-Disaster	Technical and material aid in reconstruction Assistance in seeking financial aid monitoring.

In the recent past, NGO sector has played a major role in strengthening the community to face the disasters. The trend is based on a long-term experience of the need of maximum self-reliance at the lowest level.

The Role of the Community

It has now been revealed that the community as an institution in itself is emerging as the most powerful in the entire mechanism of disaster administration. In the event of actual disasters, the community, if well aware of the preventive actions it is required to take, can substantially reduce the disaster damage. Awareness and training of the communities particularly useful in areas which are prone to frequent disasters.

It is quite heartening to note the laudable effort made in certain areas where communities have formed their own organizations which take right initiative in such situations. One such community based organization is the Village Task Force formed in villages of Andhra Pradesh by the Church Auxiliary for Social Action (CASA). The Village Task Force has been trained in emergency evacuation and relief within the village. It is elected by the people themselves and during disasters it serves as the nodal body at village level which has to mobilize resources for the community and disseminates necessary information passed on by outside agencies.

While the community as an effective institution, is yet to take shape in this country mainly due to low literacy levels and widespread poverty, considerable efforts are being made to form and strengthen community-based organizations at grassroots levels.

Research and Training Institutions

With an increase in the perception towards spreading a culture of prevention in the disaster management scenario, considerable emphasis is now being placed on research and development activities, in addition to capacity building of all personnel concerned with disaster management. In India, a number of research institutes are conducting active research in the field of disaster management. Valuable inputs in technical, social, economic as well as management areas of the field are being looked into.

Research activities are being coordinated by different ministries depending on the type and level of research. An important role is played by the universities too in this sector who, besides running programs on disaster management, also serve as think-tanks for the government. Institutes spread geographically across the country have developed specialization's in terms of particular regions where most of their research is concentrated and also in terms of particular disasters. Notable universities are the University of Roorkee, the Indian Institutes of Technology, and the Anna University.

The department of Science (Ministry of Science and Technology), Government of India coordinates activities through a network of scientific institutes, for example, the Central Building Research Institute at Roorkee. The Ministry of Urban Development carries out research through Building materials and Technology Promotion Council on subjects, such as appropriate building materials for disaster-prone areas. These institutes, besides providing technical assistance to implementing and engineering organizations also trains field level officers and other concerned role players.

The Ministry of Agriculture and Cooperation too has set up a National Centre for Disaster Management at IIPA to look after administrative training activities in the field of disaster management.

The National Centre for Disaster Management

The centre was established by Ministry of Agriculture in march, 1995 at the Indian Institute of Public Administration, New Delhi. The NCDM, besides gearing up the national, state and district level administrations to tackle natural disasters, also coordinates various research and training programs and builds a data-base on natural disasters.

Conclusion

In disaster situations, a quick rescue and relief mission is inevitable. However, considerable damage can be minimized if adequate preparedness levels are achieved. Indeed, it has been noticed in the past , that as and when attention has been paid to adequate preparedness measures, the loss to life and property has been considerably reduced.

Preparedness measures, such as training of role players, including the community, development of advanced forecasting systems, effective communications, and above all, a sound national policy and a well-networked institutional structure involving government organizations, academic and research institutions, the armed forces and NGOs would greatly contribute to the overall disaster management of the region. Later, it would lead to the much needed change in the overall orientation from rescue and relief to preparedness.

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DISASTER MANAGEMENT AND POLICE RESPONSE

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Introduction

The Oxford Dictionary of English Etymology defines disaster as "sudden or great calamity". Similarly, the Collins Dictionary describes disaster as " an occurrence that causes great distress or destruction" .There is considerable disagreement over one single definition of 'disaster'. Whereas some people consider disaster as 'a grave emergency', others describe it as catastrophe, while still others as a major incident with a large number of casualties'. However, a disaster is commonly understood by the general public as a great misfortune or calamity. A simple definition of disaster would be 'a situation where the normal services have been overwhelmed and can no longer cope'. In the context of emergency planning, therefore, a useful working definition of a disaster is any event happening with or without warning causing and threatening death or injury, damage to property or the environment or disruption to the community which, because of the scale of its effects, cannot be dealt with by the emergency services and local authorities as part of their day-to-day activities.

The following definition is set out in the Association of Chief Police Officers Emergency Procedures Manual and in the Fire Service Major Incident Emergency Procedures Manual for United Kingdom -

"A major incident is any emergency that requires the implementation of special arrangements by one or more of the emergency services, the NIIS or the local authority for: -

(a) the initial treatment, rescue and transport of a large number of casualties;
(b) the involvement either directly or indirectly of large numbers of people.
(c) The handling of a larger number of enquiries likely to be generated both from the public
and the news media usually to the police;
(d) the need for the large scale combined resources of two or more of the emergency services;
(e) the mobilisation and organisation of the emergency services and supporting organisations,
e.g. local authority, to cater for the threat of death, serious injury or homelessness to a
large number of people". (As recommended by ACPO Emergency Procedures Manual).

Disasters are frequently described in quantitative and statistical terms -the number of dead and injured, the extent of damage to buildings and other physical resources, the number of homeless, the ultimate economic costs. Yet for both victims and helpers it is the suffering the disaster brings -the human terror, anguish

and despair that is most vital and people suffer not only physical damage, but also considerable psychological damage in disasters. The Police, who perform the central role in dealing with the problem, are therefore required to perform the role sympathetically, sensitively and with kindness. In addition, there is the potential for more casualties of the disaster to occur amongst members of the Police Service dealing with the event. The welfare, morale and stress issues of the Police force have to be attended to by the senior managers of the Police force in order to achieve best possible results.

Most major disasters occur largely as unforeseen events. Any reasonable prediction or anticipation of a catastrophic event usually results in action intended to reduce the 'probable' to at least the 'possible' and ideally to the 'most likely'. The obviousness of the point that disasters are unforeseeable is often overlooked during the process of post-incident enquiry when the clarity provided by hindsight reveals , the specific factors which could/should have been spotted and resolved in order to avoid the onset of the disaster. Given the relative infrequency of major disasters it is unrealistic to expect Police forces to have the necessary resources, skills and logistics to manage a major disaster. Although Police provides the initial response to an incident and, together with the other emergency services, conducts rescue and first aid activities, the sheer scale of a major disaster means that most of the core management functions involved in the post rescue phase are beyond the experience of most Police forces. This inexperience places high levels of strains on officers in management roles. An efficient management can do much to assist officers to cope with the onerous experiences associated with major disasters by way of planning in respect of predictable/foreseeable disasters and training, in general, for all types of disasters

Thus a disaster has the following main features:-

1. Unpredictability.
2. Unfamiliarity.
3. Speed.
4. Urgency.
5. Uncertainty.
6. Threat.

TYPES OF DISASTER

All disasters can be broadly divided into two categories -Natural and Man-rnade disasters. Natural Disasters are not controllable as, indeed, nature is not controllable -such events are often termed as 'acts of God'. The Man-made disasters on the other hand are a rapidly increasing phenomenon in the present day Technological Society and occur as a result of human failure or error or malfunction of some structure or system designed by man. Similarly, while there is sometimes an element of warning in natural disaster. there is generally none in man-made disaster and this lack of warning makes avoidance difficult.

Both types of disasters can cause visible damage to a familiar environment, but some technological disasters do not have this effect like nuclear pollution from an accident like that at Chernobyl may be catastrophic, yet cause no visible damage.

Whilst Natural Disaster is often predictable to some degree, technological disaster is not. Technological catastrophes are never supposed to happen and

hence predictability is not an issue. The King's Cross Underground fire in November 1987 killing 31 persons and causing horrendous injuries could not have been foreseen as escalators are not supposed to erupt into flames.

Following are the different types of disasters under the above mentioned categories:-

1. **Natural Disasters**:- can be of the following types.
   - **a)** Famines
   - **b)** Floods
   - **c)** Storms
   - **d)** Droughts, and
   - **e)** Epidemics

2. **Man-made Disasters**:-

   - **a)** Air, Rail and Sea disasters
   - **b)** Fires
   - **c)** Explosions
   - **d)** Building collapse disasters
   - **e)** Industrial accidents
   - **f)** Football Tragedies
   - **g)** Holocausts in Civilian Violence, Terrorism and Mass shootings.
   - **h)** Mass suicides, e.g. Jonestown suicides.

DISASTER MANAGEMENT AND POLICE RESPONSE

The initial response to a disaster is usually provided by the emergency services supported by the local authority, but many agencies can become involved. The emergency services have to maintain a state of readiness so that they can provide a rapid response and alert local authorities and other services as soon as possible. All organisations who need to respond quickly to a disaster should have arrangements which can be activated at short notice. These arrangements should be clearly established and promulgated.

The police co-ordinate the activities of all those responding at and around the scene, which must -unless a disaster has been caused by severe weather or other natural phenomena -be treated as the scene of a crime and preserved accordingly. The police has to play a key role in the disaster management no matter what is its type and nature. It has to be very quick in its initial response to a disaster call or situation. When a disaster is predictable or foreseeable, such as a famine, cyclone, floods, etc., the police must keep itself in readiness to respond to it in a professional and competent manner. In other types of disasters or emergencies, such as major accidents. mishappening or natural calamities, promptness of the police response can help in saving a number of lives and fast return of normality.

Although involvement of different emergency services like Fire Brigade, Police and Hospital Services is inevitable, some other Public Utility Services, such as local bodies, Railways and Gas Boards, etc. , have to be involved also in most cases for dealing with the situation effectively. All such agencies are very different organisations, with different hierarchies and chains of command and responsibility, all talking different languages with different areas of expertise and priorities. If

rescue and recovery work is to be effective, all these different agencies have to work together in a co-ordinated way All these agencies, therefore, have to be aware of each other's areas of responsibility and systems of working. Comprehensive discussion and agreement among these agencies in the planning , stage and communication of the decisions down the chain of command to the lowest functionary of each agency and their training is, therefore, of utmost importance so that they know as to who is responsible for what and are aware of their roles and responsibility and can appreciate the need for Multi-Service Involvement in such a situation.

While the causes of disaster may be sudden and unpredictable, certain kinds of industrial activity carry known risks and are subject to legal requirements for emergency planning. These include known chemical or nuclear hazards at fixed locations, where the most probable types of incident and their likely consequences are largely foreseeable. For this reason it is possible to make detailed plans in advance for the appropriate action to be taken. The existence of such plans reduces the likelihood of errors resulting from decisions being taken under crisis conditions.

The police response to a disaster will vary, just as the nature and effects of the disaster will vary and such Police response should be an integral par1 of a combined and co-ordinated operation involving different emergency services. All such services and agencies work to achieve certain common objectives. Some of these objectives are:-

(1) To save lives.
(2) To prevent escalation of the disaster .
(3) To relieve suffering.
(4) To safeguard the environment.
(5) To protect property.
(6) To facilitate criminal investigation as well as Departmental, Public or Judicial enquiry, if any ordered; and
(7) To restore normality as soon as possible.

Under the principles of Integrated Response to a disaster, the different emergency services, including police, should concentrate on the effects rather than the cause of the disaster and wherever possible should plan it in advance integration in emergency management embraces a number of concepts, some of which may overlap. Each of the concepts will require different arrangements:-

1. **Mitigation** - This encompasses measures designed to prevent the occurrence of a disaster or reduce the likelihood or severity of the disaster Banning of smoking on Underground Railway systems, strict security checks at airports or toxic waste processing facilities in remote areas will reduce the likelihood of disasters.

2. Preparedness -It includes planning, public education, warning and training of resources in dealing with the situation.

(a) **Response** -This constitutes the provision of emergency response at tile field such as evacuation, rescue, etc; and
(b) **Recovery** -This phase will encompass long term activities which are necessary to provide a rapid return to normality and to rebuild the affected community.

Whereas efforts aimed at mitigation may help in preventing or mitigating tile effects in certain types of disasters, disasters can happen any time and can happen as a consequence of human behaviour and also as a result of an act of nature. We will 11so have to accept that if there are any disasters in future, the emergency services will continue to have to provide the initial response and bear the brunt in future as well as at present. Is not it, therefore, advisable for Police and other emergency services to remain prepared to face such a situation more efficiently in future if there be any? One way for such preparedness is identification of potential threat areas and preparation of contingency plan/manual.

Preparation of Disaster Manual

Each district/county police should have a manual containing information regarding

1. Various natural and man-made disasters
2. Myths about disasters and rumours to be destroyed
3. Panchayat, municipal and local authority level
4. Demarcation of area -wards -boroughs -sectors -villages
5. Duties of Panch, Sarpanch, Zila Pramukh -Pradhan -municipal councillors and their accountability
6. Involvement of social welfare agencies, e.g. Aanganwadis -Sathins -role of NGO's
7. Financial planning -funds frorn government and other sources
8. Role of educational institutions
9. Training to be imparted at various levels
10. Demonstrations and exercises
11. Co-ordination between various agencies and community
12. Documentation

PREPARING A CONTINGENCY PLAN

An Emergency / contingency plan should contain the following aspects in appropriate details:-

1. Brief introduction of the area

(i) Topography
(ii) Climate
(iii) Demograph
(iv) Industry

2. Natural & man made disasters

History of natural and man made disasters

3. Command

(i) Structure of the government at various levels powers and responsibilities
(ii) Chain of command
(iii) Role of emergency services

4. Listing of emergency and other services

(i) Their chain of command.
(ii) Address and telephone numbers of the agencies
(iii) Police, fire services, essential services, water and power supply, medical, transport and railways, post and telegraph, telephone, red-cross and NGO's.

5. **Activation of operations**

(i) Warning systems
(ii) Receipt and dissemination

6. Establishment of control room

7. **Co-ordination with various agencies**

8. **Arrangements at scene of disaster**

(i) Responsibility and accountability of each agency
(ii) Duties of first officer at scene
(iii) Duties of control room staff, senior supervisory officer, incident officer, investigating officer, etc.
(iv) Dissemination of information to agencies / departments concerned
(v) Medical centre
(vi) Collection point for survivors
(vii) Shelters for survivors
(viii) Temporary mortuary -identification of victims.
(ix) Evacuation
(x) Transport and traffic arrangements
(xi) Management of law and order, VIP arrangements
(xii) Role of media -to highlight accurate information -media liaison officer.
(xiii) Communication system

9. **Public information**

(i) Announcements (requiring actions)
(ii) Information releases
(iii) Emergency broadcasting and telecast

10. Rescue operations

11. **Removal of debris**

12. Housing

13. Education and training

Training in disaster management to be given to the community groups, voluntary personnel and government officials.

14. Community groups

It should focus on various skills that community can develop to meet disasters.

15. Voluntary agencies

It should take into account divergence in terms of academic preparations, experience and competence.

16. Government officials

(i) Primary duty to save lives
(ii) Training at various levels -state, district, block and village.

Training has to be multi-directional

A) Orientation training
B) Elementary training
C) Basic training
D) Specialised training
E) Intensive training

17. Design and management of disaster information resource network

(i) To establish a world-wide network of information systems related to disaster management
(ii) Improved telecommunication system to help in quick collection of information
(iii) Internet could be called to build emergency management network
(iii) Internet helps in training of emergency management community. It has the ability to send warnings of potential disasters.

18. Monitoring and evaluation

Monitoring culture and evaluation formula be evolved. This be done by an integrated team of experts.

19. **Demonstration of emergency response exercise**:

There would be a need for simulation exercises/demonstrations. An exercise is to include:

(i) advance announcement through public address system
(ii) demarcation of area
(iii) involvement of all government / voluntary / local agencies
(iv) search and rescue teams to be equipped with latest proper tools, search dogs, first aid equipment
(v) use of dummies
(vi) demonstrations of air dropping of relief supplies
(vii) media should be associated

20. Corps of trained personnel

Emergent need to establish a cadre

(i) specialised programmes be designed to impart training.
(ii) setting up of training institutes at various levels
(iii) text books at school/college levels should incorporate information
(iv) training to skilled/technical persons, artisans, engineering students.
(v) training material relevant to local conditions be prepared.
(vi) training regarding technological advances made.
(viii) documentation of major natural disasters.

ROLE/FUNCTIONS OF POLICE

The primary areas of Police responsibility may be summarised as follows. - .

1. The saving of life in conjunction with other emergency services.
2. Co-ordination of the emergency services and other organisations
3. Traffic and crowd control.
4. The investigation of the incident in conjunction with other investigative bodies where applicable.
5. The collation and dissemination of casualty information.
6. Identification of victims.
7. The restoration of normality at the earliest opportunity.

Each of the above responsibilities along with other functions are discussed hereunder:-

1. Access and Crowd Control

Whenever a disaster takes place, the police should immediately cordon off the area and prevent people from thronging the scene. The experience has shown that a large number of people try to reach the scene of occurrence out of sheer curiosity or with the intention of extending their assistance to , affected persons. ,It becomes then necessary that police establish an outer cordon around the site of the disaster to control access to the whole of the disaster site, if practical. Stricter access control shall be enforced by the police and it should be ensured that no unwarranted person gains entry to the scene of disaster. An easily located Rendezvous point, away from, but within easy reach of the incident, should be immediately selected and manned by Police to receive and direct emergency service vehicles and personnel.

Immediate traffic arrangements shall be made to divert the traffic away from the scene of disaster. The motorists shall be suitably notified about the traffic diversion through the P .A. system, radio, TV as well as by the traffic policemen present at the spot. The area should also be kept clear of all the traffic so as to ensure that the vehicles of emergency services face no hindrance to reach the site. The obstruction of way to the site of disaster may delay the arrival of fire brigades, ambulances and other vehicles as well as the staff and is likely to affect the rescue and relief operations.

Adequate arrangements are to be made by the police to prevent the crowd to reach that site of disaster. Those who have already reached there should be asked to move away. The scene of disaster shall be cleared of all onlookers whose presence would only impede the job of the elT1ergellcy service personnel. Sometimes the public also gets agitated and display their annoyance against the government which soon turns into a law ar1d order problem. The police should deal with them effectively but tactfully. They should be properly equipped to deal with such a situation.

2. Search, rescue and evacuation

During the disaster, normally the police is first to reach the spot. Till the arrival of other emergency service personnel, it should search the area al1d remove the casualties from the site. It should also extend full co-operation to other services and the local authority in the rescue and evacuation operations.

In some circumstances it may be necessary to advice the public on whether they should evacuate a given area or stay put and shelter indoors. Such circumstances include risks to life or health from:-

(a) the release or threatened release of radioactive materials. or other hazardous substances; . .
(b) the spread of fire;
(c) explosion;
(d) severe storms;
(e) flooding;
(f) earthquake; and
(g) environmental contamination.

In the event of the release or threatened release of non-radioactive hazardous materials, additional information on the nature of the risk may be obtained from the fire service or other accredited sources. Once crucial factor in determining the area to be evacuated will be the forecast of speed and direction of the wind which can be obtained from the appropriate weather office.

It is normally the police who recommend whether or not to evacuate and define the area to be evacuated. Their recommendation should, however , take into account the advice from the fire service on risks associated with fire, contamination and other hazards, from the ambulance and local authorities. The police can only recommend evacuation and have no power to require people to leave their homes.

3. Control and co-ordination

Depending on the size and location of the incident, three levels of police Command and Control may be developed:-

(a) Forward control point. Normally the first control to be established, under the command of the local area officer who would be responsible for initial communication links and deployment.

(b) Incident Control Post To control and co-ordinate the management of the incident and provide a central point of contact for all emergency and specialist services. A co-ordinator should be appointed with responsibility for the control post, reporting to the area Police Chief or Commander.

(c) Major Incident Control Room

To co-ordinate resources to a protracted incident under the control of area Police Chief or Commander. Handling of media and setting up of a cell to inform the media about the real situation and casualties and to prevent spread of rumours and dis-information.

Co-ordination means the harmonious integration of the expertise of all the agencies involved with the object of effectively and efficiently bringing tile incident to a successful conclusion. It is the police responsibility, in any disaster situation, to co-ordinate the strategic roles of all the emergency services and other organisations involved. It would be desirable that due to the nature of certain natural disasters or major incidents this coordination role is handed over to another more appropriate service or agency. At all times, however, the personnel and resources of each service should remain under the command of their respective departmental heads. Where appropriate, the formation of a co-ordinating group from the key service and agency personnel will be quite useful. This group may be normally chaired by the police who will be responsible to maintain written records of its deliberations. Appropriate members of the group will also ensure that proper records are maintained of the incident.

In discharging the co-ordinating role, account shall be taken of the features of each particular disaster, together with the professional expertise of each of the emergency services and their statutory duties. It may be necessary to assign the control of specific functions to one or more of the emergency services or other agencies. For example, the fire service and Ambulance service will normally have responsibility for the rescue, initial treatment and medical evacuation of casualties. In extreme circumstances, e.g. a terrorist incident, it may be necessary for the police to take executive action in respect of the total disaster.

4. Scene Control and Legal Action

It is vital that the scene and surrounding area of any major incident should be protected for :-

(a) safety of victims, and
(b) protection and preservation of evidence.
(c) protection of properties of the affected persons against theft, looting, etc. during the disaster and its post impact period.

It must be accepted that large numbers of police officers will be required to achieve this aim and, therefore, the in charge of the district or incident commander should take early action for the reinforcements.

Unless a disaster has been caused by severe weather or other natural phenomena, the police would be required to treat the scene at and around a disaster as a scene of crime and preserve it accordingly. It has to initiate necessary legal action regarding registration of a criminal case and investigation of the crime. Police has also to facilitate inquiries carried out by the responsible accident investigation body such as Railway, Civil. Aviation, Medical and other departmental investigating agencies. The police process casualty information and have responsibility for identifying and arranging for the removal of the dead. Wherever

appropriate, the police has to identify the culprits, arrest and subsequently prosecute them.

5. VVIP/VIP Visits

Visits by VIP's can lift the morale of those affected by the disaster as well as those who are involved with the response. It has been seen that the Ministers, members of Parliament and State legislatures, local councillors, leaders of various political parties, etc. visit the scene of a disaster and the injured to mark public concern and see the disaster response. It may be possible that the scale of a disaster may in addition prompt visits of the Prime Minister, Governor, Chief Minister, etc. Sometimes their visit to the disaster site is likely to adversely affect the rescue operations, particularly if casualties are still trapped. It should be ensured that their visits do not interrupt rescue and life saving work and the police, as co-ordinators of the disaster response, should explain the ground situation to them and try to avoid their visit, if possible. However, in case the visit becomes inevitable, it should fix up the timing of visits. The additional need for their security would also cause a problem. The police and the local services are, however, experienced at handling VIP visits and many of the usual considerations will apply to their visit to a disaster site.

It would be desirable to restrict rnedia coverage of such visits, in which case the police should liaise with the government press Officer to keep their number to minimum. It may also be necessary for the police to brief the VVIP/VIP beforehand about the details of casualties, damage and the nature of the disaster. It should, therefore, prepare a brief note for such briefings.

6. Reception Centre

Recent experience of disasters has shown that, if they believe their friends and relatives may have been involved, it is likely that many people will travel to the scene or to meeting points such as travel terminals. If necessary, a reception centre for fr1ends and relatives will be established by the police (usually in consultation with the local authority and commercial, industrial or other organisations concerned) and staffed by the police, local authority and suitably prepared voluntary organisations. The fullest possible information should be given to enquirers seeking news of those involved in a disaster. Experience has shown that this is best done in a controlled way with general enquiries being referred to a specific source. This helps to ensure consistent and non-contradictory information being given out. Friends and relatives who may be feeling intense anxiety, shock or grief, need to be treated with sympathy and understanding. Access to the reception centre should be controlled to prevent those inside being disturbed by uninvited media representatives or onlookers.

7. Intimation regarding foreigners

If foreign nationals have been -or are thought to have been -involved in the disaster, the police will, in accordance with the Vienna convention on Consular relations, inform the Consular authorities of the death or injury to any of their nationals by quickest possible means.

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CASE STUDIES OF MAJOR DISASTERS AND GOI INITIATIVES

VINAY KAJLA
Dy Comdt
NISA CISF

MAJOR DISASTERS

TSUNAMI - ASIAN

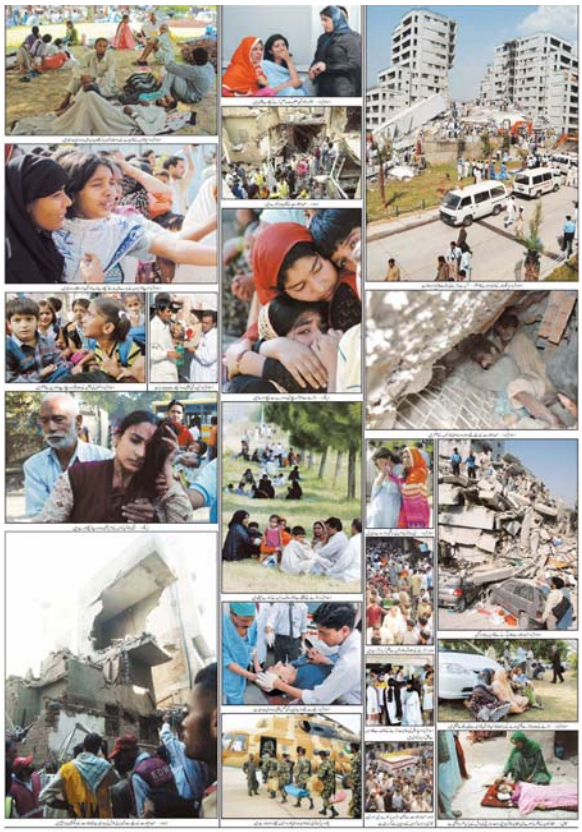
The 2004 Indian Ocean earthquake, known by the scientific community as the Sumatra-Andaman earthquake, was an undersea earthquake that occurred at 07:58:53 local time on December 26, 2004. According to the United States Geological Survey, the earthquake and its tsunami killed more than 283,100 people, making it one of the deadliest disasters in modern history.

Various values were given for the magnitude of the earthquake, ranging from 9.0 to 9.3 (which would make it the second largest earthquake ever recorded on a seismograph), though authoritative estimates now put the magnitude at 9.15.

The resulting tsunami devastated the shores of Indonesia, Sri Lanka, South India, Thailand and other countries with waves up to 30 m (100 ft). It caused serious damage and deaths as far as the east coast of Africa, with the furthest recorded death due to the tsunami occurring at Port Elizabeth in South Africa, 8,000 km (5,000 mi) away from the epicentre. The plight of the many affected people and countries prompted a widespread humanitarian response.

In May 2005, scientists reported that the earthquake itself lasted close to ten minutes when most major earthquakes last no more than a few seconds; it caused the entire planet to vibrate at least a few centimetres. It also triggered earthquakes elsewhere, as far away as Alaska.

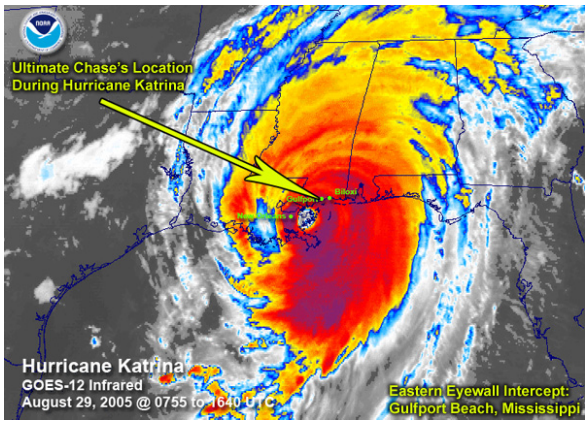
SOUTH ASIAN EARTHQUAKE



The Kashmir earthquake (also known as the Northern Pakistan earthquake or South Asia earthquake) of 2005 was a major seismological disturbance (earthquake) that occurred at 08:50:38 Pakistan Standard Time (October 8, 2005 with the epicenter in the Pakistan-administered region of the disputed territory of Kashmir in South Asia. It registered 7.6 on the moment magnitude scale making it a major earthquake similar in intensity to the 1935 Quetta earthquake, the 2001 Gujarat Earthquake, and the 1906 San Francisco earthquake.

The total casualties were over 100,000. Most of the affected areas are in mountainous regions and access is impeded by landslides that have blocked the roads. An estimated 3.3 million were left homeless in Pakistan. The UN reported that more than 4 million people are directly affected, as winter snows start. It has been estimated that damages incurred are well over 5 billion US dollars. In a show of solidarity, five crossing points have been opened on the Line of Control (LoC) between India and Pakistan on the roads between Nauseri-Tithwal, Chakoti-Uri, Hajipir-Uri, Rawalakot-Poonch and Tattapani-Mendhar.

HURRICANE KATRINA - USA



Hurricane Katrina is the first Category 5 hurricane of the record-breaking 2005 Atlantic hurricane season. It was the sixth-strongest Atlantic hurricane ever recorded. Katrina formed over the Bahamas in late August, and crossed southern Florida at Category 1 intensity before strengthening rapidly in the Gulf of Mexico. The storm weakened considerably before making its

second landfall as an extremely large Category 3 storm on the morning of August 29 along the Central Gulf Coast near Buras-Triumph, Louisiana.

Storm surge from Katrina catastrophic damage along the coastlines of Louisiana, Mississippi, and Alabama. Levees separating Lake Pontchartrain from New Orleans were breached by the surge, ultimately flooding about 80% of the city. Wind damage was reported well inland, impeding relief efforts. Katrina is estimated to be reponsible for $75 billion in damages, making it the costliest hurricane in United States history; the storm has killed at least 1,383 people, becoming the deadliest U.S. hurricane since the 1928 Okeechobee Hurricane.

TENGRATILA GAS FIELD, BANGLADESH

As the Indian Government seeks to expand its oil production facilities we need to be careful about the technical competence of the companies being granted awards for exploration and production.

In 1989, after almost 30 years of drilling in the Tengratila gas field (formerly known as Chattak), the gas field was abandoned because the remaining “reserve was not considered to be commercially viable for extraction with the technology available at the time.

AP / Khalid Mohammed

On January 1, 2005, a company named Niko began working in the Tengratila gas field. On January 7, a fire broke out at the well. The Independent, a Bangladeshi newspaper, reports, “the roaring flames, as high as 500 feet, forced the authorities to order evacuation in nearby villages as the para-military Bangladesh Rifles (BDR) men and police cordoned off the entire area around the Tengratila gas field.

Estimates for the number of people forced to evacuate range from 10,000 to 20,000. In addition, houses in the area developed cracks from the heat and cattle died.The fire burned for over a week and destroyed over a billion cubic feet of gas.

On Jun 24th , the gas field again caught fire . The new blaze burnt out of control for over a month.The new blaze has created considerable damage to the environmental and human health. The cultivable land around the gas field has been damaged as a result of the fire. One resident pointed to gas leaks with such a force that the muddy bubbles in the middle of a paddy field rose up to three to four feet. The vast expanse of marshland on the northern border of Sunamganj was home to birds and fishes; but the sight of such animals has become rare at the place after the blow-outs.

Residents of nearby villages are drinking water from tube wells which were marked contaminated with arsenic. Arsenic-tainted drinking water has become a persistent problem in this area of Bangladesh.

KUMBAKONAM SCHOOL TRAGEDY

On Jul 16, 2004 a fire engulfed a primary school in southern India killing 110 children, some of whom were reportedly trapped in an unsupervised classroom when the dry palm roof above them collapsed.
Though the main school is mostly housed in a concrete building adorned with stucco images of Hindu deities, classes for children aged between three and 10 were conducted on the ground floor in a thatch-roofed complex. Children were caught as they tried to get out of the narrow entrance of the main building.
School buildings in Kumbhakonam do not require clearance from the fire department and even where fire safety regulations are mandatory, they are rarely observed. "Most fires are caused by short-circuits since anyone can become an electrician as there are no tradesman's standards," said Mohan Guruswamy, of the New Delhi-based Centre for Policy Alternatives. Shoddy electrical equipment adds to the problem.
In January 2004, a wedding blaze killed 45 guests, including women and children, in Trichy, not far from Kumbhakonam. The worst such disaster was at a school prizegiving function at Mandi Dabwali in Haryana in 1995 when a tent caught fire killing 538 people, including 170 children.

GOVT OF INDIA INITIATIVES

While most of the disasters cannot be prevented, they can certainly be handled and human suffering mitigated by a systematic, sustained and integrated response

to such situations. Disaster Management cannot but remain a vital agenda in the governance of the country based on the philosophy of welfare state. As a matter of policy India has preferred to manage disasters on its own. However, the magnitudes of the recent disasters have increased the GOI's interest in working with all stakeholders to facilitate the delivery of aid, strengthen systems to reduce recovery costs and mitigate the effects of future disasters. Interest is high in the GOI for addressing major weaknesses such as: poor planning and coordination; lack of relevant technology for forecasting; inadequate human capacity and skills for response; inadequate attention to good zoning and building; and ineffective warning systems.

The Disaster Management Bill has been passed by the Parliament. The salient features of the Bill include setting up of a National Disaster Management Authority under the Chairmanship of the Prime Minister; State Disaster Management Authorities in the States/Union Territories under the chairmanship of Chief Minister or Lt. Governor or Administrator, as the case may be; and the District Disaster Management Authority under the District Magistrate in each district.

The National and State Authorities shall be responsible for laying down the policies, plans and guidelines for disaster management. The District Authority shall act as the district planning, coordination and implementing body for all disaster management related functions. These functions will include mitigation and preparedness measures also, besides response, relief and rehabilitation.

A key role has been assigned to the local authority for ensuring training of its officers and employees; maintenance of resources so that these are readily available for use in the event of a disaster and ensuring that all construction projects in their area of jurisdiction conform to the prescribed standards and specifications. The local authority shall also carry out relief, rehabilitation and re-construction activities in the affected areas.

The Bill also seeks to constitute a National Institute of Disaster Management which shall plan and promote training and research, documentation and development of national level information base relating to disaster management policies, prevention mechanism and mitigation measures. A National Disaster Response Force shall also be constituted for specialist response.

The Bill seeks to constitute Disaster Response Fund and Disaster Mitigation Fund at the National, State and District level. It mandates that there shall be no discrimination on the ground of sex, caste, community, descent or religion while providing compensation and relief to the victims. The powers to issue directions to the Government authorities, organizations and statutory bodies to facilitate and assist in disaster management have been vested in the Central Government. The Bill seeks to make provision for punishment for obstructing response, making false claims, mis-appropriation of money or materials and issue of false warning.

However, it provides immunity to Government organizations and officers for action taken in good faith.

Pending enactment of the law, the Government have already constituted the National Disaster Management Authority under the Chairmanship of the Prime Minister with a Vice-Chairperson and five Members. The Authority has already been made functional.

With the enactment of the Disaster Management Bill, 2005, the Government have now put in place requisite institutional mechanism for drawing up and monitoring the implementation of the disaster management plans at all levels, ensuring measures by various wings of Government at National, State and District level for prevention and mitigating effects of disasters and for undertaking a holistic, coordinated and prompt response to any disaster situation. The enactment will facilitate effective steps for the mitigation of disasters, prepare for and coordinate a more effective response to handle disaster situations. The Bill seeks to put in place Government's resolve to bring about a change in orientation from a relief-centric approach to a holistic multi-disciplinary and multi-sectoral approach with greater involvement of Panchayati Raj Institutions and Municipalities.

Keeping in view the federal polity, the Bill has been enacted under the Entry 'Social Security and Social Insurance' in the Concurrent List of the Constitution of India since it will have the advantage to allow the State Governments also to have their own legislation.

Role of CISF

The Central Industrial Security Force (CISF) has been designated as one of the agencies to respond in the case of a disaster striking any part of the country. The Govt. has also declared the National Industrial Security Academy as a National level institution for imparting training to the rapid response units. In this connection we are running Medical First Responder (MFR) and Collapsed Structure Search and Rescue (CSSR) courses not only for the responders from the CISF but have also conducted such courses for would be trainers of other organizations like the CRPF. With the active assistance of international lead agencies in the field of disaster response like Asia Disaster Preparedness Center (Bangkok) and National Society for Earthquake Technology(NSET), Nepal we have been able to develop Master

Instructors of International standards in not only imparting training but also to monitor other instructors regarding the quality of training. As on date we have 15 Master Instructors with the CISF. The fact that the training is being handled entirely by our instructors amply demonstrates the faith and confidence that the Government of India has on this Academy. Our personnel have given their valuable services in disasters like the floods in Assam in the year 2004 and recently at Andaman and Nicobar Islands in the aftermath of the Tsunami strike. Apart from these courses for first responders CISF also organizes Vertical Interaction Course for IPS officers on the theme of "Disaster Management" and Regular courses on Disaster Management and Natural Disaster Management for District Level Officers as well as IAS officers of the North East region to name a few. The conduct and success of a large number of courses reflects the relevance and appreciation of the theme in the present day context wherein Disaster Management is gradually emerging as a field of study.

CONCLUSION

The main challenges as we see them over the next ten years can be summarized as:

a) We need to acknowledge that sustainable development is not possible without taking disasters into account.

b) The political commitment and action from more national governments to update emergency planning and develop risk reduction measures is vital. Disaster preparedness pays and has to be further strengthened. But there is also a need to look beyond. In the future wider risk reduction measures, including mitigation and awareness raising need to be reinforced in each disaster-prone country. The long-term, overriding need is a world strategy for tackling risk reduction. The UN International Strategy for Disaster Reduction exists. Do we want to empower it? I hope we do.

c) Preparedness starts at the source, where the risks are, where the hazards are coming back each year. Many effective risk reduction measures are low-cost, even no-cost. In areas where people have never dreamt yet of insurance schemes awareness, simple mitigation and evacuation training can be first steps to decreased vulnerability as well as looking at women's roles and contributions.

d) One challenge is to link communities vertically to a national disaster management system. Too many of them are isolated. Governments must have stronger links to sub-national levels. Equally important are the horizontal links - to the authorities, to UN and NGO actors. The simple truth

is evident: as strong as its weakest link. In the future we need to further increase joint risk assessment and planning.

e) Natural disaster trends are clear and worrying, with particularly harsh messages for the least developed countries, and yet disaster data are so poor. Criteria for losses need to be agreed upon. Equally important, but largely unnoticed, are the multitude of small and medium-scale disasters. The losses from these disasters can be as significant as for major disasters.

f) Natural disasters in the context of complex humanitarian emergencies hide complex underlying layers. We already see a trend of increasing politico-economical disasters. The need to look beyond the disaster event and work on compounded effects will most probably increase. Dilemmas difficult to tackle today will be more common.

g) We must see natural disasters not as one-off events but as phenomena, triggered by multiple factors, requiring multiple, holistic solutions. Technical, environmental, also climate change-related, social, economic and political elements need to be analyzed jointly to give answers, adequate to changing risk patterns and an increasingly stressed planet. In the past we talked about the hazards, in the present we focus on disasters, in the future the focus should be risks.

I would like to present an interesting extract from DOUG COPP'S ARTICLE ON THE "TRIANGLE OF LIFE,"

Doug Copp is the Rescue Chief and Disaster Manager of the American Rescue Team International (ARTI), the world's most experienced rescue team.

He has crawled inside 875 collapsed buildings, worked with rescue teams from 60 countries, founded rescue teams in several countries, and is am a member of many rescue teams from many countries. He was the United Nations expert in Disaster Mitigation (UNX051 -UNIENET) for two years and has have worked at every major disaster in the world since 1985.

He writes - The first building I ever crawled inside of was a school in Mexico City during the 1985 earthquake. Every child was under their desk. Every child was crushed to the thickness of their bones. They could have survived by lying down next to their desks in the aisles. It was obscene, unnecessary and I wondered why the children were not in the aisles. I didn't at the time know that the children were told to hide under something.

Simply stated, when buildings collapse, the weight of the ceilings falling upon the objects or furniture inside crushes these objects, leaving a space or void next to them. This space is what is called the triangle of life." The larger the object, the stronger, the less it will compact. The less the object compacts, the larger the void, the greater the probability that the person who is using this void for safety will not be injured.

EARTHQUAKES

PART - I
EARTHQUAKES : HOW, WHY AND WHERE ?

Dr.B.K. RASTOGI, Dy.Director,
National Geophysical Research Institute, Hyderabad.

This article describes the damaging earthquakes in India. The concept of plate tectonics is outlined which explains how earth- quakes are caused. The difference between Magnitude and Intensity of earthquakes is explained and the current status on earthquake prediction is touched upon. Earthquake hazard potential in India is mentioned.

Most Damaging Earthquakes in India

For the Indian region, the most severe earthquakes have been in Kutch (1819, 2500 deaths) , Kashmir (1885, 3100 deaths) , Assam (1897, 1500 deaths),Kangra (1905, 19000 deaths) , Bihar-Nepal (1934, 9040 deaths) , Assam (1950 , 1000 deaths) , Bihar-Nepal (1988, 1004 deaths) , Uttarkashi (1991, 769 deaths) and Latur (1993, 7610 deaths) .However in the world, the Tangshan earth-quake in 1976 was the most severe in the recent past which killed 2,50,000 people. A list of significant earthquakes in India is given in Table 1.

How earthquakes happen?

Earthquakes occur due to slippage of rocks along faults inside the earth. Occurrence of the earthquakes, volcanoes and mountain building is due to a common process called plate tectonics. According to this revolutionary theory, the outer surface of the earth (called the lithosphere) is divided into six major and some minor blocks or "plates". Each plate is about 100 km thick and moves relative to the neighbouring plates on a layer of softer rocks. Movement of these plates is very small about 2-3 cm per year which is same as the rate of growth of your nails. The main driving force is the heat generated by the radio activity. Plate margins have been defined on the basis of earthquake belts. There are three types of plate margins along which the plates either move away from each other or towards each other or past each other. The mid-oceanic ridges, which are girdling the earth, are the spreading plate margins (the first type) where the new material in the form of lava is continually upwelling. Large earthquakes do not occur along this type of plate margin. The two sides of the ridge move apart slowly. The ridge push is carried up to the sites of deep oceanic trenches where the plate is subducted and the material from the oceanic plate, is consumed.- Strong earthquakes occur frequently along such margins (the second type) .Volcanoes are formed over the sinking slabs like those in Indonesia, Japan & Philippines. Some times when the oceanic part of the plate is fully consumed, the continents collide. In this fashion, about 45 million years ago, the Indian plate collided with the Eurasian plate and Himalaya started forming in between the two continents at a place where there was once an ocean. An example of the third type of plate boundary where two plates slide past each other is in California. Large earthquakes occur in such type of boundaries also.

Now we know that large earthquakes occur along certain belts. About 75% earthquakes occur along the Circum-Pacific belt which is known as the ring of fire due to the presence of volcanoes. About 20% earthquakes occur along the Alpine Himalayan belt and rest along the mid-oceanic ridges and intraplate regions. Young mountain regions are seismically more active.

Magnitude, Intensity and Energy of Earthquakes

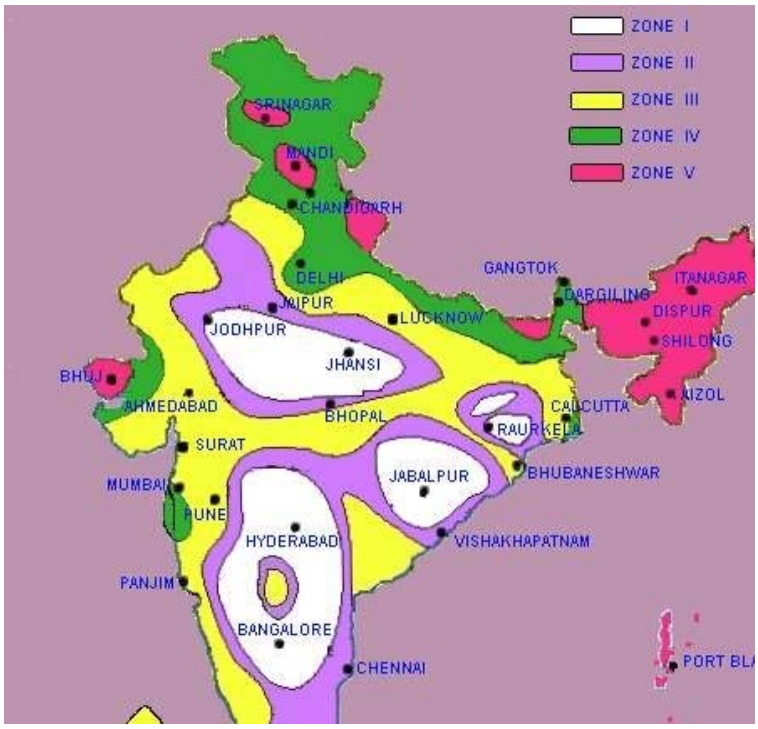
The point inside the earth where the earthquake originates is called focus and its projection on the surface is called epicenter.

The magnitude is estimated at the epicenter and the intensity is assigned to a site. Magnitude is determined by amplitude of seismic waves recorded on a seismograph which is a device to record earthquakes. Due to inhomogenities in the earth, the amplitude of the seismic waves may be amplified or attenuated giving slightly different values of the magnitude at different stations. The average value from different stations is assigned as a fixed number to be an earthquake magnitude. Intensity is assigned on the basis of damage which depends upon magnitude, depth of focus, distance from epicenter and the ground condition. The expected damage for earthquakes (shallow) of different magnitudes is depicted in Table-2. However depending upon ground condition, overlapping from one unit to the other is possible. The radius of damage area for different magnitudes is given in Table-3.

The magnitude values are on a logarithmic scale. Hence, an increase of one unit represents increase of the ground shaking by ten times and energy release thirty times. Earthquakes release a lot of energy. To have an idea, one can say that Hiroshima type Nuclear explosion would be an equivalent of a magnitude of 4.5. The Latur earthquake of 1993 of magnitude 6.1 involved an energy of a few hundred atomic bombs. Fortunately, most of the earth- quake energy is consumed in breaking of rocks and in producing heat. Only a limited amount is converted into seismic waves which causes damage.

Seismic Zoning of India

Himalaya is formed by young mountains which are as young as 20 million years of age and is seismically very active where four great earthquakes of magnitude 8 or more have occurred viz. Assam 1897 and 1950, Kangra 1905 and Bihar-Nepal 1934. There have been about forty major earthquakes too. Great earthquakes are devastating. Such earthquakes in Himalaya can destroy the taller building up to distances of about 350 Km, say in the city of Delhi, Lucknow, Patna etc. In most of the Peninsular India, the earthquakes can be at the most moderate as the rocks are old and stable (several hundred million years to three and a half billion years) with weak zones of smaller dimension. However, even moderate earthquakes in the Peninsular India cause lot of damage due to large population and non-engineered structures.



Seismic zoning maps are prepared for any country to depict the relative earthquake hazard in different regions. A seismic zoning map of India was prepared by Bureau of Indian Standards in 1986. This map has been prepared on the basis of the intensity of past earthquakes and geological knowledge. Acceleration of seismic waves causes damage like collapse of walls. Damage due to acceleration is more significant at near distances of less than 100 km. Sometimes presence of alluvium and other ground conditions cause amplification up to 350 km or so by which taller buildings are damaged.

Earthquake Prediction

On the basis of the study of distribution of earthquakes, it has been possible to have a good idea of long term assessment of earthquake hazard. The buildings can be designed to take care of the damage due to expected earthquakes. Short term prediction is' not possible, as no reliable methods or instruments have been found so far. To date there is only ope successful prediction i.e. for the Haicheng 1975 earthquake in China. The whole town was evacuated by which lakhs of people were saved. But in the very next year in 1976 the Tangshan earthquake in China could not be predicted in which 2,50,000 people died.

For earthquake prediction a number of geophysical and geochemical parameters are continuously observed and some of which show anomalous precursory changes. These include the following:

* Land deformation, tilt and strain are the most important changes which are observed well before the earthquakes.

* Number of small shocks (foreshocks) increase before a main earthquake but decrease just prior to the main earthquake. ,

* Velocity of longitudinal waves in the earthquake zone decreases and then becomes normal prior to an earthquake.

* Electrical resistivity of the ground decreases.

* Radon, a radio active gas, is found to increase prior to earthquakes.

Many other precursors are also observed like changes in groundwater table, geomagnetic field and animal behaviour. As the earthquakes happen at depths of several kilometers, many times the above changes are not possible to be measured. Many times these changes are unrelated to earthquakes giving false alarm. At other times earthquake do not occur after these changes. As a great earthquake is expected in Himalaya any time now and a few moderate but damaging earthquakes in the Indian peninsula every decade, a well laid -out hazard mitigation plan is urgently called for.

EARTHQUAKE DISASTER MITIGATION PROGRAM

Earthquake disaster mitigation program consists of three components which are Preparedness, Rescue and Rehabilitation as described below. Earthquake mitigation program and preventive action program in India are outlined.

I. Preparedness:

The preparedness phase involves the following aspects:

I. Hazard zoning.
II. Earthquake prediction and warning.
III. Implementation of earthquake engineering codes.
IV. Strengthening of existing structures.
V. Education & training.
VI. Seismic instrumentation-new & upgradation.
VII. Insurance.
VIII. Emergency preparedness:

Preparation of contingency plan and creation of administrative structure for effective and coordinated action during the emergency.

This would include arrangements of digging & clearing equipment (bulldozers, cranes, chain saw, drills & crowbars etc.) for rescue of people trapped in collapsed houses, materials for shelters, emergency bridges, fire wood, medical facilities including mobile hospitals & medicines, immunisation, water tankers & water purifiers.

ix) Training for handling damaged buildings.

2. Rescue:

Rescue at the time of emergency involves the following operations:

I. Maintenance of law and order; prevention of trespassing, looting, Keeping roads clear from sight seeing persons so that free movement of rescue vehicles is assured, etc.
II. Evacuation of people.
III. Recovery of dead bodies and their disposal.
IV. Medical care for the injured.
V. Supply of food and water and restoration of water supply lines.
VI. Temporary shelters like tents, metal sheds.
VII. Restoring lines of communications & information.
VIII. Restoring transport routes.

IX. Quick assessment of damage and demarcation of damaged areas according to grade of damage.

X. Cordoning off of severely damaged structures that are liable to collapse during aftershocks.

XI. Temporary shoring of certain precariously standing bui1dings to avoid collapse and damage to other adjoining buildings.

3. **Rehabilitation**

After the emergency, rehabilitation involves the following aspects:

I. Repair, restoration, strengthening or demolition of damaged buildings.

II. Selection of sites for new settlements, if necessary.

III. Adoption of strategies for new constructions like construction through contractors or by self-help; construction of core houses only or supply of construction material only.

IV. Execution of the construction program.

V. Preview/review of seismic codes & construction norms.

VI. Training of personnel, engineers, builders and artisans.

VII. Rehabilitation of destitute persons, orphans, widows, the aged and the handicapped.

4. **Earthquake Disaster Mitigation Program in Inida:**

Ministry of Agriculture, Government of India is responsible for providing help at the time of emergency. There is no centralised policy or program of the Government of India regarding earthquake disaster mitigation in the sense of the total program. But, the government acts as the biggest insurer to help the population in distress due to any natural calamity through 'relief and rehabilitation programs and loans and subsides.

During emergency a number of voluntary agencies came forward in a big way. The District Collector has to coordinate their efforts. Contingency plans are normally available with the District Admin & Civil Defence authorities for use after every disaster. This should be checked.

A number of government departments & institutions are engaged in activities which would cover a number of actions needed in the total mitigation program as mentioned below:

5. Preventive Action Program

Earthquake Catalogues & Sesimic Zoing Maps

Earthquake catalogue is available for the past 200 years. The Geological Survey of India studies earthquake damages. The Roorkee University studies Earthquake Engineering aspects. The India Meteorological Agency operates seismic instruments. The National Geophysical Research Institute studies the cause of earthquake.

The seismic zoning map of India was prepared by ISI in 1962. It was revised in 1966 {IS: 1893 -1966}. The Koyna earthquake in 1967 struck at a place where the map had shown low seismic activity. Thus the Koyna earthquake raised a big question mark about the approach to seismic zoning. In 1970, slight modifications

were made. However 1993 Latur earthquake again occurred in an area where the map had shown low seismic activity. Again a major revision is called for .

5.2 Earthquakes Catalogues & Sesimic Zoning Maps

IS: 1893 : 1962 -The first set of recommendations for earthquake resistant design of structures.

IS: 4326 : 1967 -A code of practice for earthquake resistant construction of buildings. Revised in 1976.

IS: 13827: 1993- on Earthen Buildings

IS: 13828: 1993- on Low Strength Masonry Buildings

IS: 13935: 1993- on repair & strengthening of buildings

5.3 Education, Training, Research & Consultancy:

Roorkee University, NGRI.

5.4. Laws For Earthquake Resistant Designs:

No laws yet.

5.5. Earthquake Insurance:

The relief by Govt. is ad hoc and haphazard, based on political and social considerations.

Relief by Govt. cuts in planned expenditure for developmental activities obstructing economic progress.

Subsidy/relief given in cash is not utilised for reconstruction (eg.Rs.90 crores for 1991 Uttarkashi)

Insurance paid in Uttarkashi Rs. 30 lakhs

Insurance paid in Latur Rs. 2 Crores

Tax relief to build up funds of Rs. 200 -300 Crores.

TABLE - 1 : DAMAGING EARTHQUAKES IN INDIA

YEAR	DATE	TIME	PLACE	M/I	DEATHS
893			INDIA		1,80,000
1720	JUL 15	12:00	OLD DELHI		100S
1819	JUN 16	18:45	KUTCH	7.8	1,543
1828	JUN 06	22:30	KASHMIR	X	1,000
1885	MAY 30		KASHMIR	X	3,100
1897	JUN 12	05:15	SHILLONG	8.7	1,542
1905	APR 14	06:20	KANGRA	8.5	19,000
1934	JAN 15	14:l3	BIHAR NEPAL	-8.3	9,040
1950	AUG 15	19:39	ASSAM	8.5	1,000

1956	JUL 25	21:02	ANJAR	7.0	115
1963	SEP 02	07:04	BADGAM(J&K)	5.3	100
1967	DEC 11	04:21	KOYNA	6.3	200
1988	AUG 21	04:39	BIHAR-NEPAL	6.4	1,004
1991	OCT 20	02:53	UTTARKASH	6.5	769
1993	SEP 30	03:55	KILLARI	6.3	7,610

TABLE - 2 : INTENSITY Vs MAGNITUDE (M= 2/3 I + 1)

GRADE	INTENSITY MM OR MSK SCALE	LIKELY DAMAGE OR EFFECT	MAGNITUDE RICHTER SCALE
MICRO	I	MAY NOT BE FELT	1
	II	SLIGHTLY	2
	III	FELT BY MANY	}
	IV	STRONGLY FELT	} 3
MILD	V	MINOR CRACKS IN HOUSES	4
	VI	LARGE CRACKS IN HOUSES	5
MODERATE	VII	COLLAPSE OF WALLS	}
	VIII	COLLAPSE OF HOUSES	}
		CRACKS OF SEVERAL Cms. WIDTH ON FLAT GROUND	} 6 } }
MAJOR	IX	PARTIAL COLLAPSE OF RCC STRUCTURES CRACKS OF UPTO 10 Cms. WIDTH IN FLAT GROUND. LIQUEFACTION AND UNDERGROUND PIPES BREAK	7
GREAT	X	SOME RCC STRUCTURES COLLAPSE GROUND CRACKS UPTO 1 M WIDTH	} } } }8
	XI	FEW BUILDINGS REMAIN STANDING GROUND DISTORTS, RAILS BEND	} } } }
	XII	ALL STRUCTURES ARE DESTROYED LANDSCAPE CHANGES……	

PART - II
EARTHQUAKES DON'T KILL, BUILDINGS DO

Shri H.K.Gupta
Director
National Geophysical Research Institute, Hyderabad

India averages a major quake every two years, often measuring more than 6 on the Richter scale. Yet, till date, the nation as a whole is unequipped in disaster management. No long term strategy, no equipment, no trained personnel.

Unlike other natural calamities, unfortunately, earthquakes cannot be predicted. The simple reason being the earth is not uniform at all places. In subjects like physics and chemistry an experiment can be conducted in a laboratory which can be repeated in other laboratories too. This is not the case for earth science.

The science of quakes, being a relatively new subject, scientists across the globe are still in the learning phase. If you take cyclones, the meteorological department can now forewarn about the calamity, its intensity and movement after which the authorities are in a position to take up precautionary measures. This was not the case even 50 years ago. After a lot of research, now they have achieved the desired results. Constant efforts are being made to understand the very phenomenon of an earthquake.

The seismic events at shield areas throughout the world suggest that the stable, continental regions are much more vulnerable to earthquakes than was once thought. Scientists at NGRI have taken up multi-parametric studies in these areas.

The problems caused by earthquakes in developing countries have become serious because of high population density and proliferation of structures not built to withstand the damage. Disturbing observations of continued rubbing sounds, small little shocks and change in groundwater levels continue to be reported from several regions of AP, Maharashtra and Madhya Pradesh.

A global conference on SCR held here also addressed several aspects of these quakes like seismicity and seismotectonics of different shield regions, structure and mechanics, stress and source parameters besides repeatability.

As I mentioned earlier the very phenomenon of earthquake is yet to be understood, we can also see differences between the nature of earthquakes in two different regions. A recent article in New Scientist said, *"For decades, seismologist trying to predict where and when quakes might strike have focused on areas where they have happened before, such as the boundaries between tectonic plates. But the evidence from the recent earthquakes in Southern California and India shows that the experts' task is far from simple".*

Source : Sunday Deccan Chronicle, dated Feb'2001

Some people now say that scientists could have taken “foreshocks” in Bhavnagar last year as precursor to Gujarat incident. We generally talk of foreshock only after the main shock occurs. To recognize foreshocks is real time is one of the most important problems in seismology. There were no foreshocks, large enough to be detected, before Latur earthquake.

What scientists across the globe are doing is to characterize earthquake zones through study of multi parametric precursor – water-related, soil, gravity and other physical properties. Thanks to the United Nations initiative which declared 1990s as International Decade of Natural Disaster Reduction, 500 scientists all over the world prepared the global seismic hazard map in nine years.

There is an old saying that earthquakes do not kill people but the buildings do so and it is proved time and again. Greater care should be taken while taking up constructions in earthquake-prone areas. In addition to the existing seismic zone mapping of the country which indicates the quake-prone areas we have been trying to convert hazard into risk by multiplying the former with vulnerability for which the micro zone mapping is being developed.

The Science and Technology Department of Union Government has entrusted the experimental project of preparing micro zoning map of Jabalpur to Geological Survey of India and NGRI. The micro zoning, which was not done for any other city in the country, would help taking all precautions while constructing buildings in a given region as the thickness of sedimentary cover there can be clearly assessed. The Jabalpur experiment, which is nearing completion, can be replicated at other places too.

It should be made mandatory on the part of builders to follow the specifications while constructing buildings in quake-prone areas and there should be a mechanism to keep a close watch on builders. Since most of our population live in rural areas, methods of improving performance of non-engineered structures should be implemented. Cost effective measures like putting steel support to the horizontal walls and making the roof very light should be taken up by the builders.

Though the advanced technologies and the on-going research are expected to help scientists to make a limited forecast of quakes for some regions in the next 15-20 years, the forecast would not be possible for all areas.

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PART – III
IT IS IMPOSSIBLE TO PREDICT EARTHQUAKES

Prof. V.K.Gaur *

It was probably difficult to predict the Gujarat earthquake but the magnitude of the calamity could have been reduced with 'diagnostic tools', said earthquake expert Prof. V.K.Gaur.

Talking to The Hindustan Times, Prof. Gaur, a senior scientist at the CSIR Centre for Mathematical Modelling and Computer Simulation, said such diagnostic tools had helped prevent disasters elsewhere.

For instance, an earthquake measuring 7.0 on the Richter scale in California in 1988 has caused fewer than 10 deaths. In contrast, the Maharastra quake of 1993 that measured 6.3 killed over 10,000 people, and now the toll in the Bhuj quake is rising.

Prof. Gaur explained the concept of 'diagnostic tools' and said that areas vulnerable to earthquakes should be studied and a risk assessment of each region should be prepared. Based on this, the government could recommend specific types of construction of buildings, disaster management groups and a permanent centre that could constantly monitor the situation based on the risk perception.

This could be done by passing a 'Natural Disasters Act' that would help focus on disaster management, including high-risk quake regions such as Gujarat.

Prof. Gaur headed a high-power task force of scientists that the government had set up in May 1999 to study the setting up of an Earthquake Risk Evaluation Centre (EREC). The task force submitted an exhaustive report around November 1999. However, it is not clear whether the central government has implemented any of the recommendations.

Task Force Suggestions

- Enactment of a National Disaster Mitigation Act.
- Bureau of Indian Standards should publish relevant codes for earthquake resistant constructions in local languages.
- Diagnostic tools should be developed to assess earthquake-prone regions and a suite of risk maps for specific areas should be generated.
- Advance planning in a systematic manner must be drawn up for earthquake-prone regions.
- A well co-ordinated executive agency should be equipped to continuously supervise and monitor the risk-prone areas.

Source : The Hindustan Times, dated 29.01.2001 .

Prof. Gaur, a former chief of the Indian Institute of Astrophysics, said that these diagnostic tools could be implemented only if high fidelity observation systems are set up with online connectivity, so that any indications of an earthquake could be immediately followed up.

He said that it was only once that an earthquake prediction had come true. The year was 1974 and authorities in the Han Cheng region of China noticed earthquake related activity. They asked residents to stay out of their houses on a particular night. A couple of hours later, there was a massive earthquake and the people were saved. "The quake could have occurred anytime, even 10 years later than predicted. So, it was a rare chance that it happened when predicted. Such a prediction has never been repeated since", he said.

Prof. Gaur said an earthquake was a 'critical phenomena' that could be studied by physics. The precise event was near impossible to predict, he said.

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PART - IV
THE BHUJ QUAKE : Frequently Asked Questions

A.K.Shukla *

"India has been divided into five different seismic zones. The quake in Bhuj, which is in Zone V, and the tremors felt in Karnataka and Tamil Nadu are isolated phenomena and not linked in any way."

Tremors from the devastating earthquake in Gujarat continue to create panic, both literally and figuratively. Stories of immense human tragedy have been pouring in, especially from Bhuj and surrounding areas which have borne the brunt of the terrible impact. The quake has inflicted untold pain and suffering on thousands of people who were caught unawares and unprepared. The India Meteorological Department in New Delhi is the national agency for detecting and locating earthquakes and for the evaluation of seismicity in different parts of the country. **A.K.Shukla**, director of its seismology division, provides answers to some frequently asked questions (FAQs) about the quake. He spoke to **Saira Kurup** :

There have been several major earthquakes in India over the past one decade – Uttarkashi in 1991, Latur in 1993, Chamoli in 1999 and now's it's Bhuj. Does this indicate an upsurge in seismic activity in recent times ?

No, it does not indicate any increase in seismic activity. The whole globe is divided into 12 seismic plates. Earthquakes are normal and expected phenomena. Due to the constant movement of plates of the earth, ' deformation' is caused which results in the generation of strain energy. When the energy is released, it generates seismic waves which cause vibrations or quakes on the surface of the earth. Stress and strain builds and recedes in the neighboring faults each time a surrounding batch of rock snaps under the pressure of earth's continuously moving plates.

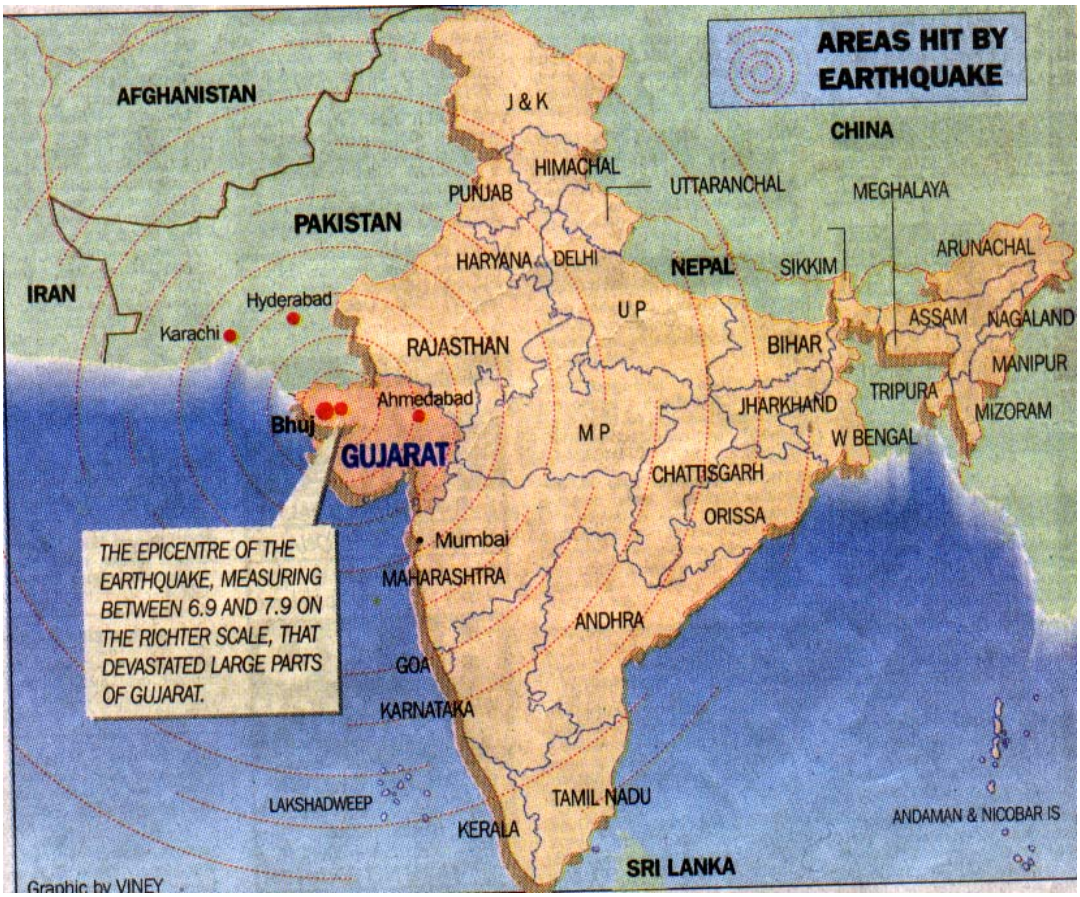
The Indian plate is moving in the North-Northeast direction and colliding with the Eurasian plate along the Himalayas. All these places where quakes took place in India are high seismic zones.

Tremors were felt in Karnataka and Tamil Nadu a few days after the Bhuj quake. Are they linked in any way ?

India has been divided into five different seismic zones with respect to the severity of the earthquakes. Of this, Zone V is seismically the most active region where earthquakes of the magnitude of 8 or more on the Richter scale could occur. The quake in Bhuj, which is in Zone v and the tremors felt in Karnataka and Tamil Nadu are isolated phenomena and not linked in any way.

Why can't quakes be forecast with all the advanced technology that we have.

Source : The Times of India, dated 01.02..2001 .



Earthquake prediction is not yet scientifically possible with reasonable accuracy in terms of location, time and magnitude. The technology is not advanced enough yet. But what we are doing is to intensity monitoring of seismic activities. Our efforts are to inform the authorities concerned of a quake, after it has happened, as early as possible so that relief and rescue efforts can be mobilized to keep the damage to life and property to the minimum. In case of the Bhuj quake, we informed the authorities within 15 minutes.

We could predict that an earthquake is likely to hit an area during the next ten years, but that would not be of much help.

What is the role of the Indian Meteorological Department in 'seismic studies?'

Our objective is to pinpoint the epicenter of the quake so that relief operations are mobilized. For this, the IMD has 55 observatories round the country; of these 34 are digital and the rest are analog observatories. Ten have been upgraded to the standards of the Global Seismograph Network and are connected to the Central Receiving Station (CRS) which records observations round-the-clock. The upgraded observatories record data in the digital mode.

Seismographs record the ground motions. For Delhi, there is a digital seismic telemetric network of 16 stations which are connected to the CRS. Data from these stations are coming directly to crs in real time, i.e. immediately. The dense network around Delhi can record tremors measuring as low as 2-2.5 on the

Richter scale. The digital network was put in place after the killer quake in Latur in 1993. the first seismological observatory was established by IMD in Kolkata as early as in 1898.

How can we reduce the impact of quakes in urban areas?

It can be said that quakes don't kill people, buildings do. Earthquakes cause widespread disaster and loss of human lives primarily due to the collapse of structures or buildings. The design seismic coefficients set by the Bureau of Indian Standards should be adopted in all types of construction as far as possible. Construction of earthen houses random rubble masonry and brick work in clay should be avoided. Steel reinforcements should be introduced and the roofs and ceilings should be kept as light as possible. After the Bhuj experience, government officials are now gearing up to enforce these codes in the Capital.

Can human activity like building dams and conducting nuclear explosions trigger quakes?

Earthquakes originate too deep-some are as deep as 700 km – inside the earth to be influenced by human activities. But there are some dams that are giving induced seismicity. A National Geo-physical Research Institute study has shown that the Koyna and Warna dams, which are close to each other, are causing induced seismicity in the region. On the other hand, the Bhakra dam, one of the largest in India, has shown no such indications.

Why is there so much confusion over the magnitude of the Bhuj quake?

The IMD recorded it as 6.9 on the Richter scale, China as 7.4 and the US as 7.9 ?

Magnitude is measured on the basis of the ground motion recorded by an instrument and applying standard correction for the epicentral distance from the recording station. It is related with the logarithm of amount of energy released by an earthquake and expressed in Richter scale. Epicenter is the point on the surface of the earth vertically above the originating place of an earthquake. This point is expressed by geographical latitude and longitude.

Earthquakes are classified as slight, moderate, great and very great on the basis of their magnitude – slight quakes measure up to 4.9 on the Richter scale, moderate ones are between 5 to 6.9, great one are between 7 and 7.9 and very great quakes measures 8 and more. The Uttarkashi, Latur and Chamoli quakes were all moderate ones.

The Bhuj quake was caused by the movement of the faults in the earth. Yes, there has been some controversy over its magnitude. The IMD has an observatory very close to the epicenter of that quake. Hence, we measured the quake under the ground and gave its body wave local magnitude on the Richter scale. The US observatories were far from the quake's epicenter and measured the surface wave magnitude. The differences were in the frequency wave.

Are remote-sensing satellites being used to detect the movement of plates ?

That is on the research side and we are not involved with it.

PART – V
TAMING THE TREMORS

Sanjay Singh *

Better Planning Can Save Lives

EARTHQUAKES don't normally kill people. Faulty construction and poor crisis management do. We have seen the same cycle of tragedy unfolding at Latur, Uttarkashi, Jabalpur and now Kutch. We have seen homes becoming graveyards, hospitals turning into death traps. The real tragedy is that the death toll could have been so much lower, if only some basic principles of disaster management had been followed.

Most casualties in an earthquake occur due to walls collapsing and crushing people. If the walls could be made to withstand the shock waves of an earthquake, half the battle would be won. In many countries there has been tremendous progress in developing earthquakes-resistant buildings, especially in the vulnerable areas of Japan and the US.

In notoriously earthquake-prone San Francisco, containers of layered steel and rubber are situated below the foundations of the buildings to act as shock absorbers. And in Japan, scientists have created 'smart buildings' equipped with sensors to detect and counter quake tremors. The sensors in the basement pick up the tremors and immediately send the information to a computer. The Computer then activates a hydraulic power device, which promptly shifts the building's centre of gravity with the help of a steel weight.

All these safety measures are taken for granted abroad. But in India ,one constantly hears about how such precautions are economically unviable. It might surprise most people that the department of earthquake engineering at Roorkee University has been developing low- cost earthquake resistant technology for years now. It has even printed a manual , which prescribes low –tech solutions like reinforcing the corners of walls – which bear the brunt of the shock - -with a simple steel bar bonded to the edges with mortar.

The department- - headed by Dr D.K.Paul- - also recommends using concrete reinforcement to keep the walls together during an earthquake. Although the walls would sway with the shock waves, they would not crack or collapse. The Roorkee University team is now working on a model for earthquake – proof construction of high –rise buildings. According to research conducted by the department, buildings can be easily designed to withstand earthquakes with a magnitude of 10 or more on the Richter scale.

Such buildings would be ideal for areas like Bhuj, which fall in seismic zone 5. It must be mentioned here that there are five seismic zones in India , ranging from one to five. The probability of an earthquake measuring eight on the Richter scale is the least in Zone 1 and increases progressively thereafter. Here is a chilling fact : Delhi has a Zone 4 rating .

Source : The Times of India, dated 31.01.2001 .

The department's work on high rise buildings has so far been largely confined to the laboratory, though it expects to glean a lot of data from the Republic Day tremblor . However, if you think its work is restricted to theoretical rambling ,think again. After the Jabalpur earthquake in 1997, the Housing & Urban Development Corporation decided to adopt two villages ,Ghana and Kausamghat for rehabilitation . In fact, Kausamghat had to be re-built virtually from scratch. Using in-puts from Roorkee University, Kausamghat has been developed as a model village for earthquake survivors. Yet, ironically villagers refused to believe the new houses were safe because of lack of awareness about earthquake-resistant structures.

But why blame the villagers ? Most of us tend to be blissfully complacent . Occasionally, we get a rude jolt. But soon enough, we slide back into our usual casualness. According to Tranjot Kaur, senior fellow at HUDCO, "just spend 10 per cent more on house construction and that can become a life long insurance . We are working in the area of training masons about good building practices, but the main thing is stringent implementation of building laws by big builders." Yet, how many cases do you know of builders willfully violating those very laws and getting away with it ?

Still, it is really pointless lamenting the past. So let's look ahead to the future and see what can be done. For starter's let's focus on the immediate priority- - accommodating the homeless . The Central Building Research Institute (CBRI) has developed designs for temporary houses. After an earthquake, it takes time to construct new buildings. In the interim period, temporary structures can be set up speedily to provide shelter to the people who have been rendered homeless.

The temporary corrugated sheet structures designed by CBRI are easy to install, as they can be fixed on nuts and bolts. These were successfully installed in the aftermath of the Uttarkasi earthquake. Yet they were conspicuous by their absence immediately after the Kutch earthquake- - largely because the scientists who designed these structures do not have direct linkage to procuring agencies. That is another of India's tragedies- - we not only do not learn from previous disasters, we actually forget things that came in handy.

Looking ahead though, is there not any way to ;prevent such disasters, or at least minimize their havoc ? Certainly, by following a simple technique called micro-zonation to identify the most vulnerable areas in a city. The obvious next step is to ensure that major structures don't come up in these areas. According to P.S.Mishra of the Geological Survey of India ," Micro-zonation is the most important disaster management tool . It is the first step towards careful planning for new construction. "

Reliable communication systems are imperative for timely and effective disaster control. Yet, virtually the entire communication network collapsed in the wake of the Kutch earthquake. At this juncture, HAM sets came in handy . Working on the principle of wireless technology, with a world wide range, HAM radio is a natural communication technology during disasters. Yet, apart from a few dedicated operators , how many people do you know who are capable of using it ? Maybe it is time to start promoting it actively in schools and colleges.

Finally, let us not forget the importance of preparation. In California, which lies on the top of the infamous San Andrea's fault, communities are regularly reminded about safety precautions. Storing heavy items near the floor level, fixing decorative items like statues and artifacts and putting brakes on heavy furniture are par for the course. In Japan, school children regularly carry out earthquake drills. Despite all manners of technological development, no one can yet predict an earthquake with pin-point accuracy . Which is why, even if you 're not a boy-scout ,it's a good idea to always be prepared.

(* The author is a geologist and has made documentary films on earthquakes)

HEALTH ISSUES

UNNIKRISHNAN P.V.
EKBAL B.
MIRA SHIVA

If anything is sacred the human body is sacred.

-Walt Whitman

All disasters, natural or human-made, leave a trial of death and illness. While they undoubtedly have a long-term impact on the collective body and mind of the community, the immediate wounds and shock, left unattended, may lead to partial or complete disability and psychological trauma. Furthermore, if food, nutrition, water, and sanitation issues are ignored during the initial emergency phase, the vulnerability of the affected community may be amplified and their impact may include epidemics and starvation.

In India, Emergency Medical Relief, a constituent of the Central Government's apex mechanism, plays a very low-profile role. Leading NGOs, including health-based NGOs are yet to factor disaster-related health needs into their agenda. They mostly end up doing band-aid medical relief in the crucial first weeks, by which time it is too late to do anything but repair mistakes.

Under Studies

Compounding all this is the fact that disaster medicine is not a subject focused upon in medical/social work curricula even in states that have a long history of disasters. In fact, medical colleges even in the vicinity of disaster sites tend to send their doctors to provide short-term `emergency' medical relief of a philanthropic nature, rather than planned disaster mitigation. While disaster medicine has yet to emerge as a discipline of specialization, medical assistance during disasters has not yet become a mandate of medical colleges.

The same is more or less the case with institutes that teach and train paramedics and health and social workers. Placing medical students in rural areas, especially disaster-prone areas, during their internship period may be one way to familiarize them with specific needs in disaster situations.

Professional health and medical bodies such as the Indian Medical Association (IMA), the Indian Association of Psychiatrists, and the Indian Association of Physiotherapists are yet to place disaster-induced health concerns in their organizational and operational agenda.

This is one of the reasons why disaster-related disability is such an under-studied and under-monitored area in India. There is a glaring omission of disaster-induced disability rights in the `Disability Bill'. Disability specialists, leave aside anyone else, are yet to raise their voice on this issue.

Health Consequences of Disasters

Health consequences vary according to types of disaster. At one end of the spectrum, vector-borne epidemics and waterborne diseases are the short-term and long-term health impacts of floods; at the other, repeated cycles or eruptions of violence may actually be, according to mental health experts, a fallout of ethnic conflicts. The main direct public health impacts of a cyclone are drowning and injuries. Indirect impacts include waterborne diseases, diarrhea, dysentery, hepatitis and poliomyelitis, respiratory infections, snakebites, skin infections, and conjunctivitis.[1]

It is a well-established fact that diarrhea diseases are a major cause of mortality and morbidity in emergencies and studies have shown that they contribute to between 25 to 50 per cent of all deaths.[2]

Furthermore, disasters often give rise to vector-borne diseases. Water-borne diseases are common in flood and cyclone disasters, and the ensuing waterlogging often leads to epidemic outbreaks. The 1996 flash floods in Rajasthan killed about 100 people. In the subsequent months, more than 1,000 lives were lost to a malaria epidemic outbreak. The epidemic brought to the fore the negligence of both the government and the NGOs in a region traditionally uncompromised by waterborne diseases; the people were inordinately vulnerable and the flood waters became an ideal breeding ground for mosquitoes.

Health is not a condition of matter, but of mind……..

Mary Baker Eddy

At the other end of the spectrum, the psychosocial consequences of disasters routinely escape the attention of health planners and workers. Recent joint research by the National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore, the National Centre for Disaster Management, New Delhi, and Oxfam has shown an increase in alcoholism, divorces, and suicides following some of the major disasters of the 1990s.

A string of disasters tells upon the general public health, particularly given that the public health system in India is a study in vacuousness. The 1990s, in fact, saw a further weakening of the national public health care system, with the country going through a resurgence of malaria and tuberculosis epidemics.

Misplaced Priorities

The following is a brief exposition of problems faced by voluntary health workers at the grass-roots.

Preventive and Curative Care

Ideally, emergency medical intervention must take broad long-term perspectives within the principles of primary healthcare. The current approach in medical colleges and state medical services does not give adequate importance to disaster medicine.

Food and Nutrition

At the scene of a disaster, in the first few days food is usually in abundance. But supplies from charities and philanthropists in India and abroad are often off loaded at population pockets located nearer the link roads and highways, or those providentially highlighted by the media. In the absence of traffic policing it is the more remote villages that suffer. There has not yet been a serious, systematic move to streamline or even to rationalize, this very human, virtually reflexive, gesture of supplying food to the needy. For instance, following the 1993 Latur earthquake, cartons of imported milk cans lay unused for months only because they had labels with instructions in a foreign language indecipherable by both aid workers and locals.

Thus, perversely, the `unending stream' of edibles is not necessarily based on a proper assessment of the food and nutritional needs of the adequate nutrition, especially to the most vulnerable sections such as children and women, can avoid a situation that may warrant supplementary and therapeutic feeding.

An alternative to this scenario of fulsome waste would be to inform suppliers of the immediate necessities and to ensure the equitable distribution of food. For this, local NGOs and community-based organizations will have to play a proactive role.

A review of food relief in the wake of recent disasters showed that mostly prepared food/dry rations form the bulk of provisions. But the relief package falls short of the minimum calorific standard stipulated by international relief agencies. Disturbingly, the special nutritional needs of pregnant women,. Lactating mothers, and children are usually ignored in food distribution interventions. Evaluations of supplementary feeding programmes for ethnic conflict-displaced people in the Kokhrajhar area of Assam point out that today's relief manuals make no special provisions for foods for children and infants, perhaps one major reason for the inordinately high infant and child mortality rates amongst the displaced.

Water and Sanitation

Ignoring public and environmental health has perhaps the greatest mistake with reference to cyclones. It has been found that improvements in water quality alone can reduce childhood diarrheoa by no more that 15 per cent. As for the rest, the most significant reduction was attributable to safer excreta disposal (36 per cent) and washing of hands, food protection, and improvements in domestic hygiene (33 per cent).[3]

Pressure on water resources, and inadequate sanitation and waste disposal provide ideal conditions for the spread of water-related diseases such as diarrhoea, dysentery, typhoid, and scabies. Water supply in sufficient quality and quantity is imperative.

Medical Aid

During the Marathwada earthquake, health workers reported the dumping of outdated and post-expiry-dated medicines. Evaluations by some NGO-run

emergency operations have noted that hazardous and banned medicines and highly irrational medications – aphrodisiacs, in one case – often end up in the emergency drug kit. The agencies must take a bold and unequivocal decision to stick to global, across-the-board and consensual medicinal standards in disaster situations, such as using only WHO-approved essential drugs. In the same spirit of rationalizing medical relief, it is time to evolve, for the Indian context, a `health code for emergencies' that would incorporate rational and tried-and-tested practices from traditional systems of medicine.

Psycho-social Consequences

Disasters strike at the very roots of human emotions and invariably cause uncontrollable psychological reactions. The WHO has reviewed the dimensions and magnitude of the psychosocial consequences of disasters, and possible interventions to manage them.[4]

Professor R.Srinivasa Murthy, a psychiatrist at NIMHANS opines that psychosocial coping depends on the ability of the victims to adjust psychologically, the capacity of community structures to adapt to crises, and the individual and institutional help available. At the individual level, post-disaster psychosocial trauma includes anxiety, neuroses, sleeplessness, and lethargy. At the community level, psychosocial trauma manifests itself in the form of school dropouts among children and high rates of alcoholism and divorce and suicide among adults.

Institutional Lacunae

The Central Government's Emergency Medical Relief division still does not find an active position in disaster planning. In the wake of the 1993 Marthwada earthquake, for instance, the Bombay High Court had castigated the Maharashtra state health department for failing to provide primary healthcare, water, and sanitation to the affected people, but little progress has since been made.

In contrast, at the international level, the health constituency has long optimized its crucial role in emergency disaster operations. Specialist agencies such as the International Red Cross and Red Crescent Movements, the Medical Emergency Relief International Network, and Medicines Sans Frontiers have always been in the vanguard, establishing and holding a lifeline for the disaster-affected.

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IDENTIFICATION AND REHABILITATION OF VICTIMS

H.S.Brahma, IAS

INTRODUCTION

Natural Disasters are like any other Natural Resources. It is only in a negative form. It can strike suddenly in any place location with or without warning. It leads to temporary disruption of all social, economic and community life. Besides, it will also require victims. In the absence of victims, there can not be any disaster. Larger the number of victims, its severity will be felt. In fact, as long as human beings survive in this planet, the disaster will continue to haunt the mankind, rather it will continue to increase due to increase in population besides due to poor response mechanism or lack of coordination between the various Governmental Organisations.

DISASTER

Quick onset	Slow onset	Industrial Technological Disaster
Earthquake,	Flood	Nuclear Bombs,
Cyclone	Drought,	Reactors etc.,
Hailstorm,	Post attack,	Chemicals.
Tsunamis etc.	Glacial movements	

Not all crises become disaster

A disaster is a crisis that outstrips the capacity of a society to cope with it. Some societies can develop both social / economic systems so that they do not require any outside help or assistance. That is, they do not have experience or suffer any disaster. Poverty is the most latent and obvious physical vulnerability. Poor families often live in a dangerous or hazardous area. Economically they live in a precarious condition, in very few resources for preventing or recovering from such. They live in marginal land which is poor in fertility. .Houses are of poor quality and their children and family members are poorly fed and under-nourished. The children are mal-nourished, have poor education and therefore few opportunities for employment. In general, the women folk are more vulnerable than men in any grim disaster situation . They have a very few resources, poor education and lack of mobility due to social structure. As a household manager of the family, women generally tends to cut down their share of food consumption during the time of shortages in order to preserve or provide more to their children,thus, putting themselves in very high risk of mal-nutrition. It is also our experience that homogeneous society in terms of caste, class or religious fraternity have a better chance of facing the disaster, compared to a society or class which is fractured and divided in lines of caste, colour and class or religion etc.

TYPES OF RISK

(1) Injury to people
(2) Health impact

(3) Environmental affect
(4) Property damages
(5) Loss of profit in business industries
(6) Loss of public image
(7) Prosecutions – (Union Carbide case)
(8) Loss of employment

RISKS:

Sources of risk - Hazard

Technical risk - Severity & Likelihood
Sociological risk - Severity & outrage factor

DEALING WITH DISASTER -SUMMARY

1) Natural Disaster can strike suddenly, unexpectedly and with or without warning. It leads to temporary disruption of all social, economic and community life
2) Large number of agencies like Revenue, Police, Health, Transport, Electricity, Fire brigade have a part in dealing with disaster and rehabilitation.
3) Effectiveness of the response depends upon how well the emergency services both Local and Central Governments have harmonised and fine tuned their preparation and exercised their preparational arrangements - emergency procedures.

MANAGEMENT ISSUES:

- Hazard assessment - to know the expected range of events on site-specific basis for Planning Operational response.
- Vulnerability & Risk -to know the accurate site and target.
- Prevention- To take preventive steps
- Community Awareness -Training and Perceptions.
- Warning - has to be very effective and accurate
- Logistics and transportation - Complete evacuation of population.
- Relief Rehabilitation: to extend appropriate relief / rehabilitation measures.

ROLE OF COORDINATION

STATE
DISTRICT
SUB-DIVISION
TALUKA/MANDAL
PUBLIC

Reduction in loss of life and properties, Search and rescue 0perations	Channelise the efforts of all towards logical end.	Utilise the resources in most effective way.

VULNERABLE SECTIONS :

1) Children, women/aged and disabled persons.
2) Landless poor Agriculturists, Labour, Artisans and Daily wage workers.
3) People living in low lying areas.
4) Fishermen community living along the coastal zone .

ADMINISTRATIVE RESPONSE TO DISASTER BY THE STATE

- State is responsible towards protection of life and property of the citizens.
- State with its limited resources at its command has to indemnify the loss sustained by the individuals during the Natural Disasters.
- To extend relief and rehabilitation packages to the more vulnerable sections of the Society .
- To extend provide loans and other allowances to the individual entrepreneurs to re-commission re-start the economic activities.
- It should be the endeavour of the State Government to prepare emergency management action plan so as to mitigate the hardship caused due to the Natural Disaster.
- Disaster Management Plan should be development oriented, rather than Post Relief Operation Plan.

EFFECTS OF DISASTER ON STATE

- Disruption of public and community life.
- Halting of National Developmental Programmes due to diversion of scarce funds. Repeated
- disasters provoke negative growth .
- Image of the Government is at stake.
- Appreciation condemnation by DONOR .
- Loss of face in International Community .
- Collapse of Government

Once the initial impact of disaster is blown over, the Administration will face its first major test of its response mechanism. Maximum strain will be faced in providing relief and rescue operation besides restoring the existing life line. They are:-

1. Immediate restoration of existing communication network both surface and wireless communication .
2. Medical support to affected victims as well as supplies.
3. Provision of safe drinking water in the affected areas.
4. Provision of food supplies and opening of community kitchen in the affected areas.
5. Restoration of power supply.

In short, maximum effort should be made to restore normalcy as soon as possible. Search and rescue team has to be formed in advance and despatched immediately to locate the affected villages habitation and render necessary assistance to injured persons besides removing the dead bodies. Normally, teams are constituted with 4 to 5 officials with supporting staff , comprising of Revenue, Police, Medical and one engineering staff .This composition will depend upon the immediate availability of adequate staff in the affected areas. Generally the identification of dead and injured are attended to by Revenue staff assisted by Police, while burial and mass cremation is attended by Police with the help of local volunteers or villagers. Burial and removal of dead bodies of animals are attended to by the veterinary staff, sometimes assisted by voluntary workers(Non Governmental Organisations) etc.

Once contact is established with the affected areas, one must be careful enough to understand that most of the affected victims will be under terrible stress - they will be dazed and dumb at the moment due to loss of near & dear ones. One should desist from asking too many personal questions, unless the other party is prepared to volunteer or share additional information .

In most cases, one could notice young women becoming widows or vice-versa, weeping orphaned children and large number of crying elders in the village.

RELIEF & REHABILITATION:

Having stepped into a New Millennium, there is an urgent need to review and re-orient our Relief and Rehabilitation Programme. Firstly, we must accept that " A stitch in time, saves Nine" -and prevention pays. However, it would pay only when it is properly invested on community .The cost of Disaster Relief in our country is going up in geometrical proportion. Most of the States have exhausted their share of calamity relief funds and are very much dependent on Government of India for additional relief funds. In plain and simple language it means that the developmental funds are being diverted to Disaster Relief Operations.

Another important concern for all of us is about the way relief is handled and managed by our Administration.

Firstly, relief is given out as a charity to affected families and not taken as an opportunity for permanent investment for preventing future recurrence of disaster.

Secondly, cost benefit analysis or social audit/accounting etc., are not being conducted independently to assess the effectiveness of such relief.

Thirdly, a detailed on site enquiry should be conducted by an independent authority to assess whether the response was appropriate, relief extended was just

and to ensure that any flaws in operational preparedness was rectified to avoid recurrence of lapses in Administration.

Fourthly, while extending relief supplies to affected families, it is desirable to involve local elders/Non-Governmental Organisations to reduce the cost of operation and to expedite the distribution.

REHABILITATION

While relief works continue, it is the sole responsibility of the State to prepare blue print for permanent rehabilitation of the affected families. This rehabilitation could be done in two ways :-

1. Structurally
2. Non-structurally

In conclusion, while one is in the job of a permanent rehabilitation of the victims, one should always apply “common sense”.

THE CARE AND TREATMENT OF DISASTER VICTIMS

1. The care and treatment of those involved in a disaster lies at the heart of the response. This applies to the care and treatment not only of those injured and traumatised and their relatives and friends, but to everyone involved in the emergency response who may be affected by their experience.

2. It is possible that the survivors or casualties may not always be found near the site of the disaster. For example, a member may suffer psychological injuries and wander off. It is therefore important to consider the need to search the surrounding area. If this is necessary the task should normally be coordinated by the police. Where the task may be labour intensive and cover a wide area, assistance should be sought from local authorities across the emergency services, from the military or from volunteers etc.,

CARE OF INJURED SURVIVORS:

3. Those who have survived a disaster uninjured (or with only minor injuries) may nevertheless be traumatised and suffering from shock, intense anxiety and grief. They will, therefore, need to be treated with great sensitivity. Hence, utmost care should be taken to ensure that the person is not put to further psychological or mental stress.

4. Survivors will often be able to provide crucial information about what happened and may be important witnesses at any subsequent trial or inquiry. A balance has to be struck between the requirement to gather evidence from survivors and the reluctance of some to remain at the scene of their distress. For example, prioritising information might help, so that only names and addresses are taken from those anxious to leave, with further details being obtained later. Information will usually be gathered at the survivor reception centre, a secure area to which all survivors who are uninjured or have only minor injuries should be taken.

5. Survivors are usually frantic for information about the incident, number and location of other survivors, information about their own friends, colleagues and relatives and what will happen to them next and when.

Their initial needs are likely to include support in their distress, food, drink, first aid to treat minor injuries and perhaps spare clothing and changing, washing and toilet facilities. They may also need immediate social and psychological support, including help in finding temporary accommodation, in contacting family and friends, with transport back home and financial advice and assistance. It is possible that some apparently uninjured survivors will later display adverse symptoms. For this reason medical and social services staff should be present at the survivor reception centre and if necessary, at rest centres. The responsibility for organising, staffing and providing logistical support at survival reception centres usually rests with the local authority. Social services will need to coordinate both the professional and voluntary welfare response, while the police maintain order and security.

THE INJURED

6. Injured survivors may be taken to a casualty clearing station (CCS) or local Public Health CentreIDispensary where medical and para medical personnel will carry out triage and any appropriate stabilisation measures, before ensuring that casualties are evacuated in accordance with priorities for hospital treatment.

7. Responsibility for ensuring the proper establishment of medical communications on site, the transport of medical teams, the distribution and replenishment of medical supplest in first aid. the provision of all ambulance resources necessary for the on going treatment of casualties and, liaison with the Medical Officers(MO) for conveyance of casualties to the receiving hospital(s) all lie with the MO.

POLICE CASUALTY BUREAU

8. In the event of a disaster, the role of the police casualty bureau is to provide a central contact point for all those seeking or providing information about persons who might have been involved and to collect data and collate all records. As part of this process the police will send documentation teams to each receiving hospital, the mortuary and the survivor reception centre as well as to next of kin. Good coordination of this activity is essential to avoid unnecessary duplicated visits, particularly to next of kin.

FRIENDS AND RELATIVES

9. Experience of disasters has shown that if they believe their friends and relatives may have been involved, many people will travel to the scene or to meeting points such as travel terminals. If necessary a reception centre for friends and relatives will be established by the police (usually in consultation with the local authority and commercial, industrial or other organisations concerned) and staffed by the police, local authority and suitably prepared voluntary organisations, including representatives of churches and other faith groups. The fullest possible information should be given to enquirers seeking news of those involved in a disaster whilst taking care to preserve the privacy of the individual. Experience has

shown that this is best done in a controlled way with general enquiries being referred to a specific source. This helps to ensure consistent and non- contradictory information is given out. Friends and relatives who may be feeling intense anxiety shock or grief need to be treated with sympathy and understanding, and experience has shown that the most effective way of caring for next of kin is using one trained police officer together with one trained social worker for each family. Access to the reception centre should be controlled to prevent those inside being disturbed by the uninvited media representatives or onlookers.

SOCIAL AND PSYCHOLOGICAL SUPPORT

10. There will be a need to provide immediate social and psychological support to some of those who are suffering from the effects of the disaster, who may include members of the emergency services, volunteers as well as others called upon to respond. Social and psychological support services should be set up in the immediate after math and will undoubtedly be needed in the longer term. Much will depend on the nature and scale of the disaster and local circumstances . Provision of this support is through local authorities, many of whom maintain crisis support is, specially trained to respond to the particular personal problems associated with a disaster.

CHILDREN

11. A special approach is needed if children are caught up in a disaster. The emotional effects on children are not always immediately obvious to parents or school staff. At times, children find it difficult to confine their distress to adults, often because they know it will upset them. In some children, the distress can last for months and may affect academic attainment. All involved with children need to be aware of the range of symptoms that children may show after a major trauma. They should note any changes in behaviour and alert others as set out in contingency plans.

DISASTER – REDUCTION(STEPS)

- Natural Disasters are like Natural Resources, only it is having negative effects.
- There is every scope to reduce the effects of disaster. Experience shows that by better planning and coordination both structurally and non-structurally, damages to life and properties could be reduced substantially.
- Such of those States which links developmental activities with the disaster mitigation, the result has been minimal losses to life and properties.
- Politicians do not take into account the long term investment proposals under disaster mitigation due to lack of awareness and also least attraction to heavy funding.
- Lastly while implementing various schemes in disaster-prone areas, one should apply common sense.

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MANAGEMENT OF CYCLONES IN ANDHRA PRADESH

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INTRODUCTION

India has experience of facing Natural calamities in various parts of the country almost every year. Sometimes there have been more than one disaster affecting the country.

COAST LINE OF ANDHRA PRADESH

The state of Andhra Pradesh has a long coast line of approximately 1030 Kms and has an equally long history of cyclones of varying intensities over the last 100 years. The coast line with Srikakulam in the North and Nellore in the South has faced cylones on an average of one to two cyclones a year. All districts except Vizianagaram ,West Godavari and Guntur have more than 100 Kms of sea coast.

The Terrain and Vulnerability

The terrain is sloping generally from West to East and most of the area in the districts is plain except for portions of northern districts. The main lines of communications like the National Highways, Railways , state roads and the connecting roads to the villages literally run across the natural drainage and has a lot of bearing on the present scenario of flooding both due to rains and due to cyclones. Along this large coastline as per the figures of 1980 there are 2482 villages having a population of 54.33 lakhs. In the 5 Kms zone from the coast are 500 villages with a population of 11.63 lakhs, between 5 -10 kms are 601 villages with 15.02 lakh population and between 10 -20 kms are 1381 villages with population of 27.68 lakhs. As is clear from this disposition, the area immediately close to the coast is comparatively less populated, less accessible due to poor communications and with negligible availability of drinking water . The area astride the two major rivers Godavari and Krishna consist of extensive flat delta plain with the rise of ground being 4 to 6 feet only above the mean sea level. These areas are vulnerable to storm surges. However there are small areas where there are strips of high ground running almost parallel to the coast which offer relative safety from inundation caused by storm surge. Apart from this, there are other areas along the coast where minor rivers and streams, which back up with the tides rendering adjoining areas liable for inundation. The people living in the belt of 20 kms from the coast generally comprise of Fisherfolk and weaker sections and the majority have thatched type of houses which are very vulnerable to the wind pressures of cyclonic gale which exceed 100 kms per hour. There are very few permanent buildings by way of temples, churches or the odd school, which can afford some protection to the people from the effects of cyclones. Since 1980 there has been

growth in population and the corresponding increase in structural assets which are vulnerable to the hazards of cyclone.

History of Cyclones in A.P.

The State has a long history of cyclones and floods and the people have been facing their fury for many years. The state has experienced 74 cyclones in the last 105 years (1892 to 1996) and every time they have caused considerable amount of damages. A brief look into the period from 1892 to 1996 during which the cyclones affected the coastal districts of the state is given in **Annexure -1.** During this period Nellore district was struck by cyclones 22 times, Krishna 16 times, Srikakulam 10 times, East Godavari 10 times, Prakasam 9 times, Visakhapatnam 5 times and West Godavari 3 times.

In the last two decades, we had three major cyclone storms which caused tremendous loss to human lives and livestock and colossal damages to properties of people and the Govt. The first one in **NOV 1977** caught the attention of the whole world due to the large number of human deaths- about 10,000 and in addition to very high losses to properties. The attention drawn to Andhra Pradesh from the rest of the country and the world prompted the State Government to look into the management of disasters seriously. A contingency plan for cyclones and floods on the suggested pattern as given in the C.D.M.C.'s report was made in 1981 and was updated in 1987.

The second major storm was in **May 1990** which affected all the coastal districts and Khammam, caused damages amounting to about Rs. 2300 Crores. The third one in **November 1996** was a severe cyclone storm which was small in comparison to the previous cyclones and affected mainly the two districts of East and West Godavari, but it caused greater amount of damage in monetary terms to the tune of Rs.2142 crores . The plan as it exists today is totally a reactive plan in that all actions are contingent on the event **-the cyclone.** All the focus is towards the time period immediately before , during and after the cyclone. It covers mainly the impact and post- impact periods only whereas the ideal approach towards management of disasters is to address the whole series of actions which include Preparation, Impact , Rescue, Relief ,Restoration ,Rehabilitation Reconstruction and Mitigation processes. The preparation part referred to here means that it should include the long term activities which have the mitigation components and not the short term application as is being done in the present contingency plan for Cyclones and Floods.

Disaster Management

Disaster management should aim at reducing the impact of the three main characteristics and effects of a cyclone, which are- High speed winds, Storm Surge and Floods caused by Heavy and wide-spread rainfall. The focus therefore has to be on the following: -

a) Understanding the mechanism of formation, development, structure and movement of cyclones,
b) The capability of detecting cyclones while out at sea,
c) The capability to predict their movement and behaviour,
d) Capacity to warn vulnerable people in time,
e) Measures for cyclone preparedness both in advance and during a cyclone,
f) Relief and rehabilitation after the cyclone.
g) An integrated hazard mitigation policy dove-tailed into the development plan.

The first four are essentially based on meteorology and the rest are in the field of planning, organising, and implementation. For the sake of clarity a separate chapter on tropical cyclones is included to cover the aspects from (a) to (d) above. It will be found that most measures (e) and (f) above have been included in the state contingency plan for cyclones. The aspects covering (g) are now formulated by Disaster Management Unit (DMU) under the Revenue Department.

Losses on account of natural calamities are periodically causing such heavy losses on the state exchequer that the planned development is suffering serious set-back by a few years. The table below presents a few essential losses to give an idea of the enormity of the problem.

TABLE-1

DETAILS OF ESTIMATED LOSSES AND DAMAGES DURING CYCLONES FROM 1977 TO 1996.

YEAR OF CYCLONE	DISTRICTS AFFECTED	HUMAN DEATHS	LIVE-STOCK LOSSES	HOUSES DAMAGED	CROP DAMAGED (IN LAKH HECT.)	EST.LOSS (IN Rs.LAKHS)	REV EXP. (IN LAKHS)
NOV 1977	8	9921	431786	1014800	13.35	17200.00	5305.80
MAY 1979	10	638	257082	609400	0.73	18000.00	7814.72
NOV 1984	4	575	90650	320000	2.07	9489.93	4928.89
NOV 1985	7	16	0	3196	1.06	2426.12	2617.68
NOV 1987	12	119	0	110553	9.61	12648.77	5072.92
NOV 1989	5	69	7117	149112	0.62	4082.37	10178.00
MAY 1990	14	967	5170301	1439659	4.80	224776.00	13864.46
NOV 1994	7	172	512	79220	3.97	62593.18	2968.70
NOV 1996	3	1077	19856	616553	5.11	612925.00	30822.00
TOTAL		**13554**	**5977304**	**4342493**	**41.32**	**964141.37**	**83573.17**

Source: State Govt. Memorandums on Cyclones -Revenue(Relief) Dept. A.P. & Technical Library - Secretariat. The Andhra Cyclone of 1977 by Stephen P Cohen & C.V. Raghavulu 1979 Vikas Publishing House Pvt. Ltd.

Comments

1. The above table reveals that cyclone affects many districts depending on its characteristics and therefore the scope of damages extends beyond the confines of the coastal districts.

2. The losses in human lives has reduced in the years 1979 to 1989 and in 1994.This could possibly be to the increased awareness and the implementation of the Cyclone Contingency Plan 1981 by the State Government.

3. The loss estimates also show a corresponding decrease but the resources used do not bear a similar relationship.

4. The highest losses are recorded in 1990 when the cyclone was a large one and it affected the entire coast. In comparison the smaller cyclone of Nov. 1996 affected only two districts but the estimated cost of the damages has been almost equal to that of 1990 cyclone.

PART - II
TROPICAL CYCLONES

While there is a general understanding that a cyclone has the characteristics of high speed winds of the order between l00 to over 200 Kmph, that there is a tidal wave (actually a misnomer for storm surge) accompanied by torrential rain which causes heavy damages to a large area, the mechanics of why and how the tropical storm becomes so and the cause and effects need to be fully understood to enable the people in general and Administration to be able to take appropriate protective and preventive actions to reduce the damages. It is also important to draw a relationship to time and space of the event. This is essential to be able to focus the time frame available for preparation to meet the event and to influence the quality of developmental activities in a region.

The Global scenario of Cyclones

Tropical cyclones as they are called in India are known as typhoons, hurricanes and Willie- Willies in other regions of the World and generally occur in the tropics between 50^0 to 30° North and South of Equator. The profile of the cyclones World over is given in **Figure I.** It will be seen that 72% of cyclones occur in the Northern Hemisphere and 28% in the Southern Hemisphere. Out of the 72% cyclones in the Northern Hemisphere, Bay of Bengal has 5% (4) and Arabian Sea has 1% (1). East Coast of India has a ratio of 4: 1 proportion with the West coast.

Deployment of the cyclone System

Conditions favorable for formation of cyclones over the sea are as follows: -

- Sea surface temperature higher than 26°C.

- A pre-existing weak low pressure area.
- Corialis force greater than minimum (which corresponds to its value around 5 degrees latitude on either side of equator).
- A weak vertical wind shear in the basic wind flow.
- Upper divergence above the sea level system.

Due to above conditions, the air above the body of water gets heated up and causes a localised drop in atmospheric pressure. This is called depression. The warm air starts to rise and the surrounding denser air moves in to fill the vacuum created in the depression. This in turn gets heated up gaining speed due to the rotation of the earth. Therefore, a self-sustaining system is created and continues to grow in intensity. As the system develops in intensity it becomes a Deep Depression, then to Cyclone Storm, Severe Cyclone Storm, and finally Severe Cyclone Storm with a core of Hurricane winds. Tremendous energy is created by the system and due to earth ' s rotation the system travels across the sea. The movement of the winds is Anti-clockwise in Northern Hemisphere and Clock- wise in Southern Hemisphere.

The area of low pressure around which the winds move is called the "Eye" of the cyclone. This area can vary from 8-10 Kms to 30-50 Kms. This area is surrounded by a wall of clouds called as "Eye Wall" and can extend upto 50-100 Kms beyond the center of the eye. This is the most dangerous zone of the cyclone where the winds are strongest and clouds cause torrential rains. The wall cloud region can extend to distances as large as 500 Kms on either side of the eye. The wind speeds reduce as we go away from the eye to the outer edge. The special feature in cyclones in Northern Hemisphere is that dangerous and heavy winds persist to the right of the center (looking in the direction of motion). The implication of this is that the area North of the cyclone path as it crosses the A.P. coast will suffer more than the areas South of the path. A typical schematic representation of the vertical structure of a mature cyclone storm is shown at **Figure -2**

The storms are classified as per the International classification and are given in the Table below.

TABLE.I

INTERNATIONAL CLASSIFICATION OF STORMS

S.NO	TYPE OF STORM	WIND SPEEDS			
		kmph	knots	mph	m/s
1..	Depression	30-50	17-27	10.4-16.6	4.7-7.5
2.	Deep Depression	50-65	28-33	17.2-20.3	7.8-8.2
3.	Cyclonic Storm	65-90	34-47	20.9-28.9	9.4-13.0
4.	Severe Cyclonic Storm	90-120	48-63	29.5-38.7	13.3-17.5
5.	Severe Cyclonic Storm with core of Hurricane Winds	Above 120	Above 64	Above 39.1	Above 17.8

Kmph: Kilometers per hour mph : Miles per hour m/s : Meters per second

Source: Cyclone and Its Effects: A Cyclone Information Manual, Mission on Natural Hazards Mitigation, Indian Institute of Technology, Madras -600036.

The number of disturbances, which reach the stages of cyclone intensity, is bi-model distribution and we have in the Northern Indian Ocean two distinct cyclone seasons. One is May to June and the other is September to December. May, June, October, November and December are known for severe cyclones.

In the period of 100 years (1892- 1992) there were 68 cyclonic storms, which hit the Andhra Pradesh Coast. The details are given in Table- 2 below:

TABLE.2

DISTRICT-WISE DETAILS OF CYCLONES IN ANDHRA PRADESH

FOR PAST 100 YEARS (1892 -1992)

1.	Nellore	20	9	3	3
2.	Prakasam	1O	3	2	2
3.	Krishna	18	9	.5	5
4.	Guntur	-	-	-	-
5.	West Godavari	-	-	-	-
6.	East Godavari	8	2	2	2
7.	Visakhapatnam	3	2	1	1
8.	Vizianagaram	-	-	-	-
9.	Srikakulam	10	4	2	2
	TOTAL	**69**	**29**	**15**	**15**

Source : Planning For Management and Mitigation of Cyclone and Flood Disasters in Andhra Pradesh, Centre for Disaster Management, National Institute of Rural Development, Hyderabad.

Frequency of Cyclones

The above table highlights the fact that out of the 9 coastal districts Nellore, Prakasam, Krishna and Srikakulam have more share of cyclones, with East Godavari following closely. While this is so there is a gap between cyclones affecting the districts in some cases very short and in some case more than 15 years. Let us take East Godavari as an example. The first one occurred on 15th Julle,1893. Second 10 years later on 29th October,1903 followed by l5th October,1904,(1 year) then a gap 11 years to 02nd October,19l5 followed by 23rd October, 1916, then 7 years gap l8th October, 1933. Then there is a long gap of almost 22 years to 07th May, 1955 and yet a gap of over 14 years to 07th November,1969 and finally in the recent past to 06th November,1996 after a gap of 27 years. This trend is by no means any indication that the next cyclone in East Godavari may occur after a long gap. One would like to hope that the interval is as long as possible.

NELLORE CYCLONES 1892-1992

Let us now see the time gap of Nellore district, which had 20 cyclones in the period from 1892 to 1997 :-

1st	cyclone	..	17th October, 1892
2nd	cyclone	..	18th January, 1918 (26 years gap)
3rd	cyclone	..	08th October,1921 (3 years gap)
4th	cyclone	..	01s1 November, 1927 (6 years gap)
5th	cyclone	..	25thNovember,1932 (5 years gap)
6th	cyclone	..	20th May, 1940 (8 years gap)
7th	cyclone	..	16th October, 1943 (31/2 years gap)
8th	cyclone	..	26th October,1944 (3 years gap)
9th	cyclone	..	08th November, 1946 (2 years gap)
10th	cyclone	..	29thNovember,1962 (16 years gap)
11th	cyclone	..	05th November, 1968 (6 years gap)
12th	cyclone	..	23rd November, 1972 (4 years gap)
13th	cyclone	..	16th November, 1976 (4 years gap)
14th	cyclone	..	31st October, 1977 (1 year gap)
15th	cyclone	..	May,1979 (2 years gap)
16th	cyclone	..	23rd November, 1979 (6 months)
17th	cyclone	..	18th October, 1982 (3 years gap)
18th	cyclone	..	l2th November, 1984 (2 years gap)
19th	cyclone	..	02nd November, 1987 (3 years gap)
20th	cyclone	..	08th November, 1989 (2 years gap)

The above two examples have been given out to draw attention to one of the peculiarities of tropical cyclones which is about its unpredictable frequency. The next observation is that 11 out of 20 have occurred in November and 6 in the month of October. It can also be observed that in Nellore after the November 1976 cyclone (13th) the next cyclones have occurred within a gap of 3 years .

DURATION OF CYCLONE

The life of tropical cyclones averages to about 5 to 6 days of which 2 to 3 days are consumed in change from depression to severe cyclone stage. In doing so the system also moves due to the force generated and moves towards the land and generally takes about 2 days to cross the coast. This is known as translation speed and a cyclone can cover anything between 300 to 500 Kms in a day (24 hours) giving it a speed of 12.5 kmph to 20.8 kmph. Sometimes the cyclone may remain stationary from one to several days during which period energy is gained. American Researchers into Hurricanes have stated that the energy generated in a well-formed cyclone is enough to supply electricity to the entire USA for one year.

Cyclones in the North Indian Sea are less frequent, mostly moderate in intensity, smaller in size and short lived.

CYCLONES IN 1987

5 cyclones were tracked during the year 1987. Cyclone of 30th Jan traveled from East of Srilanka at Longitude 88.5 East, traveled towards Bangladesh, became severe cyclone storm on 01st February at 03.00 UTC (Universal Time Constant or GMT) curved to the North and North East, reduced to a cyclone storm after crossing 15 degree North Latitude and then dissipated in the sea on the afternoon of04th February, 1987. The Second one on 1st June was a depression on 16 degree North Latitude which took a Northwesterly curve up to 03.00 UTC on 03rd June, turned North and East and became a cyclone storm by 03.00 UTC 04111 June traveled North and crossed Bangladesh 04111 June afternoon and dissipated on 05111 June, 1987.

In contrast to this, observe the cyclones which have their origin in the square of Longitude 85E and Latitude 10 degree N. The cyclones crossed the coast of Andhra Pradesh at Nellore, Ongole and Machilipatnam. The Nellore cyclone started on 31st October (0300 UTC) as depression, became cyclone at 1200 UTC , changed direction at 0300 UTC on 01s1 November traveled West wards till 0300 UTC on 02nd November, became severe cyclone, changed direction again North-West wards and crossed in Nellore district evening of 02nd Nov, reduced its intensity to cyclone after crossing the coast and became depression at 0300 UTC on 03rd November and dissipated after 1200 UTC on 03rd November, 1987 (31/2 days).

Next cyclone started as depression on 14111 October, 0300 UTC travelling West North West direction became cyclone on 15111 October, 0300 UTC and crossed Ongole as a cyclone after midnight on night 15/16111 October (2 Ifz days) became a depression, took a curving path South of Hyderabad East of Bombay skirting Bhopal headed towards Patna and dissipated.

The cyclone in November,1987 started as depression on 11th November 1200 UTC headed West North West wards, became a cyclone after midnight of 11/l2 night and intensified into severe cyclone storm by day break of 12th November and crossed Machilipatnam night of 12/13 November became a cyclone storm by 0300 UTC on 13th November and thereafter dissipated.

The above narration has been given to highlight the fact that Cyclones do not follow any set pattern and will vary in the direction. The second point to note is that all the above examples show that they are all of short duration life. Let us now see the cyclone paths of 1996 on the slide you will see the tracks of 3 cyclones which occurred in Jun, Nov and Dec'96.

6 NOVEMBER 1996 CYCLONE

A clearer track of the cyclone track of 06111 November 1996 cyclone prepared by APSRAC shows that the system became depression at 05.30 on 05111 November and 3 hours later intensified to deep depression (DD) and 9 hours later into cyclone storm (CS) at 17.30 hours. That night itself it became severe cyclone storm (SCS) at 23.30 hours. It intensified into severe cyclone storm with core of hurricane wind- SCS(H) on the morning of06d1 by 08.30 hours. All along

from inception it was travelling along East to West direction along 16 degree N Latitude.

So far we have seen the formation of cyclone, its broad characteristics and the general pattern of frequency and the unpredictability of its path. That cyclones cause destruction is a universal truth. Let is now see how the system components affect us. These are the High Wind Speeds as given in Table.l; Torrential Rains in the wall cloud causing very heavy downpour (upto 50 cms in 24 hours period) and Storm Surge.

WIND EFFECT

Wind speeds greater than 120 km/h are characteristic of severe cyclone storms with core of Hurricane winds. At 120 km/h the wind speed is 33 meters per second. All physical structures are vulnerable to the extreme pressures exerted by winds and thus collapse or are damaged. Wind speeds of cyclone storms have been incorporated in the building code for coastal areas but the post damage surveys done by the scientists from the Structural Engineering Research Center at Madras in December 1977. Recently the scientists from lIT Madras have revealed that structures are subjected to pressures, which far exceed the basic pressures computed from the building code.

A micro wave tower designed to withstand a wind velocity of 250 km/h (70meters per second) collapsed in the Kavali cyclone in 1989 and another one in cyclone of 1990 and lately at Ravulapalem in November 1996 .The typical effects are failures or damages to buildings and failure of roofing elements, windows, doors, uprooting of trees, blowing away of thatched huts and so on.

Damages due to wind are not confined to the coastal areas only. Damage can occur well in the interior.

For example a number of structures around Vijayawada which is about 100 km from the coast, were damaged in a cyclone. In America during Hurricane "Hugo;' cladding failures were found as far back as 290 km from the coast.

Loss of roof, irrespective of materials used -may be AC sheets, Mangalore tiles, local tiles or thatched roof leads to water damage of walls and mud walls collapse resulting in total collapse of houses. There was evidence of roofs of some houses, built by the Government and voluntary organisations, which were blown off. Roofs get blown off due to lack of proper connections between the roof and the exterior walls. When the roof gets blown off the exterior walls would lose the support provided by the roofing system and collapse even in less wind intensity. Walls crack, compound walls collapse. Failure of masonry walls seems to depend on the type of foundation soil like what was observed in Guntur, where houses were built on black cotton soil.

So to put it simply the structures that exist in various parts of the coastal districts do have some vulnerability by way of poor material, poor construction method and structural weaknesses at some point in the buildings resulting in the damages. As far as thatched houses are concerned they suffer from greater weakness all-round and thus are the first causalities due to high-speed winds.

HEAVY RAINFALL

In a mature cyclone, rainfall over land commences even when the cyclone is 400-500 kms away from the coast line. In the Nov 1996 cyclone which was a small core storm about 60 to 70 kms in diameter the rain commenced in Kakinada from about 5.45 PM when it was about 80 to 100 kms away from the coast gradually escalating in intensity along with rise in wind speed. Rainfall is generally very heavy and spread over a large area thus leading to excessive amount of water, which leads to flooding. The size of drops, in a rainfall, increase with increase in the rainfall intensity. Raindrops strike the ground with energies substantially greater than those do in ordinary rainfall. This results in a lot of soil erosion. The heavy rains waterlog the ground and cause softening of the earth due to soaking. This contributes to weakening of tank embankments, the leaning over of utility poles or collapse of pole type structures.

STORM SURGES

One of the peculiar characteristic and having a very high damage potential is storm surge which is generally misnamed as Tidal wave in the literature available in India. A tidal wave has its origin in an earthquake on the ocean floor or volcanic eruption in the seabed or when a submerged volcano erupts. The tremendous pressure is released in shock waves. The waves travel outward in ripple like movements called seismic waves. Part of the seabed is forced upward and this creates enormous waves, which travel at very high speeds between 400-500 miles per hour. "Tsunami" is a Japanese word for "Storm Waves." In deep water tsunamis are low and wide often less than three fact high and as much as 95 miles between the crest of one wave and the next one. Yet when waves reach shallow water they become closer together and taller. They become deadly as they rear up to 100 feet or more and crash inland sweeping away everything in their path. Same thing happens when an under water Volcano erupts. After the volcanic island of Krakatu exploded in 1883 a tsunami 115 feet high smashed into the islands of Java and Sumatra killing 36000 people. A tsunami may strike without warning often on a calm day. The earthquake, which unleashed it probably occurred far away, so the shock waves would not be felt on land. The largest recorded tsunami was 280 feet high which surged past the Japanese Island of Ishigaki, in 1971, 90% of all recorded tsunamis have been in the Pacific Ocean where there are over 10,000 volcanoes.

HEIGHT OF STORM SURGE

So coming back to the storm surge, which is caused by a number of factors associated with the cyclone, is an abnormal rise of seawater. The low pressure in the eye allows the sea level to rise. The high-speed winds surrounding the "eye" drive more water over this rise. The sloping bed of the sea and contours off the shoreline add further to the height. A further contribution to the height of the storm surge is added if the cyclone arrives at high- tide time. Thus the height of storm surge works out as follows :-

(a) Low pressure in the "eye" -level rises by say 20 ft.
(b) The speed of winds in the cyclone may add 5-6ft.
(c) The speed of cyclone itself may add 5-10 ft
(d) The high tide of say 10 feet will add further 10 ft.

Thus, a storm surge at high tide of 10 feet may work out to 40 to 50 feet. If however the storm surge occurs at low tide the height of the surge will be reduced by the difference between the normal sea level and low tide. In the above case the height of surge will be 20-30 feet.

The highest storm surge recorded in the world is 12m(40feet) at Bakerganj cyclone of 31.04.1876. Similarly the Bhola cyclone in Bangladesh in November 1970 accompanied by a storm surge of 10-33 feet due to which 3,00,000 lives were lost. The Orissa cyclone of 1985 had a storm surge of 11 ft.

Storm surge is not a wave though it may look like one if any body sees it. It is a mass of water, which will submerge every thing in its path, till it recedes back into the sea. It moves at the same speed as that of the cyclone. It travels up to the point where the ground height (above mean sea level) is equal to the height of the surge.

In other words a storm surge of 20-ft height will move inland upto a point where the land is 20 feet above the sea level. The actual period of submergence of the land may be as long as 45 minutes or more depending on the depth it reaches inland.

As the leading edge of the surge crashes against the coastline and the water continues to travel inland there will be surface waves created which criss-cross each other and carry much under water turbulence. The destruction caused by the surge is tremendous. Houses are the worst affected. First the speed of the surge places great stress on the walls. The turbulence and currents created destroy the foundation of the structure. The debris like uprooted trees, fences and parts of broken house act as battering rams, which cause further damage. The sand and gravel carried by the fast moving currents at the bottom of the surge can cause "sand papering" action of the foundations. And last but not the least the huge volume of water can cause such pressure difference that the house "floats" and once the house is lifted from the foundations water enters the structure and causes collapse of the building.

Damages occur to every kind of assets built above the ground level due to the above characteristics. Salinity affects cropped areas very badly and Sand-cast .

The above text has been placed with the specific aim of trying to highlight the many peculiarities and complexities which are caused by cyclones. In all the assessments of the cyclones the large numbers of the casualties and the colossal damage that occur is due to the simple fact that there is a vulnerability in the structure or installation and that is the main cause of damage / destruction. Cyclone knows no distinction whether it is in Bangladesh, India, America or Japan.

It is important that the concerned officers understand the existing forecasting limitations and apply the above information in anticipating the future course of the cyclone. Such information should also be passed on to the public on a regular basis to reinforce the awareness and thereby modify their responses to their own advantage.

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PART - III
MANAGEMENT OF CYCLONES IN ANDHRA PRADESH

Although the State had been experiencing cyclones for a number of years in the past it was not until after the 1969 cyclone that a committee was formed at the initiative of the GOI under the chairmanship of Dr. P.Koteswaram the then Director General of Observatories, Indian Meteorological Department. This committee made several recommendations in its report submitted in 1971 which had looked into the aspects of cyclone management .The recommendations numbering 49 dealt with a wide range of essentials dealing with upgrading of forecasting techniques, communication, provision of rescue implements, building of cyclone shelters. Even then the committee recommendations were not implemented in full till the disastrous November cyclone of 1977. The magnitude of damage was very high in all the infrastructure facilities. The first Contingency Plan was made in 1981 and was updated in 1987 and is in use till today.

CONTINGENCY PLAN OF ACTION-(CCPA)

The Plan referred to as CCPA hereafter consists of 9 chapters dealing with :

1. General set up at State and District level
2. Visuality of Natural Calamities, Cyclone Forecasting and Warning
3. Action immediately before the occurrence of a cyclone
4. Action after receipt Second Warning
5. Post Cyclone Masures
6. Community Preparation -Mass Publicity
7. Visuality of Natural Calamities; Flood Warning
8. Measures to be taken by the Government Departments
9. Cyclone Stores.

The Plan identifies the Revenue Department as the nodal department to carry out all tasks related to the management of cyclones. A high Powered committee is formed at the State level headed by the Chief Secretary with as many as 53 senior officers drawn from all the departments including the Armed Forces, which have a role to play in the cyclone management. There are two sub committees one headed by the Chief Secretary and the other by the Principal Secretary Revenue or the Relief Commissioner to deal with the every day activities in dealing with the situations as they arise and to control the relief operations.

At the District level the District Collectors head the committee with the officers of the relevant departments as members. The committees meet twice in a year when the precautionary measures required to keep the Government machinery in readiness to meet the cyclone situation are discussed. The plan incorporates details about the Early Warning system with actions to be taken. The actions to be taken fall into two parts (a) on receipt of the Alert for a cyclone and (b) on receipt of the cyclone warning. Control rooms are opened at the State Secretariat, the District and the Mandal Headquarters with suitable communication set up and the staff required for maintaining 24 hrs vigil to deal with the situations as and when they arise. The actions on receipt of the Alert are basically preparatory and the actions after cyclone warning are for Evacuation, Rescue, Relief, Restoration and Rehabilitation. The plan apart from the routine meetings

twice a year in April and September is really put into effect on receipt of the first alert message from the Cyclone Warning Center (CWC). Meetings are convened on receipt of Alert messages both at the state and the district levels and control rooms are opened to keep vigil over the situation as it develops. The focus of the plan is on saving human lives and on restoring infrastructure as soon as possible.

CYCLONE WARNING SYSTEM IN INDIA

The early warning system has been quite efficient, however there are some areas which could be improved as suggested in the CDMC's report of 1971. The present warning system consists of 10 Radar stations covering the Indian coastline with 6 on the Eastern coast and 4 on the Western coast. The range of present equipment is 400 kms and the locations are such that no cyclone can go undetected in the Bay of Bengal. The dispositions are shown on the slide.

CYCLONE WARNINGS

Cyclone Warning Centre at Visakhapatnam is responsible to issue all warnings and De-warnings. The messages are sent by land line Telegrams, Wireless of the Police, All India radio stations - Hyderabad, Viskhapatnam and Vijayawada, by telephone to the Chief Secretary , the Commissioner for Relief, the Collectors, and telegrams to Ports for hoisting danger signals for day and night.

The existing communication facilities are used to pass the messages to the recipients among whom are the AIR stations at Hyderabad, Visakhapatnam, Vijayawada and Cuddapah. The broadcasts through the AIR are the main source of information about cyclones to the general public. During the second stage of the warning service i.e. when the cyclone is 24 hours away from the coast the warnings are issued at hourly intervals over the radio. State and District Administration are advised to listen to these broadcasts.

The existing system has been found to be unreliable due to the vulnerability of the landline communications to adverse weather conditions, which precede the onset of a cyclone. On many occasions the warnings are received very late or not at all. Based on this experience the dissemination of the messages was also done through the police wireless system, which has a wide network of wireless stations in most parts of the state. The messages are given to the police wireless control at Viskhapatnam who pass it on the Automax machine to their HQ at Hyderabad and the concerned addressees. This method is still being followed and yet in the case of East Godavari district the crucial message was somehow not passed on this system but on the telegram, which never reached in time. More on this topic later.

The Indian Meteorology Department (IMD) introduced a more dependable method, by using the facilities of the INSAT. The system is called the Disaster Warning System (DWS). In this system the warning message is transmitted from the cyclone warning Centre to the satellite which, in turn, broadcasts it for instantaneous reception by the receiving sets wherever they are deployed. By a system of selective addressing, warnings are received only by those receivers for whom the warnings are intended. At the receiving end a loud siren will be sounded for one minute followed by the actual message for about nine minutes. Arrangements are also made for selected receivers to receive warnings meant for more than one district i.e. at the State HQ. The essential point to note is that these

warnings are received only by the receivers wherever they are placed and not by all like the Radio broadcasts. This system is meant to be complimentary to the existing systems.

Elements of DWS

There are four major components of the INSAT -DWS:

1. The cyclone warning centre (CWC) for originating the area code of the districts and the warning message.
2. The earth station located near the CWC with uplink facility in C -band .
3. The C / S band transponder on board INSAT and
4. The INSAT -DWS Receivers located in the cyclone prone areas.

The Cyclone Warning Centre

This is the prime element of the system where the warning message is prepared based on the latest meteorological data including radar observations and satellite pictures. The message is in two parts namely the (a) the information on the area likely to be affected in a digital code and (b) the voice message giving the details of the information about the cyclone. This is transmitted in the language used in the particular area where the transmission is to be received. Initially 100 stations were installed in Andhra Pradesh and Tamilnadu out of which 47 stations were located in A.P. State HQ, AIR stations, District HQs, Mandal Offices, CWC Visakhapatnam and the Meteorological Centre at Hyderabad were included. This has been further increased to 80 stations in A.P .

The schematic diagram of the DWS system is given at **Annexure -I**.

DWS Receivers.

This component consists of:

- One 3.66-m diameter aluminum mesh antenna.
- A front -end converter which translates the incoming signal to the intermediate frequency.
- A DWS receiver consisting of Code detector, alarm, loud speaker and power supply. Once a code is detected by the receiver, an audio alarm in the form of siren gets switched on for one minute. The detection of code also switches on the audio -amplifier for 9 minutes to enable the warning to be heard over the loud speaker. The power system consists of a charger- cum-regulated power supply unit and two 12 v batteries. The batteries are used in a floating condition to take over when the local power supply fails.

OPERATION OF DWS-

1. The DWS will be in operation only during the period from April to May and October to December. The messages will be transmitted in the "Cyclone Warning Stage" about 24 hours before the expected crossing of the coast.

2. The warnings will be in the local language of the area for which they are issued and will be broadcast every hour till the threat is over.

3. Warning will be addressed to the only those districts that are likely to be adversely affected. However composite bulletin for the entire state will be addressed every hour to the State Government Headquarters and AIR stations

4. The DWS is only a complimentary system and not intended to replace the existing system.

5. The Chief Secretary of the State will be informed in case of failure of the DWS transmission due to any eventuality.

6. The DWS Centre at Madras will be transmitting test messages at specified timings for different districts according to a test transmission schedule communicated in advance to the users along with directions about how to send the reports of reception of the test signals. The custodians of the DWS receivers are requested to send the reports promptly.

7. The DWS receivers will be serviced and maintained by the staff from the DWS Unit at Madras. The users are however requested to pour distilled water once in about 15 days in the batteries, which are connected to the receivers. The proper upkeep of the instruments and batteries rests with the offices manning these DWS stations.

At the District level the District Collectors head the committee with the officers of the relevant departments as members. The committees meet twice in a year when the precautionary measures required to keep the Government machinery in readiness to meet the cyclone situation are discussed. The plan incorporates details about the Early Warning system with actions to be taken. The actions to be taken fall into two parts (a) on receipt of the Alert for a cyclone and (b) on receipt of the cyclone warning. Control rooms are opened at the State Secretariat, the District and the Mandal Headquarters with suitable communication set up and the staff required for maintaining 24 hrs vigil to deal with the situations as and when they arise. The actions on receipt of the Alert are basically preparatory and the actions after cyclone warning are for Evacuation, Rescue, Relief, Restoration and Rehabilitation. The plan apart from the routine meetings twice a year in April and September is really put into effect on receipt of the first alert message from the Cyclone Warning Center (CWC). Meetings are convened on receipt of Alert messages both at the state and the district levels and control rooms are opened to keep vigil over the situation as it develops. The focus of the plan is on saving human lives and on restoring infrastructure as soon as possible.

NOVEMBER 1996 CYCLONE

East and West Godavari Districts were subjected to a severe cyclonic storm the likes of which was not experienced since September 1969 even the May 1990 cyclone was not as severe as the November '96. This cyclone was quite unusual with very strong winds in its formation and traveled East to West direction along the 16-Degree Latitude for most of its journey. This is quite unlike the normal pattern of cyclones.

A look at the tables in Chapter.I will show that both the districts combined have an area of 17.92 % of the total area and the population is 27.9 % of the total state population. It may be noticed that the rural population is as much as 77.54 % and the SC/ST Categories are at 21.3% of the total population of these two districts. The Irrigated area is 35.95%and the Cropped area is at 27.10 % of the total areas of the State in the respective segments.

The meteorological characteristic of the 6th Nov 96 cyclone was a compact one confined to a 50km radius covering the East and West Godavari districts but the resultant destruction was extensive. Kakinada and Peddapuram had received 21 and 28 cms of rains in a six-hour period on the fateful night; Machilipatnam recorded only one cm. Visakhapatnam experienced some showers during the day and it was a clear sky during the night when rains and tidal waves were lashing the East Godavari coastline. East Godavari District in particular suffered heavy losses in terms of human deaths and property losses.

In the past this district had cyclones in Oct 1893 Oct 1903 & m(3U1904, Oct 1915 & 1916,1933,1955 Nov 1969and in May1990. In other words a total of 9 before, the November '96 cyclone. Not withstanding this there have been cyclones in other parts of the coast which would have been known to the people of those times and who are now the senior citizens in the villages. Though the past cyclones did not affect the districts directly both the states had suffered 74 deaths in 1977, and 141 deaths in 1990. In 1994 these districts felt partial effect though the loss of lives were few (only 6). Thus even after the 1969 cyclones indirect effect was felt in '77,'90 and 1994.

With the history of cyclones as above, though, at larger interval between each and the fact that there were cyclones in other parts of the coast the Nov '96 cyclone warnings, should have prompted better response from the people and the Administration. One of the main reasons for this is perhaps inadequate understanding of the characteristics and the effects of the cyclone. The characteristics of a cyclone and its effects have been already been covered in Chapter 2. Dissemination of the warnings using the existing communication facilities and the short duration of the cyclone has brought out the need for reviewing the channels of communication and improving the system. Deaths, which have occurred, have really not been due to the faulty dissemination but in greater part are due to the victims not taking precaution of listening to radio broadcasts by the A.I.R. and acting upon the information relayed.

There were three cyclones in the year 1996 and to add to the woes of the State there were also Floods in the period between Jun to Dec'96. We shall now see the cyclones of 1996 at Figure -Sa. It may be quite apparent that 2 (12jun & 28Nov/Dec) out of the 3 cyclones have their origin in latitudes 12 & 13 N .Both these cyclones did cause very serious damages. In contrast to this is the cyclone of Nov '96 which originated around latitude 16 N and longitude 86 E. The most damaging cyclone was that of 6 Nov 96. Now we shall see a different view of the path of the cyclone.

Cyclone Path of Nov '96 Cyclone

Track of the 6 Nov cyclone as prepared by the APSRAC is being shown at **Figure -5.** The description of the cyclone from the starting stage to its finality will be explained with the help of this figure.

Build UD of cyclone

The system became depression at 05.30 on 05th November and 3 hours later intensified to Deep Depression (DD) and 9 hours later into Cyclonic Storm (CS) at 17.30 hours. That night itself it became Severe Cyclonic Storm (SCS) at 23.30 hours. It intensified into Severe Cyclonic Storm with core of hurricane wind-SCS (H) on the morning of 06th by 08.30 hours. All along from inception it was travelling along East to West direction along 16 degree N Latitude. At 08.30 hrs on 6th it was lying 200 Kms from the coast at 16 degree N Latitude and 84 degree East Longitude. There after it changed its course slightly north and crossed the AP Coast in Amalapuram area late evening of 6th November, 1996. Had it continued along 16 degree N Latitude and crossed the coast the brunt of the damage would have been borne by Avanigadda area of Krishna district and the effect would have been felt by Krishna, Guntur and perhaps Chirala area of Prakasam district. This cyclone entered the radar picture by about 12.00hrs 5th November and was last reported located 50 Kms SW of Kakinada at 23.30 hours on 6th November.

Cyclone Warning Messages

As per the contingency plan of the State the CWC, Visakhapatnam is to send 'ALERT' and 'WARNING' bulletins at periodic intervals to all the addressees involved in the cyclone contingency plan.

The early warning messages though being sent by the CWC as per agreed schedules did not in some cases reach in time particularly the crucial messages when the storm was close to the coast. Analysis of the messages has revealed that the CWC requires about 2 to 3 hrs to study the meteorological data from other stations along the coast and formulate the warning message. Then there is a time loss in actual transmission of the message to the recipient and collection at the delivery end. As per the contingency plan the warning messages are also to be heard on the All India Radio from where broadcasts are made repeatedly. Unfortunately this is not happening in the case of some of the Control rooms and more so in the case of fishermen who are supposed to listen to the broadcasts transmitted especially for them even in normal times. This perhaps explains partly the reason as to why the fishermen had gone for fishing and got trapped in the cyclone of 06 Nov. 1996. The second aspect is that some fisher folk had received the radio broadcasts but chose to ignore them and thus paid for it with their lives.

Interpreting the Messages

It would be better if the warning messages are plotted on the India map and the advisories given in the text are interpreted by the District Administration so that they are in a better position to assess the future course of the storm. The ultimate decision of ordering evacuation rests with the collector of the district .It is felt that the control room staff at the Dist. HQ should be knowledgeable enough to make some assessment of the future course of the cyclone.

However from the analysis of messages originating from CWC and delivered by police wireless/DOT it has been found that some of the messages were delayed and their utility was reduced / lost. An example of this are the two messages that the cyclone is at 120 kms and 100kms respectively indicating likely crossing of the coast between Machilipatnam and Kakinada. These messages reached the collectorate at a time when the utility of information was already lost -the cyclone had already started crossing the coast and caused havoc.

Alert and Warning Messages

A study of 9 messages received and on file at the offices at the Collectorate and other offices was carried out and it revealed that are some time delays at each stage of the message from the observation, analysis, originating of message, transmission delivery and receipt.

The details of the Alert and Warning messages received from the CWC are shown in a tabular form at **Annexure -A**. It shows the essential contents of the messages and abbreviated to some extent without losing the main points. Some of the abbreviations used are explained below:

TABLE- 1

COLUMN	ABBREVIATION	EXPANSION/MEANING	REMARKS
TYPE/MSG NO	CWB 1 Thi 003	Cyclone Warning Bulletin followed by serial number. Time message was handed in for transmission	
Origin at CWC VSP	2030 5/11 3.00 AM 6/11	Time of origin followed by date & time received.	In some columns the time of receipt is not given as it was not noted on the message.
Location of cyclone	16N 86E 350 kms SE Vsp 1430h 5/11	Grid reference in Latitude & Longitude, distance from the coast & direction to Visakhapatnam time of the observation and date.	This is the standard format followed by the CWC in all their messages.
Direction	Westerly	The direction the cyclones is expected to travel	
Crossing on the coast	Ong-Vsp 6th night	Crossing expected between Ongole and Visakhapatnam on 6th night.	
Rainfall	Most places Hy-V Hy Nlr, Pkm……..	Most Places Heavy to very Heavy rains – followed by the District names abbreivated.	
Wind speed in Km/h	65-75	The speed of the winds will be between 65 to 75 kilometers per hour.	
Advisory		The names of the districts are abbreivated	
Remarks	Thi Tdl	Time of input into the Automax at the Police wireless station. Time the message was delivered at the destination wireless station.	

The time sequence for originating the messages after the observation of the location of the cyclone to the receipt of the message at the collectorate office has been tabulated and is presented at **Annexure-A**.

A perusal of both the annexures reveals the following time periods which are given with the least time and the maximum time taken given in that order:

Locating of disturbance, analysis and originating the message 30 min to 3hrs 30min Handing in of message at the wireless station / telegraphic station 35min to 4 hrs 10min Transmission time up to delivery time 25 min to 6 hrs 30min Receipt by the collectorate lhr 55min to 4 hrs 30min for telegram, 10hrs 30min by police wireless (Only in the case of the last message which is a cyclone de -warning bulletin) The above computation has been done while studying the messages in the files to assess the actual time taken for a message to reach the recipients. In a short span cyclone as the Nov '96 cyclone, has proved to be, time assumes all the importance for making crucial decisions by the authorities.

Some observations

- Some time is required between the observed position and analysing of other meteorological data to create alert/ warning message. The Director CWC Visakhapatnam can only confirm possibility of reducing time interval.
- Time for handling in the message could perhaps be reduced by locating a wireless set in the CWC office complex.
- Time of delivery at the receiving wireless set and collection by the collectors' office could be reduced.
- Use of hotline between the CWC and the collectorate offices or fax could be considered. NICNET is another possibility.

It is felt that the next few paragraphs have become essential to highlight certain important issues, which are required to be kept in mind for effecting improving the systems and the future use by the Administration elsewhere in the State.

Points from the District Administration

The Collector of East Godavari District in his report to the Principal Secretary to Govt., Revenue Dept. and the Commissioner for Relief, on Communication of messages and warnings had stated that messages were received through the Relief Commissioner, Collector, Visakhapatnam by phone and Police wireless other channels like the telephone, Fax, wireless or NIC net facilities were not used, that early warning system was inadequate and the forecast put out by the Meteorological Department did not reach the District Administration in time. Certain other points highlighted in the letter are extracted below:

1. The warning has not pointed clearly the place where it would cross the coast, in fact.
2. Since the Govt. had moved a Special Officer to Krishna, it was expected that it was going towards Machilipatnam coast.

3. The cyclone has suddenly changed course in the afternoon of 6/11/96, but such a sudden change has not been adequately relayed to the Dist. Administration by CWC.
4. "Evacuation was mentioned for low-lying areas -meaning that there is likely hood of heavy rains. There was no caution about the Tidal wave, which has resulted in many deaths.
5. As could be seen, although necessary messages were regularly sent to MROs/RDOs there was hardly any method of communication between Mandal HQ and the remote Fishermen habitations, which are accessible only by country Boats. To add to that, as a precaution all the APSRTC buses were stopped. The MROs had no chance of evacuating anyone in those circumstances.
6. The CWC failed to predict the exact time of the storm. Even after the cyclone crossed coast, message on Police wireless was received at 12.00 midnight on 6/11/96, that the storm was likely to cross the coast on 7th Morning. In these natural disasters, leadtime is very important for taking advance actions.
7. Some of the DWS are not functioning.

Ironically message No. Cwb 3 / 4 06 giving the position at 120kms South East of Kakinada and heading West- Northwesterly was sent by a telegram at 19.10 hrs from Visakhapatnam and received at Kakinada telegraph office. But could not be passed to the Collectorate on phone as the telephones were out of order due to heavy rains. It seems the same message sent through the Police wireless never reached. At this point of time it should be stated that the message about the cyclone being located 100 kms away from Kakinada, at Latitude16.3 degrees and Longitude 82.7 degrees (please refer Figure -4A) though originated by CWC Visakapatnam at 18.30hrs on 6th November 1996 (please refer to Cwb 4 (Vsp) S (Dists) under column -1YPE/MSG No) never reached the East Godavari Collectorate in time. Kakinada felt rain and wind around 6.00 p.m. onwards on 6th Nov 96 and the intensity kept on increasing and after 10.30 p.m. all wind and rain had stopped as cyclone moved inwards. With all the sophisticated communication system available, the non-delivery of the messages showing the latest position of the cyclone was a systems failure. However the Collector of East Godavari was informed at Amalapuram on telephone around 17.00hrs that the cyclone was heading towards East Godavari. The Collector leaving the Joint Collector at Amalapuram, proceeded to Kakinada but got caught in the cyclone at Ramachandrapyram and reached Kakinada on the 7th Nov'96.

a) The Nov'96 cyclone has highlighted the importance of the need for serious consideration of the following:
b) Location time of the cyclone, analysing the meteorological data, preparation and issue of the warning bulletins requires to be reduced and the IMD may examine this aspect.
c) Better use of the channels of communication available by revamping the existing procedures.
d) Establishing direct communication between the CWC and the District headquarters to include VHF sets.
e) Need for interpretation of the messages at the District Headquarters and prioritisation of the tasks to be done by various line departments based on the assessment of the warning messages.

f) Focussing on the vulnerable inaccessible villages in the coastal areas for dissemination of warnings and standby preparations for evacuation to be kept ready should the cyclone change its course.

g) Increase awareness level in the officials and the public.

h) Increase the capacity of villages to receive warnings by other media channels over and above the dissemination through the Revenue channel.

Time and Space Factors in a Cyclone

It will be seen from the above points highlighted that communications hold the key for successful implementation of the contingency plan at various echelons of the Administration. Lead- time is required to execute the respective actions during the preparatory period before the cyclone. Unfortunately due to a combination of many factors as already highlighted in the preceding paragraphs time was really not available for effective dissemination of warnings and evacuation procedures.

A simple graphic presentation has been made to show the time and space relationship between the time of observation by the CWC and the position identified as a distance from the coast and is given in the attached -**GRAPH**.

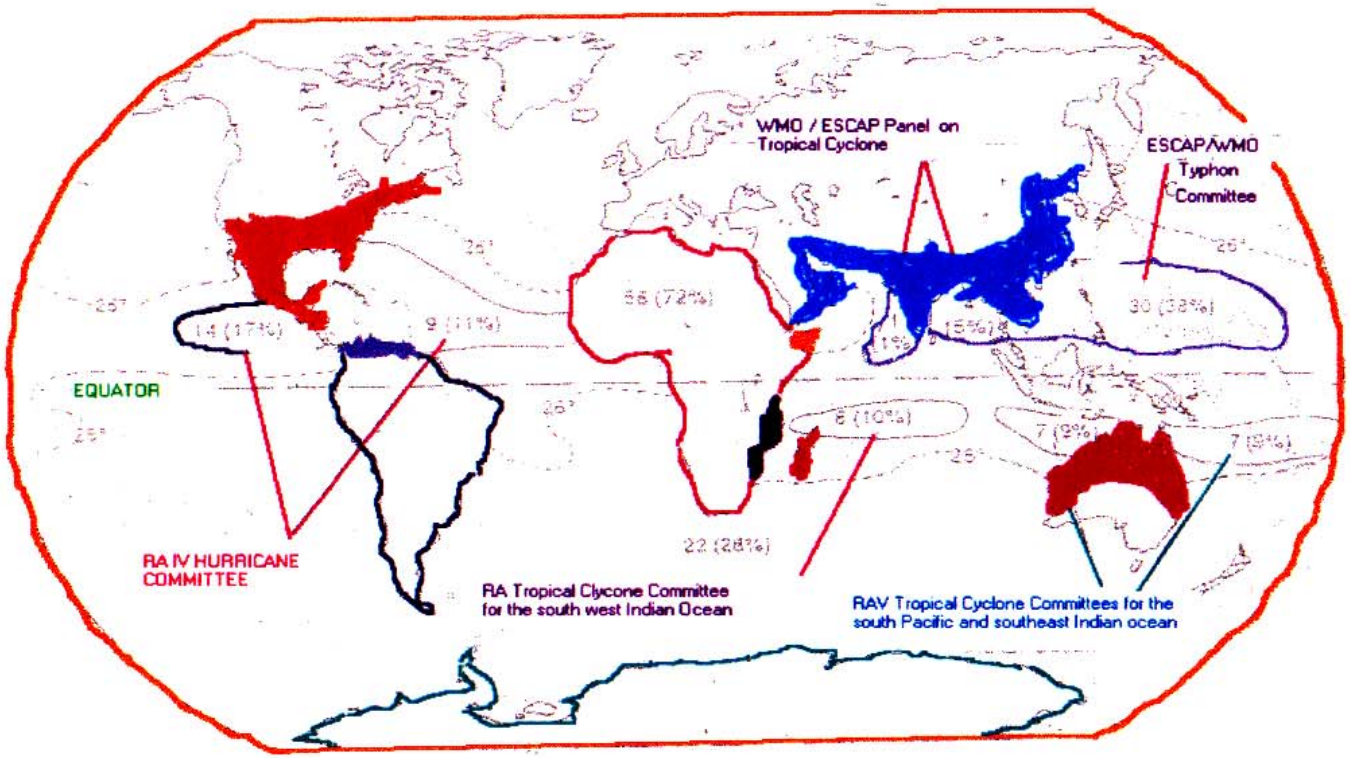
This graph is not representing the path of the cyclone. It gives out the relationship between the time at which the cyclone is located and the distance from the coast. It may also be noted that the position of the cyclone is given in terms of Latitudes and longitudes. Officers receiving the messages are not in a position to assess the time and space relationship since maps showing the coastline and the grid markings of latitudes and longitudes do not exist at the control rooms. It is suggested that besides the enlargement map of the district there should be a map showing the entire coast line of India and the coast of Bangladesh, Mynmar including Andaman Islands & Srilanka, to follow the warning messages from depression stage to the 'De-warning' in a meaningful manner .

The second advantage is that without waiting for the fresh bulletin from the CWC a reasonable assessment can be made of the likely course the cyclone may take. It is very much possible that a cyclone may not adhere to the assessment in most cases. But as the cyclone approaches closer to the coast the bracket of its likely deviation from the path is much narrower and the district authorities have that much lead time to make a decision for evacuation or any other action related to the impending threat to their district.

A tropical cyclone as mentioned in chapter 2 could change direction and speed at any time or not move at all or take a complete loop and move in opposite direction. An experience of this was felt in the December '96 cyclone which fortunately spared A.P.

Coming back to the Graph. The main purpose is to draw attention to the movement of the system in relation to time and distance thereby arrive at the translation speed which is essential to make a reasonable guess about the next position even before the next bulletin is prepared.

PREDICTABILITY



The annual average global occurance (numbers and precentages) of tropical cyclones reaching force, and their regions of genesis. Cyclones from only where areas affected by subsequent winds and flooding are shown hatched (after Gray 1975) the names of WMO regional cyclone bodies and the basins covered by their programmes are also indicated

Brief Explanation of – GRAPH

The details shown in the GRAPH. The horizontal axis shows the distance in blocks of 50 kms the coastline shown as ▭ is at the "o" mark. The coastal land is shown as ▬ ; on the right hand column are the timings and dates starting at 1200 hrs on 5 November, at the bottom going upwards to the last serial at 2330 hrs on 6Nov. The (O) mark indicates the origin time of the messages. The dotted line in the grid refers to the time interval between the observations and distance traveled by the cyclone. The (✸) mark represents the cyclone crossing the coast. We shall trace the distance- time sequence from the point of entry into the radar range i.e. 400kms in the table given below: -

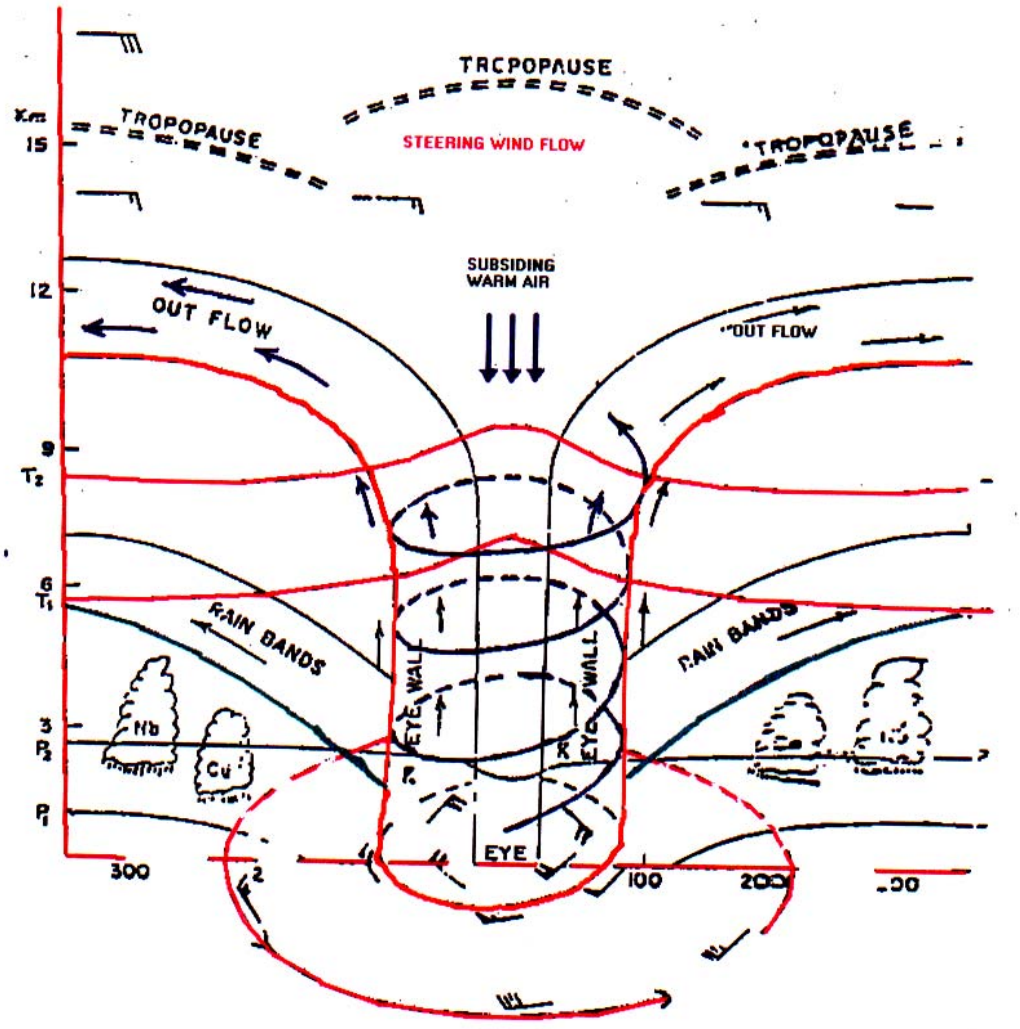
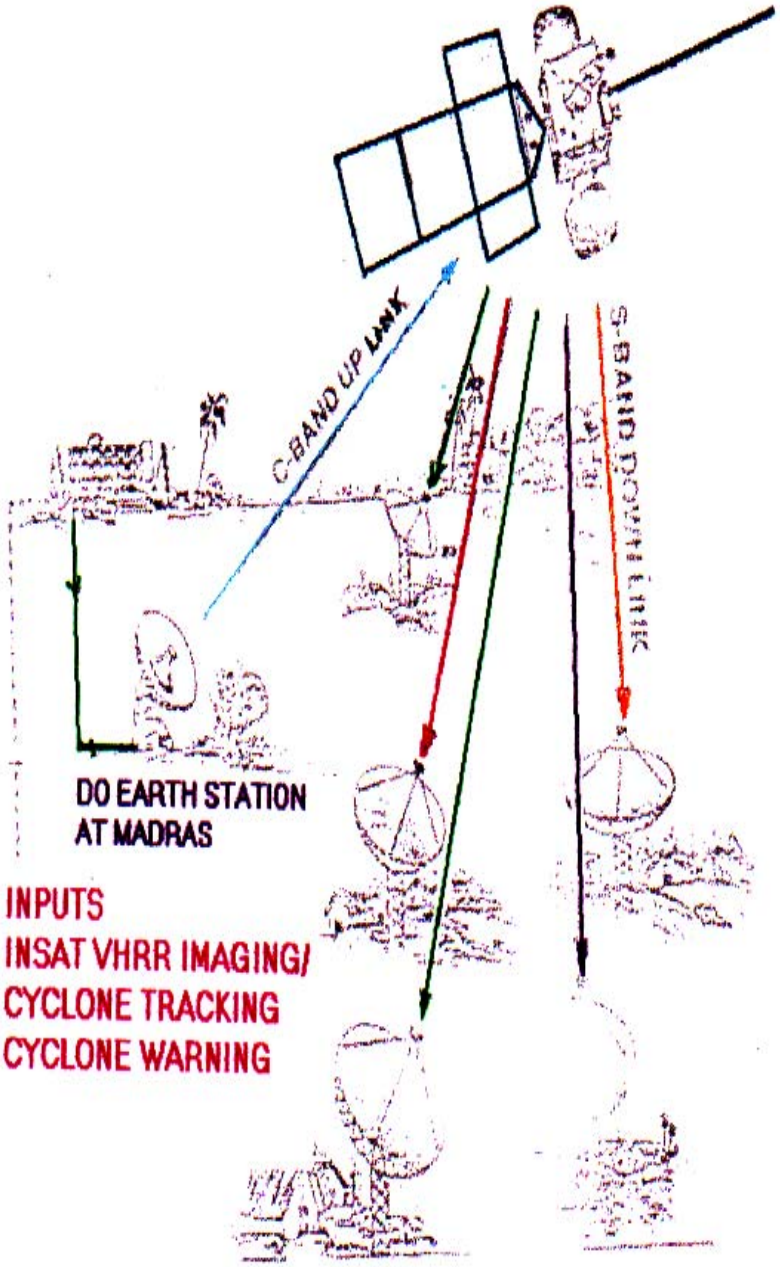


Fig 2 : schematic representation of vertical structure of a mature cyclone



CYCLONE FORMATION

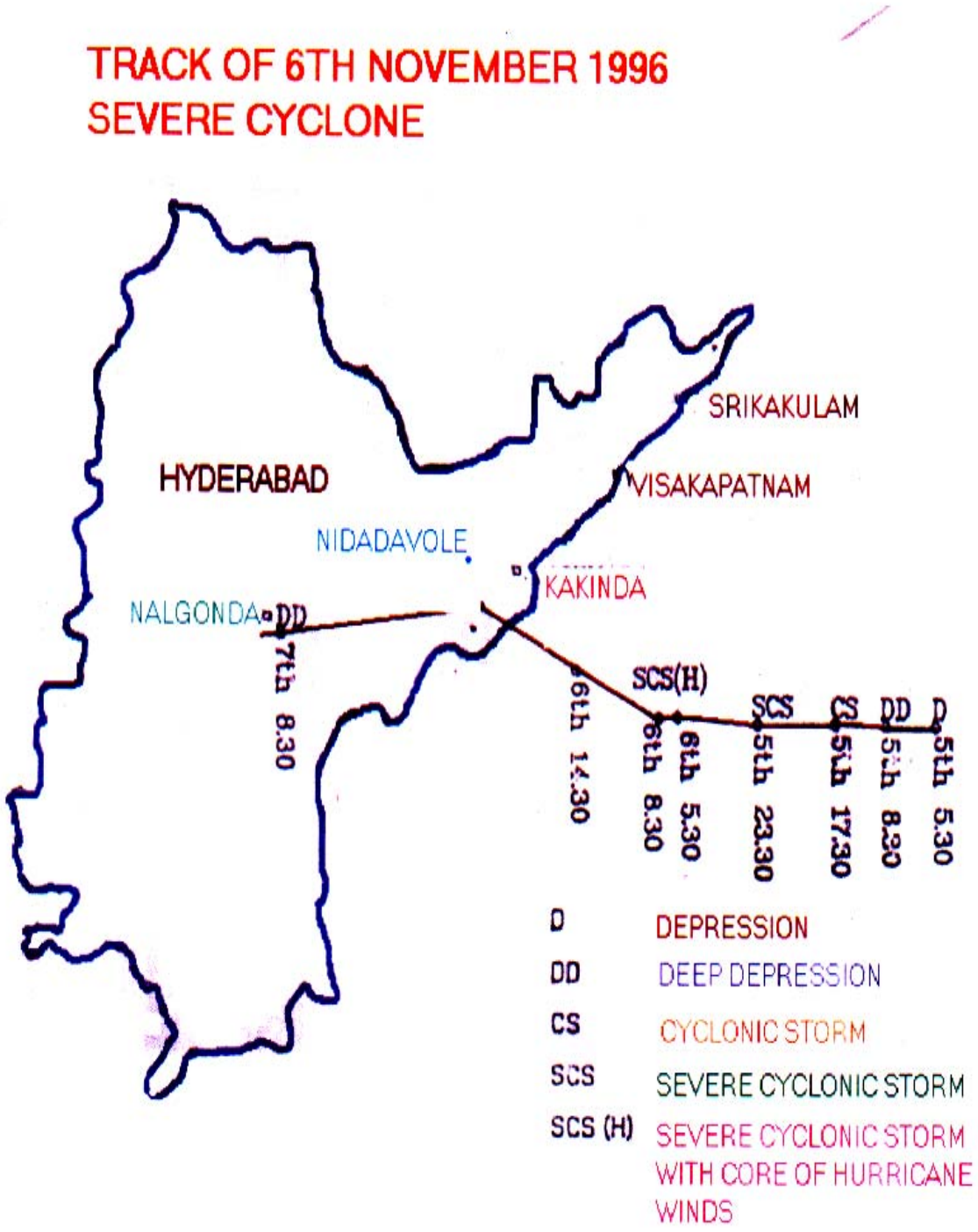
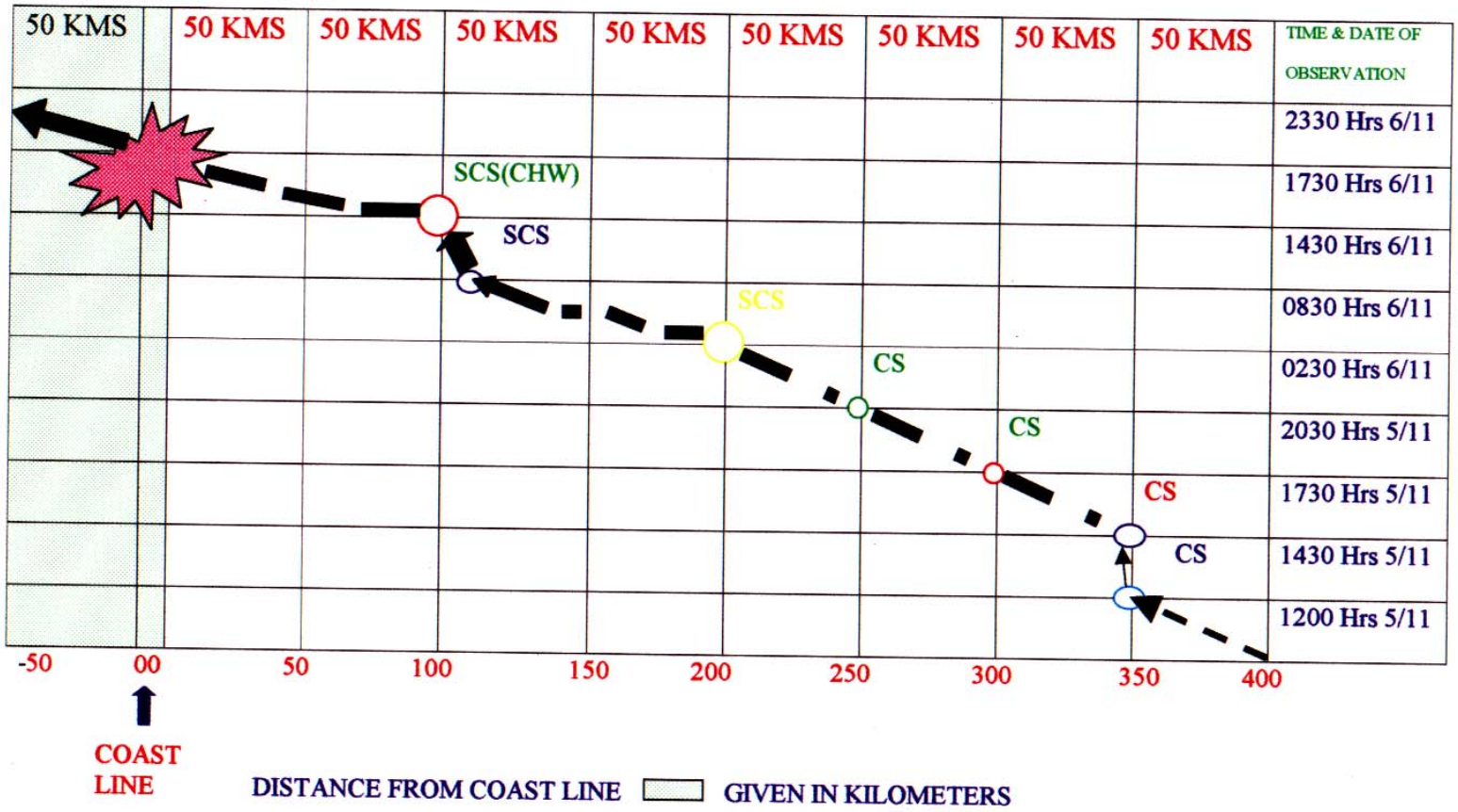

TRACK OF 6TH NOVEMBER 1996
SEVERE CYCLONE
SRIKAKULAM
HYDERABAD
VISAKAPATNAM
NIDADAVOLE
KAKINDA
NALGONDA
DD
7th 8.30
6th 14.30
SCS(H)
6th 8.30
6th 5.30
SCS
5th 23.30
SCS
5th 17.30
DD
5th 8.30
D
5th 5.30
D DEPRESSION
DD DEEP DEPRESSION
CS CYCLONIC STORM
SCS SEVERE CYCLONIC STORM
SCS (H) SEVERE CYCLONIC STORM WITH CORE OF HURRICANE WINDS

Fig 5

TIME AND DISTANCE PLOT OF IMPORTANT WARNING MESSAGES FROM CWC – NOVEMBER 1996 CLYCONE



At 8.30 hrs on 6th it was lying 200 Kms from the coast at 16 degree N Latitude and 84 degree East Longitude. There after it changed its course slightly North and crossed the A.P.Coast in Amalapuram area late evening of 6th November, 1996. Had it continued along 16 degree N Latitude till it crossed the coast the brunt the damage would have been borne by Avanigadda area of Krishna district and the effect would have been felt mainly by Krishna, Guntur and perhaps Chirala area of Prakasam district. This cyclone entered the radar picture by about 12.00 5th November and was last reported located 50 Kms SW of Kakinada at 23.30 hours on 6th November. It means it has travelled 450 Kms from 12.00 hours 5th November to 23.30 hours 6th November in a time span of 35 hours 30 minutes. Between 14.30 hours and 17.30 hours on 5th November it remained stationary at 350 Kms distance from the coast. This time span gives it an average speed of 12.7 kmph. But this is a deceiving image. In fact it has moved from its position at 16.4 degree N and 82.7 degree E about 100 kms SE of Kakinada at 17.30 hours on 6th November,1996 to a point 50 Kms South West of Kakinada at 23.30 Hours on 6th November, 1996. A distance of 150 Kms in 6 hours gives it a speed of 35 kmph. There seems to be a reason to believe that cyclones pick up speed when they are close to the coast At this point of time it should be stated that the message about the cyclone being located 100 kms away from Kakinada , though originated by cyclone warning centre at Visakapatnam at 18.30 hours on 6th November,1996 never reached the East Godavari Collectorate in time. With all the sophisticated communication system available the non-delivery of the latest position before crossing was a systems failure. It is a different matter that the Collector was informed on telephone around 5 PM that the cyclone was heading towards East Godavari.

TABLE -2

TRANSLATION SPEED OF CYCLONE -NOV'96

Time sequence of observations	**Time interval in Hours**	**Distance Traveled**	**Translation Speed in Kms per Hour**
1200 – 1430	2 ½	50	20
1430 – 1730	3	0	0
1730 on 5/11 to 0830 on 6/11	15	150	10
0830 to 1430 on 6/11	6	80	13.33
1430 – 1730 on 6/11		20	6.66
1730 to 2330 on 6/11	6	150	25
1200 on 5/11 to 2330 on 6/11	**35 ½**	**450**	**12.67 (Average Speed from 1st to last observation)**

The above table shows quite clearly the unpredictability of the speed of the cyclones and also the point that had been made earlier in this section that cyclones tended to increase in translation speed as they get closer to the coast. The time and space dimension is considered essential for the decision- makers to order evacuation or hold on for some more time. The Officer could easily make this analysis on duty at the Control room by plotting the positions from the messages as

they are received. It is here that the reduction of time in transmission and delivery of messages gives the advantage of increasing the lead -time for flow of orders to lower levels.

It is also evident that the messages contain all essential information required for dissemination to all concerned. If adequate awareness is built up in the officials and the public then the text of the message could be further reduced thus saving some time in transmission at all levels and they will be hopefully better complied with.

Accuracy of the landing Point of Cyclones

The next aspect of warnings is the accuracy of the landing point of the cyclone. The tropical cyclones are highly unpredictable and there is uncertainty because the direction, speed, and the energy dynamics have not been understood as yet despite heroic attempts at climatological research. It is true that accuracy in the landing point will help in avoiding unnecessary evacuation of a large number of people. During the study, on this cyclone, the impression given by some District officials was that they were depending on the CWC to give a narrower band of the area likely to be the target of the cyclone. This is not possible and even in the United States of America, the Alert message covered an area of 800 kms initially and the Warning covered an area of 300 kms. Therefore this limitation has to be accepted.

One of the suggestions made by the CDMC is to have a reconnaissance aircraft fitted with meteorological instruments to record the actual conditions and thereby improve the assessments. As yet in India we do not have such an aircraft. As regards the accuracy the IMD is believed to be going in for upgradation of the radars to Doppler type which would enhance their assessment capabilities. Even then the accuracy expected by the public and the officials may not be forthcoming. The long-term outlook should then be to strengthen the capacity of people by cyclone-proof shelters and minimise the damages by protective structural measures.

Evacuation is definitely the better way to avoid losses of Human lives. Inspite of the best efforts of Govt. people are reluctant to leave their houses because of the lack of security of their properties and also because of disbelief in the warnings more so when their area does not become the target of the cyclone. An example of this is that in the Nov. '96 cyclone villagers in sakinetipally mandal refused to move out of their village which was on the sea shore and was separated from the main land by a water channel. The MRO found that the people were adamant even when he threatened them evacuation by force. In return they threatened him with dire consequences. Fortunately for them the cyclone did not touch their area. One month later when there was threat of cyclone.in December1996 some people from the very same village came to the MRO and said that they had all crossed the water channel and wanted to know which relief camp they should go to. They had learnt from the experience of the unfortunate mandals which got hit by the Nov'96 cyclone.

Dissemination of warnings

The CWC Visakhapatnam is responsible for issue of cyclone Alerts and Warnings. This system is of two-stage gradation of advance cautions issued by the CWC. CA) 'Alert' to fore-warn the District and State Administration of the impending hazardous situations as early as possible and CB) to change the 'Alert' to 'Warnings' and to predict the crossing of the coast. CWC is also responsible for predicting the landfall, speed, and intensity of rainfall and to give advisory bulletins to the state administration and the general public at large through the All India Radio.

CWC here had sent out six port warnings and four fisheries bulletins each day when the cyclone was intense. Eight warnings were sent to the state government officials. Twelve bulletins were sent through the Disaster Warning System CDWs) -a direct satellite based communication system to the district collectorates and other coastal stations. In spite of repeated warnings and indications of the cyclonic position, many people were killed.

Explaining the cause for heavy loss of human life along with crops and coconut trees and dwellings Dr Naidu Director CWC said the islands located in the estuaries of the Godavari were just above the sea level and were dangerously exposed to the 3-meter high tidal wave. The tide remained for 3 to 4 hrs. The tide along with the gale of 60 to 90 km/h swept away the thatched houses. Almost 90% of the dwellings in the area consisted of thatch house or semi-permanent dwellings with mud plaster walls.

Summary

People's Participation

The contingency plan that was prepared covers all the main aspects from the govt. point of view. A significant omission is the emphasis on people's participation in disaster management This approach of people's participation has only come about since the late 80's largely due to the efforts of NGO's/VA's. At the moment this component of people's participation is being gradually strengthened in Rural Development and therefore consequently in Disaster Mitigation planning. Having a contingency plan is certainly important but to implement the plan upon receipt of alert in effected areas requires much larger mobilisation efforts.

Evacuation, Rescue, Relief and Rehabiliation

Over the years the population has developed a "Relief" syndrome in which people have abrogated their own efforts in cyclone management to that of the State Govt. As the years have rolled by the state has experienced more frequent disasters at closer intervals with increasing losses / damages, in structural assets, which are becoming difficult to sustain.

The existing plan is not comprehensive enough to include the other important features of preparation which aim at mitigating the damages suffered by

the infrastructure and also protective works which can reduce the impact of cyclone caused by the gales, flooding due to torrential rains and the storm surge. In order to do this it is essential to have vulnerability analysis, hazard mapping and an integrated planning to dove-tail developmental activities with disaster mitigation. This is particularly important, as there are many departments involved in the maintenance of the public assets for the use of the people. It is an accepted fact that departments normally do not concern themselves beyond their own activities. One of the biggest reason for the increasing value of damages to property particularly could very well be the limitations of financial resources coupled with lower construction standards which are not able to withstand the pressures and stresses created by the storm conditions. Absence of effective regulating measures in land use, building construction and unrestricted destruction of vegetative cover have compounded the vulnerability of the society.

Lead-time required to initiate actions as per the plan, will only come from, proper interpretation of the warnings from the CWC, listening to the radio broadcasts from the A.I.R. by every one in the coastal area, (community radio sets in vulnerable villages). Voluntary teams suitably equipped with megaphone could also help in dissemination of information and instructions.

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FLOOD AND DROUGHT DISASTER MANAGEMENT

FLOODS

INTRODUCTION:

The country receives an annual precipitation of 400 million-hectare meters. Of the annual rainfall, 75% is received during four months of monsoon (June-September) and, as a result, almost all the rivers carry heavy discharge during this period. The flood hazard is compounded by the problems of sediment deposition, drainage congestion and synchronization of river floods with sea tides in the coastal plains. The area vulnerable to floods is 40 million-hectare and the average area affected by floods annually is about 8 million hectares. The average annual total damage to crops, houses, and public utilities during the period 1953-1995 was about Rs 9720 million.

The Table below depicts the average annual loss in the 1953 onwards.

Table 2.3 Average annual loss due to Floods

	Items	
1.	Land Area Affected	7,56 Million Hectare
2.	Population Affected	32.03 Million
3.	Human Lives Lost	1504 Number
4.	Livestock Lost	96713
5.	Houses Damaged	11683
6.	Houses Damaged	Rs 136.615 Crore
7.	Crop Damaged	Rs 460.07 Crore
8.	Public Utilities Damaged	Rs 377.248 Crore
	Total Losses	Rs 982.126 Crore

Causes of Floods

Flooding conditions may occur due to:

- Rivers in spate,
- Snowmelt
- Storm surges
- Short intense storms causing flash floods

Flooding in rivers is mainly caused by:

- Inadequate capacity within the banks of the river to contain high flows.
- River bank erosion and silting of riverbeds.
- Landslides leading to obstruction of flow and change in the river course.
- Synchronization of flood in the main and tributary rivers.
- Flow retardation due to tidal and backwater effects.
- Poor natural drainage.
- Cyclone and heavy rainfall.

Courtesy: Manual on Natural Disaster Management in India, NCDM, IIPA, New Delhi

The Nature of Flood Problem in Various River Basins

Brahmaputra River Region

The predominant problem in this region is the flooding caused by spilling of rivers over their banks, drainage congestion and tendency of some of the rivers to change their courses. In recent years, the erosion along the banks of the Brahmaputra has assumed serious proportions. The region is subject to severe and frequent earthquakes, which cause numerous landslides in the hills and upset the regime of the rivers.

Considering the individual states in the region, the flood problem is acute in Assam where the inundation is caused by over bank spillage along the Brahmaputra, the Barak and their tributaries. Besides bank erosion in northern portions of West Bengal, the rivers Tista, Torsa, Jaldhaka and Mahnananda are in floods every year and inundate large areas. These rivers also carry considerable amount of silt and have a tendency to change their courses. The rivers in Manipur spill over their banks frequently. The lakes in the territory get filled up during the monsoon and spread over larger marginal areas. In Tripura, there are problems of spilling and erosion by rivers.

Ganga River Region

The flood problem is mostly confined to the areas on the northern bank of the River Ganga. The damage is caused by the northern tributaries of the Ganga like Kosi, Gnadak etc., which spill over their banks and often change their course. Even though the main Ganga is a mighty river carrying huge discharges of 57,000 to 85,000 cumecs (2 to 3 million cusecs), the inundation and erosion problems are confined to a relatively few places.

In Uttar Pradesh the flooding is frequent in the eastern districts, mainly due to spilling of Rapti, the Sharada, the Ghaghra and the Gandak. The problem of drainage congestion exists in the western and north-western areas of Uttar Pradesh, particularly in Agra, Mathura and Meerut districts. The erosion is

experienced in some places on the left bank of Ganga and on the right banks of the Ghaghra and the Gandak.

In Bihar, the floods are largely confined to the rivers of North Bihar and are, more or less, an annual feature. The rivers such as the Burhi Gandak, the Bagmati and the Kamla and other smaller rivers of the Adhwara Group, the Kosi in the lower reaches and the Mahananda spill over their banks causing considerable damage to crops and dislocation of traffic.

In South and Central West Bengal, the Mahananda, the Bhagirathi, the Ajoy, the Damodar etc. cause flooding due to the inadequate capacity of river channels and tidal effect. There is also the problem of erosion of the banks of some of the rives and on the left and right banks of Ganga upstream and downstream respectively of the Farakka Barrage.

In Haryana, flooding takes places in the marginal areas along the Yamuna and the problem of poor drainage exists in some of the south-western districts.

In Delhi a small area along the banks of the Yamuna is subject to flooding by river spills. In addition local drainage congestion is experienced in some of the developing colonies during heavy rains. In Rajasthan, in addition to the flooding caused by heavy spells of rainfall in certain years, drainage congestion is experienced along Pahari-Kava drain.

North West Rivers Region

Compared to the Ganga and the Brahmaputra river regions, the flood problem is relatively less in this region. The major problem is that of inadequate surface drainage which causes inundation and water logging over vast areas.

At present, the problem in the states of Haryana and Punjab are mostly of drainage congestion and water logging. Floods are also caused sometimes by the Ghaggar river, which used to disappear in the sand dunes of Rajasthan after flowing through Punjab and Haryana. In recent years, besides flooding Punjab and Haryana areas, it has become active in the Rajasthan territory also, occasionally submerging large areas.

Floods occur periodically in the Jhelum and its tributaries in Kashmir Valley causing a rise in the level of Wullar Lake thereby submerging marginal areas of the lake and sometime threatening Srinagar and other areas along the riverbanks. Similarly, the Chenab and its tributaries like Tawi are often in spate endangering several densely populated areas in Jammu and Akhnoor etc.

Central India and Deccan Region

This region covers all the southern Sates namely Andhra Pradesh, Karnataka, Tamil Nadu and Kerala and the States of Orissa, Maharashrtra, Gujarat and parts of Madhya Pradesh. The region does not have very serious problem because the rivers have mostly well defined and stable courses.

The flood problem in Andhra Pradesh is confined to spilling by the smaller rivers and the submergence of marginal areas along the Kolleru Lake. Godavari and Krishna rivers on the east coast have acute drainage problem and face floods particularly in the wake of cyclonic storms. The small rivers of Kerala when in spate, cause considerable damage.

The Tapti and the Narmada are occasionally in high floods affecting areas in the lower reaches in Gujarat.

In Orissa damage due to floods is caused by the Mahanandi, the Brahmani and the Baitarni which have a common delta where the floodwaters intermingle, and when in spate simultaneously, cause considerable havoc. The problem is accentuated when the flood synchronizes with high tides. The silt deposited constantly by these rivers in the delta area raises the flood level and, the rivers often overflow their banks or break through new channels causing heavy damage. The lower reaches along the Subarnarekha are affected by floods and drainage congestion.

Types of Floods

Snow Melt Floods

Precipitation in the form of snow does not produce runoff or infiltrate into the soil, but waits until the snow melts, which means that several months of precipitation can accumulate above the soil surface. Rain on the snow pack or water from the melting snow can be held within the pack until the high liquid water content finally causes the pack to collapse, releasing water catastrophically and causing a very large runoff very rapidly. Warm rain after a large cold spell may cause the snow pack to melt while the underlying ground is still frozen, which prevents any infiltration. Because of these reasons, snow melt floods can be very large.

Storm Surge

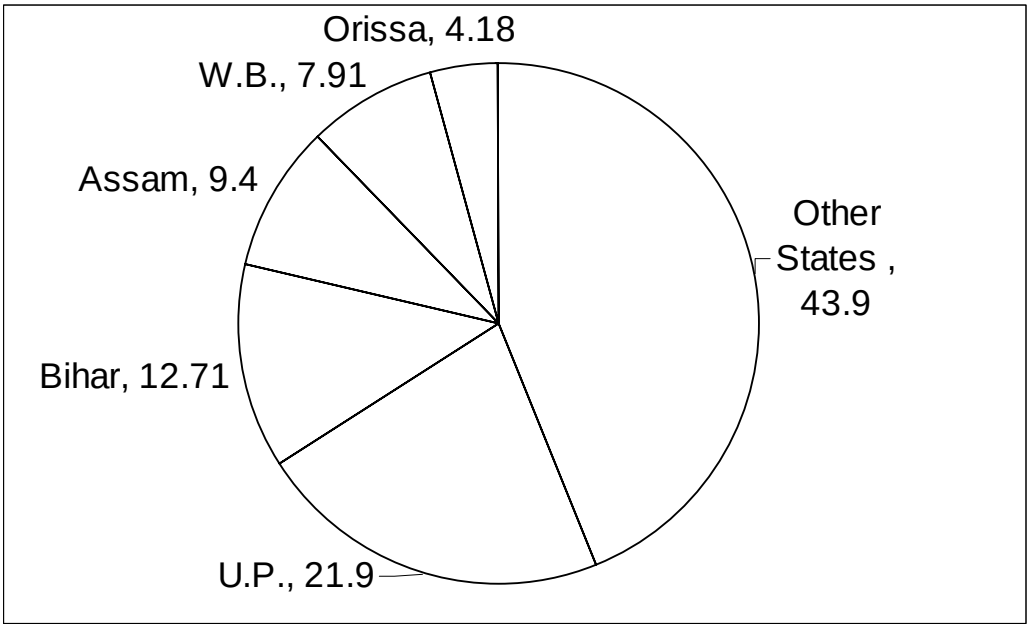
Floods in coastal areas and in river estuaries are usually due to storm surges, which result from the sea being driven on to the land by meteorological forces. Here two physical forces act together. A storm with intense low pressure causes the level of sea to rise because of barometric effects and strong winds associated with this storm, if directed on shore, drive the sea or the land. Storm surges are thus, commonly associated with tropical cyclones. The east coast of India is particularly prone to storm surges. The storm that produces the surge can also give rise to heavy rainfall inland so that the estuary region can be subject simultaneously to river flooding and storm surge.

Flash Floods

Flash floods are defined as floods of short duration with a relatively high peak discharge. They arise from local precipitation of extremely high intensity, typical of thunderstorms. The high concentration of rainfall on a small area can have devastating effects as the river flow can rise to several hundred times the normal flow in the space of a few hours. Flash floods are common in arid and semi-arid areas. In these areas, what little rainfall there is usually occurs in short, intense storms. The intensity of the storms and the poor absorptive capacity of arid

zone soils lead to much of the annual runoff occurring as flash floods, which can also occur following thunderstorms in more humid regions. Mountainous areas are prone to thunderstorms and the steep terrain and thin soils in the mountains assure high runoff with a short delay time.

FLOOD PRONE AREAS IN INDIA (%)
Total flood prone Area – 40 million Ha.



Flood Disaster Management

The various measures adopted for flood mitigation may be categorized into two groups:

i) Structural
ii) Non-structural

The general approach was aimed at preventing floodwaters from reaching the potential damage centres, as a result of which a large number of embankments came up along the various flood prone rivers. The main thrust of the flood protection programme undertaken in the country so far in the form of structural measures may be grouped into the following:

- Dams and Reservoirs
- Embankments, flood walls, sea wall
- Natural detention basin
- Channel improvement
- Drainage improvement
- Diversion of floodwaters.

For effective functioning of all the physical measures taken, it is necessary that pre and post-monsoon checks must be made and special repairs must be carried out prior to flood period.

The non-structural measures, on the other hand, aim at modifying the susceptibility of flood damage as well as modifying the loss burden. The various non-structural measures being implemented in the country are:

i) Modifying the susceptibility to flood damages through:
   - o Flood plain management
   - o Flood proofing including disaster preparedness, and response planning and
   - o Flood forecasting and Warning

ii) Modifying the flood loss burden through:
   - o Disaster Relief
   - o Flood fighting including Public Health Measures

Setting up of flood forecasting and warning services is one of the most cost-effective non-structural measures available.

The flood forecasting organization set up in Central Water Commission is presently responsible for issuing forecasts at 157 stations, of which 132 are for water stage forecast and 25 for inflow forecast used for optimum operation of certain major reservoirs. These 157 stations are located in the 11 flood prone states and 2 Union Territories as shown in the table:

Table: Flood Forecasting Stations in India.

S.No	**States/Union Territory**	**No. of Stations**
1.	Andhra Pradesh	11
2.	Assam	23
3.	Bihar	36
4.	Gujarat	10
5.	Haryana	01
6.	Karnataka	04
7.	Madhya Pradesh	03
8.	Maharashtra	07
9.	Orissa	11
10.	Uttar Pradesh	33
11.	West Bengal	14
Union Territories		
1.	Delhi	02
2.	Dadar & Nagar Haveli	02
	Total Stations	**157**

Flood forecasting methods are being constantly reviewed and further improvements are being made with assistance from UNDP, USAID, Denmark, etc., so as to make flood forecast more reliable and timely. Flood forecasting methods are being reviewed by the Ministry of Water Resources also. Modernization involves installing automatic data collection system by means of census, transmission of data by latest techniques of communication, and formulation of forecast using computer based comprehensive models.

The final forecast are communicated to the concerned administrative and engineering authorities of the state, and other agencies connected with flood protection and management work, on telephone or by special messenger/telegram/wireless, depending upon local factors like vulnerability of the area, availability of communication facilities etc., (refer Appendix 'B') .

There is a growing feeling that the incidence and intensity of floods has grown alarminingly over years. In a country of continental size, with 35 metrological sub-divisions there is excess or deficient rainfall in one part or the other. Thus in the current monsoon season, while North Bihar and Assam are reeling under floods, North India particularly Punjab and Haryana has been experiencing rainfall deficiency. Floods have thus been more or less annual phenomenon.

Another major cause is the increased encroachment of flood plains because of developmental and population pressure. The flood plains are integral part of the flood regime and unimpeded drainage without hindrance with its benign and life supporting aspects is necessary for meaningful resolution. The answer lies in proper flood zoning with strict guidelines prescribing the land use in flood plains and other vulnerable areas and priority needs to be given for tackling critical areas as a part of the master plan for flood proofing, flood control and drainage in each of the states. The flood plain zoning would also include demarcation of zones liable to flooding by floods of different return periods such as 5, 25, 100 years, and the delineation of floodplain activities for each zone.

Preparedness against Floods:

Within the overall master plan of the state, there has to be a contingency plan for each district, involving steps requires to be taken before the onset of floods during the floods and post flood management. The following would be some of the essential components of flood preparedness.

1. By Department Concerned:

- "Pre Monsoon inspection" of all railway tracks, canals and drains by respective departments, which would include silt and details clearance from the seasonal rivulets.
- Regular clearances of the drains from silt and weeds to make the drainage system fully functional and restoration of natural drainage blocked by roads, railway tracks and canal.
- Regular maintenance of embankments of rivers, canals, distributors etc., and regular check of canals and siphons and clearing them from silt.
- Clearing of storm water and sewerage drains in towns before monsoon.
- Constitution of committees comprising of heads of all emergency services, medical, police, transportation and district administration to ensure proper co-ordination during the crisis.

2. By the State and District Administration:

- Review of Contingency Plan.
- Update/Modify it, if deemed necessary.
- Co-ordinate with NGOs/CBOs.

- Review and visit to likely places for evacuation to ensure their functional availability.
- Make people aware of the warning dissemination mechanism.
- "Do's" and "don'ts".

Response Mechanism

On receipt of warning of the impeding disaster, part of the immediate response has to be **to warn the people.** In the case of floods and cyclones, enough early warning time is normally available for this purpose.

Existing procedures lay down dissemination procedures on the part of the Government agency concerned – through print and electronic media as well as informing the authorities concerned. It is the secondary reach to all the people in the likely affected areas that is the responsibility of the District administration especially to those people who have no access to mass media modes. This could be by beat of drums, sounding of sirens, village gongs, if any, or by word of mouth. Some local means need to be evolved and be kept in place to ensure that people come to know of the impending calamity and to take suitable follow – up action to save their lives and property as also to help the neighborhood wherever they can.

It has been seen that the largest cause of loss of lives is through house collapses when giving warning is possible and when it is not possible. Safety lies in evacuating people to safer pre-designated areas along with their precious belongings for the duration of the calamity. Generally safe places (at higher elevations) are the pucca buildings i.e. school, Panchayat Ghar and other public and identified private buildings. It is essential to provide food, safe drinking water hygiene and sanitation facilities in these areas.

Evacuation Drill must be well know to the population at large, as to where to go in case of a calamity.

One of the known reasons for non-evacuation is the safety of the abandoned houses and material left behind. It should be an integral part of the preparedness plan to earmark responsibility for safety of these properties and instill confidence in this regard. This will help people gain confidence in the system, make them willing to get evacuated and thus keep the loss of human lives to the minimal.

During the occurrence of a natural calamity, two activities come to the forefront simultaneously – administration of relief and search and rescue. The latter can comprise of rescuing people from the fallen/damaged houses or other places and evacuating them to safer places and administering medical treatment when required.

The other aspect of rescue and relief is to search for and rescue people, where fishermen/boatmen etc. are swept away by the current of river or sea. In the early stages, locally available resources attempt these efforts. When that is not possible, the armed forces are called in for bodies in spate, or from the sea, where all other modes of communication are cut off.

There are well established procedures for rendering relief – evacuation, rescue, providing food, shelter (temporary), drinking water, medical care, few

pieces of clothing, utensils. Once the calamity is over, relief can help people restore their lives back to normal by helping them repair/rebuild their houses, helping them in restarting their small businesses, compensating somewhat for loss of life and property.

These measures can have two phases; one adhoc and the other after proper assessment of the damage.

Damage Assessment is the responsibility of the district/local administration, which covers all aspects of private as well as public properties, including loss of crops etc. An inventory of all such details is prepared along with the estimated costs of damages and sent to the State Government who may release funds from the Calamity Relief Fund for distribution of assistance at the prescribed norms.

If the calamity is found to be beyond the capability of the State Government to meet from CRF, then a memorandum detailing the damages caused and the help required to sent to the Central Government in the Ministry of Agriculture. The Ministry may, after examination, decide to depute a Central Team to make an on the spot assessment of damages caused by the calamity. They arrive at their own conclusion after visits to the affected areas and arrive at a certain figure required to meet the calamity. Thus, the final figures of damage assessment is that of the State Government when they do not call the Central Government for assistance but where they do call; the final figure of damages is that of the Central Team. It forms the basis for distribution of assistance at the prescribed norms. If the State Government does not fall in line with the Centre's assessment, they may assist as per their own assessment, but funding has to, in that case, come from the state's own resources.

A checklist of action points constituting the District Contingency Plan is given in Appendices 'C' & 'D'.

Post Flood Management :

Post – Disaster Management could inter-alia include the following essential requirements:-

- Speedy restoration of roads, rail routes and the [postal services.
- Normal water supply in the affected areas either by arranging tankers or fire tenders
- Repair of the power, telephone and sewerage lines on priority basis so that normalcy is restored.
- Proper arrangements for the supply of food, shelter and clothing to the marooned people.
- Ensuring adequate supply of POL and kerosene oil and keeping the supply line moving.
- Constitution of a survey team to assess the loss and compensation to be given to the affected population.
- Assistance for repair/rebuilding of private properties.
- Desilting and dewatering of the inundated areas.
- Taking up appropriate measures according to Contingency Plan for the agriculture sector.

Floods are not an unmixed evil as they bring beneficial silt and help in procuring a better Rabi harvest. While an attempt can be made to minimize damages on account of a flood of 25 years return, it is by no means easy to do so

against a 50-year or a 100-year flood return. This is exactly what happened in Haryana in 1995. There against an average annual rainfall of 600-700 mm in the state, the average daily rainfall from 26.08.95 to 30.08.95 and again from 02.09.95 to 04.09.95 was 200-300 mm which engulfed a population of over 2.5 million involving a colossal loss placed at Rs.1800 Crores. The damage caused by floods can at best be minimized and not altogether eliminated and the old-age philosophy of living with the floods has to be adapted to the emerging situation with all the concomitant pressure of population and developmental activities.

DROUGHT

INTRODUCTION

Drought is a temporary reduction in water or moisture availability significantly below the normal or expected amount for a specific period. This condition occurs either due to inadequacy of rainfall, lack of irrigation facilities, under-exploitation or deficient availability for meeting the normal crop requirements in the context of the agro-climatic conditions prevailing in any particular area. This has been scientifically computed as moisture index (MI). Drought, in this context, can be defined as adverse MI or adverse water balance which may be attributable not only to a prolonged dry spell due to lack or sufficient rainfall but also due to such other factors as excessive evapo-transpiration losses*, high temperature, low soil holding capacity etc. The inadequacy is with reference to the prevailing agro-climatic conditions in any particular area. Therefore, there is a drought in Jaisalmer (Average rainfall 200 mm) if rainfall is not sufficient to grow grass and paltry coarse-grains, whereas in Bolangir or Koraput (Orissa-rainfall above 1000 mm) there is a drought if there is not enough rainfall for bringing the paddy crop to maturity.

Types of Drought

There are three types of drought:

- **Meteorological Drought** describes a situation where there is a reduction in rainfall for a specific period (days, months, season or year) below a specific amount (long term average for a specific time).
- **Hydrological Drought** involves a reduction in water resources (stream flow, lake level, ground water, underground aquifers) below a specific level for a given period of time.
- **Agricultural Drought** is the impact of meteorological/hydrological drought on crop yield.

The three drought types are completely different and not synonymous.

Rainfall

The Indian subcontinent experiences an average rainfall of around 1200 mm and as such its water resources are enormous and are well comparable to any other country of its size and magnitude. However the problem lies in its distribution across the country, ranging from over 10,000 mm at Cherrapunji and 8500mm in parts of Western Ghats at one end to around 200-300 mm in parts of westers Rajasthan and Gujarat at the other. Looking at the picture as a whole, the distribution of the area sown for the country as a whole under various ranges of rainfall is as under:-

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*- Out of above 1% of water absorbed by the roots of the plants, 99% moves up through the vascular system of the stem and escapes through the leaves to the atmosphere and the loss thus caused is said to be due to evapo-transpiration.

a)	33%	- Low Rainfall Region	750 mm
b)	35%	- Medium Rainfall Region	751-1125 mm
c)	24%	- High Rainfall Region	1125-2000 mm
d)	8%	- Very High Rainfall Region	>2000 mm

Because of the erratic behaviour of the rainfall, even the medium rainfall region is vulnerable to drought conditions. Consequently, 68% or roughly 2/3 of the country's arable area is at one time or the other susceptible to drought. This is particularly true of states, which have a good 1000/1100 mm rainfall, but in the absence of a well-developed irrigation system any deficiency or erratic behaviour in rainfall causes distress. Most of the major states have both drought as well as high rainfall areas and these are situations in states like Bihar, where while the northern part is reeling under floods, some of the southern districts falling in the rain shadow are simultaneously under drought. In 1993, there was a strange situation, whereby some of the districts of north Bihar were having floods and drought at the same time, floods due to water coming in the rivers from catchment areas in Nepal and drought due to local deficiency in rainfall.

Some remarks regarding the pattern of rainfall may be appropriate. Any delay in the outset of monsoon causes worry and the Centre and the States immediately girdle themselves with contingency plans for shorter term alternative crops. In fact the National Commission on Agriculture (1976) felt that month wise rainfall has much greater relevance than rainfall for the entire season, and we have several drought situations, where the overall precipitation in the season is normal but its uneven distribution over the months creates adverse conditions. Very often, delayed rains are followed by heavy precipitation over a short period thereafter, thereby causing flood, as in 1995 in Punjab and Rajasthan. Good rain in the later half of the season, even after drought in the first half of the season can considerably retrieve the situation. A classic case cited is that of cultivation of paddy in Thanjavur (Tamil Nadu) by resorting to direct sowing of seed during the later half of the kharif season during 1987-88 that met with considerable success. Failure of rain in the later half of the season, particularly at the maturity stages is an invitation to disaster. A comparison with floods can further help in getting clarity. Whereas floods are a sudden visitation, often coming without warning, droughts are a creeping phenomenon, with hopes still lingering till the last stage.

The drought of 1987, caused by the failure of the south-west monsoon over large parts of India, was one of the worst in the century. Only 14 out of the 35 meteorological sub-divisions of the country received normal or excess rainfall : 18 sub-divisions received deficient and 3 received scanty rainfall. Approximately 37 per cent of the geographical area of the country received normal rainfall, leading to an overall deficiency of (-19 per cent) the delayed monsoon affected agriculture operations in 43 per cent of the cropped area, with Rajasthan and Gujarat being the worst affected states.

The Prime Minister set up Cabinet Committee on Drought (CCD), which formulated an action plan and closely monitored its implementation. By adopting an effective agricultural contingency plan incorporating optimum use of water resources, the loss in production could be minimized. The Action Plan emphasized on (a) Employment Generation ; (b) Provision of drinking water; (c) Fodder availability; (d) Supply of essential commodities; and (e) Drought Proofing as drought mitigation measures.

Identification of Drought-Prone Areas

The Hanumantha Rao, Technical Committee on DPAP/DDP (April 1994) has formulated the criterion currently under usage. The committee has worked out a Moisture Index (MI) to assess the extent or aridity, which broadly speaking is the ratio between the precipitation received and the water requirement of the plants under the given agro-climatic conditions. The Moisture Index on this basis is readily available for various areas, as monthly and annual figures of about 300 stations in and around India are regularly computed by the Indian Meteorological Department (IMD). The zoning on this besides worked out by the Hanumantha Rao Committee is as follows :-

Table : Moisture Index in Different Climatic Zones in India

Moisture Index	Climatic Zone	Per cent Area
-66.7	Arid	19.6
-66.7 to –33.3	Semi-arid	37
-33.3 to 0	Dry sub-humid	21.1
0 to +20	Moist sub-humid	10.2
+20.1 to 99.9	Humid	7.8
100	Pre-humid	8.3

The incorporation of a new dry-humid category is one of new innovations suggested by the committee. Arid districts where area irrigated constituted more than 50%, semi-arid districts with 40% irrigation and dry sub0humid districts with 30% irrigation were totally excluded from the programme. The number of DPAP blocks (Drought Prone Area) identified on this basis in 946 in 149 districts in 14 states,. Other blocks in districts in states have been identified as DDP (Desert Prone). Thus of out of a total of around 6400 Blocks in the country 227 Blocks have been identified for micro watershed treatment in which Rs.15-25 Lakhs per watershed is to be provided at the rate of Rs.3000 to 5000 per hectare spread over a period of 4-5 years. Even though these were the DPAP/DDP Blocks, but most of the other parts of the country except Punjab and Kerala are susceptible to drought situation in one year or the other.

Drought Management

It may be stated that drought by its very nature partakes of crisis management, the success depending on one's ability first to predict and then to control. The strategy for this management is basically threefold :-

- close monitoring of the emerging drought scenario so as to develop an advance warning system.

- relief measures required for providing immediate succour to the affected population and the upkeep of the cattle wealth, and if possible it integrate it with long term objectives and
- hammering out an alternative crop strategy for maximum possible retrieval of the Kharif crop and a better ensuing Rabi crop.

Since drought prediction methods are at a very nascent stage, IMD has made efforts to provide a long range forecast of monsoon rainfall. In 1988, a parametric power regression model was developed on the basis of global and regional meteorological and oceanic parameters (physically related with monsoon and rainfall) for estimating the monsoon rainfall of India. The model is successful in estimating the correct nature of monsoon and can be utilized for drought mitigation planning. Besides this, IMD carries out rainfall monitoring unto district level on a real time basis. All this helps in estimating the drought conditions over any particular region.

Warning and Dissemination

- There is a "Weather-Watch-Group" in the Ministry of Agriculture, which meets every week to take stock of the rainfall progress, its effects on the crops from sowing to harvesting, during the Kharif season. Weekly input from IMD gives an early warning about the impending drought as and when symptoms arise in this regard and the states are warned accordingly.

- The National Agriculture Drought Assessment and Management System (NADAMS) is being developed by the Department of Space for the Department of Agriculture and Co-operation, and is primarily based on the monitoring of vegetation status through National Oceanic and Atmospheric Administration (NOAA) Advanced Very High Resolution (AVHR) data. The drought assessment is based on a comparative evaluation of satellite observed green vegetation cover (both area and greenness) of a district in any specific time period, with that of any similar period in previous years. This comparative evaluation helps in fixing the current season in the scale of historic agricultural situations. In 1990-91, drought assessment was intimated to drought-affected states and districts within 48-72 hours of every biweekly period by telex/telegrams and the printed bulletins dispatched within 10 days. During 1992, the frequency of drought report was changed to monthly interval but with more detailed assessment of seasonal conditions and integrating ground observations of rainfall and agricultural situation with satellite data. This nation-wide early-warning service has been found to be useful for providing first alert of drought conditions.

Gujarat is an endemically drought prone state and has developed a sophisticated monitoring system. An attempt is being made to convert the abundant day-to-day rainfall data emanating from the taluks along with IMD (Indian Meteorological Department) data into a management information system. The water levels in each of the 105 main reservoirs in the state, the additional inflow of water in these reservoirs during the preceding 24 hours and loss of water, if any, either through evaporation or through spill-over is relayed to the Central Control Room through wireless stations. Based on this data, both in October, 1985 and November, 1986, the Government took a decision to drastically cut down or regulate releases of water for irrigation purposes and to utilize the available quantity of water mainly for purposes of supplying drinking water.

The Agriculture Department provides information regarding the area under various types of crops, the progress of agriculture operations and the growth of the crops sown during the Kharif season linked to the advance of monsoons. This is regularly monitored by the Weather Watch Group established in each state under Agriculture Department. The District Collectors as the revenue head give a socio-economic analysis mainly indicating the signs of distress consequent to failure of rains and the estimated 'anna' valuation during the two preceding crops. If the produce of the corp. in terms of 'annawari' is below a certain percentage say 37 paise then scarcity conditions are deemed to exist. An action plan to meet such a situation is put into effect that takes into account commencement of relief works, primarily fodder for the cattle, preparation for providing drinking water, alternative crop contingency plan etc. The primary responsibility for assessment of damages rest with the district revenue hierarchy who report it to the State Government while initiating ameliorating measures simultaneously. If the calamity is beyond the means of the state to handle, then a memorandum seeking central assistance is sent to the Central Government who after examination may depute an inter-ministerial Central Team to carry out an on-the-spot study and submit its report to the Central Government. There it is considered by a High Level Committee headed by the Secretary (department of Agriculture and Co-operation) and remit it for consideration and approval of National Calamity Relief Committee (NCRC), whose orders on the subject are final for release of funds from the National Calamity Relief Fund. This amount is over and above the CRF for taking up relief measures in the drought affected areas.

Alternative Crop Strategy

First of all reference may be made to the all important issue of formulating an alternative crop strategy for maximum possible retrieval of the Kharif crop and a better ensuring Rabi season. The steps taken in this regard during the drought of 1987 can help in clarifying the position. Water availability from 47 major reservoirs in the country was systematically monitored, and by controlled releases it was ensured that the storage available on 15TH January 1987 (commencement of the most critical period) was practically the same as in the corresponding period during 1986. An all out effort was made to provide power for a minimum of 8-10 hours to the agricultural sector and the Rural electrification Corporation (REC) implemented a crash programme for energizing agricultural pumping sets. Electrification of the maximum number of tube-wells and provision of adequate power supply, even though it may become necessary to divert power from other area, would have to be a major input. The requirements of seeds crop-wise were assessed, sources for procurement of seeds were identified and wherever consideration necessary, seeds were procured through the National Seeds Corporation/States Seeds Corporation. Arrangements were made for providing credit to farmers for purchasing seeds and fertilizers, the purchase of these and the other inputs was subsidized for the small and marginal farmers and the short term co-operative and other loans taken by the farmers were converted into medium term loans. Since there were reasonable rains in the later months, strategies were worked out for increasing production during the ensuring Rabi season.

Employment Generation

Three other aspects which call for urgent attention in a drought situation are **employment generation, drinking water supply** and **fodder availability**, the first out of the three being by for the most important, utilizing, as it did about 60-70% of the resources earmarked for drought relief in the past. Generation of additional employment through labour intensive works has been the actual practice with the main objective of alleviating the distress arising on account of loss of employment opportunities in farming sector due to droughts, the permanent benefit from them being somewhat fortuitous. With insufficient technical support for executing local development, unmotivated amateur labour force, and capital component of the scheme not readily forthcoming, all exhortations for having a shelf of worthwhile schemes not readily forthcoming, the building up of permanent assets as desirable objective have largely remained unheeded. Very often, many schemes starting from the CRF (Calamity Relief Fund) are not completed, as in the ensuing years availability of funds are contingent upon the drought occurring next year, which may not happen.

Detailed planning is required to arrive at a reasonable and realistic estimate of the total labour force required so as to have a realistic picture of 'man-days' which would be required to be generated to cater to the employment needs of each group of villages. In mono-cropped areas without any other worthwhile irrigation facilities, work has to be provided for almost till the onset of the next monsoon season. A list of projects, which can be taken up short notice, has to be kept ready.

With the universal extension and application of poverty alleviation programmes, along with various schemes in the nature of social security such as old age pension and mid-day meal for children and the likelihood of more such schemes being brought into operation in the foreseeable future, and with a considerably increased purchasing power placed in the hands of the rural populace, there is likelihood of considerable change in the entire employment scenario. The present scenario is that demand of employment is to be met from employment generation programmes for two reasons – firstly, there is continuity in availability of resources as well as provision for its maintenance, and secondly, technical input is found to be better in these works. Funds available under EAS are demand driven. Only when funds are not available under employment generation programme funds from CRF could be used for this purpose. All such expenditure must be undertaken in the context of an overall long-term strategy and instead of a paradigm of relief, **a paradigm of 'relief cum development' would be much more appropriate.**

Drinking Water

With the implement of the Rajiv Gandhi National Drinking Water Mission (RGNDWM) and the Accelerated Rural Water Supply Programme (ARWSP) a vast network of water supply schemes has been set up in the entire country. There are still a large number of villages without adequate water supply within reasonable distance or where sources have got dried up or gone derelict. Drying up of existing wells and search for new sites is a perpetual exercise. Hand pumps account for the bulk of the coverage and their repair and maintenance is a major problem for which the village community itself must assume much greater responsibility. Another part of this problem is that concerning hamlets (Dhanis and Majras) or group of houses situated at a distance as a sub-village. In Rajasthan, 30% of the rural population is said to live in these Dhanis and Majras and those living at such

places are still required to cover 2 to 5 km distance for getting their drinking water supply requirements and the problem is similar in many other states.

- A detailed contingency plan for supply of drinking water in rural areas to be formulated with technical help from the Central Ground Water Board (CGWB) and utilizing, if required, the rigs and other capital equipment from the CGWB.
- Adequate plans to be made in the supply of drinking water in urban areas through bores, tankers, special trains and other suitable measures.
- Continuous monitoring of rural and urban drinking water availability in drought affected areas.
- Preparation of a water budget for each irrigation reservoir covering drinking water, kharif and rabi requirements and capping damage to ground water regime.
- Undertaking repairs of tube-wells to make all tube-wells operational and install additional tube-wells, taking care at the same time to prevent over-exploitation of and damage to ground water regime.
- Regulating supply to water-intensive industries, if necessary.
- Minimising evaporation losses in tanks and small reservoirs by using chemical methods, subject to Health Clearance.

Health & Public Health Measures

The nutritional requirement of all the children, expectant mothers and nursing mothers should be taken care of. Care has to be taken to disinfect drinking water sources to prevent the spread of water-borne diseases and plans need to be drawn up to cope with likely epidemics. There is need for constant surveillance of public health measures including immunization to be undertaken.

Cattle Care

The cattle are the worst affected during a drought situation. The upkeep of the cattle was rendered singularly arduous during drought of 1987 in the arid western part of the country that had been subjected to droughts in preceding years. Out of a bovine population of 214 million in 17 drought affected states and union territories , as many as 120 million were affected by drought to varying degree. The impact of drought on cattle population was severe in northern north-western Rajasthan (Barmer, Jaisalmer, Jhunjhunu, Jodhpur, Jalore, Churu Nagore, Sikar and Pali districts) and in northern Gujarat (Banaskantha, Surendranagar, Kutch and Saurashtra). Where it is not possible to supply fodder or take medical care of cattle camps are opened to take complete care of the cattle population.

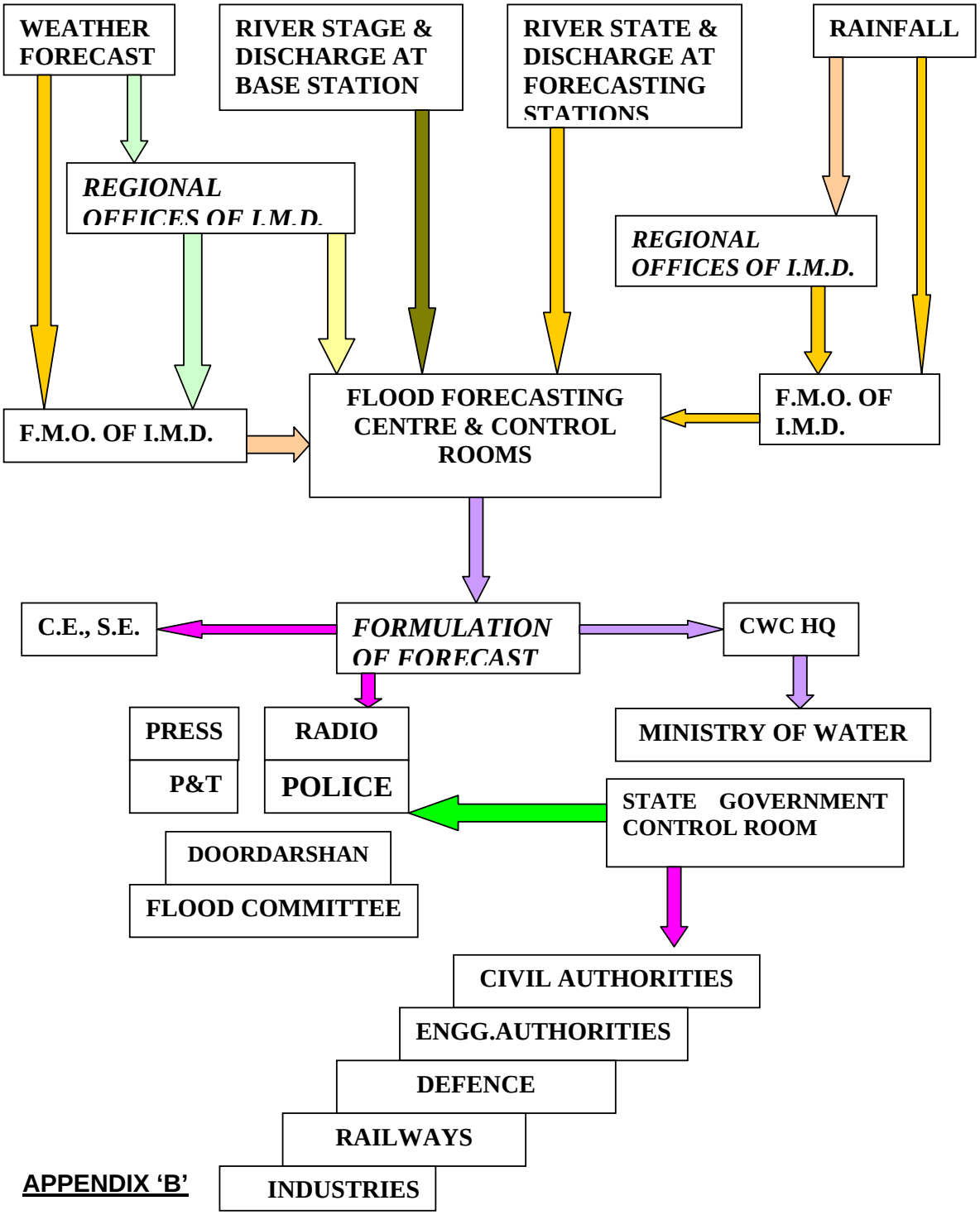
The following is a checklist of points for monitoring the fodder requirement in a difficult drought situation.

- Assessment of fodder requirement in drought affected districts and locate areas where shortages are likely to occur and arrange for supplies from outside.
- Monitoring the prices of fodder in selected places/markets.
- Arrange to procure fodder in selected outlets.
- State Forest Department to arrange for the cutting and bailing of grasses in the forest, wherever possible to meet the demand from fodder deficit districts.
- Fodder cultivation to be encouraged wherever feasible.
- Ensure supply for molasses to cattle feed plants.
- Obtaining from premixed feed and urea-molasses bricks to the extent necessary.

APPENDIX – A

FLOOD FORECASTING

PRESENT SYSTEM – SCHEMATIC DIAGRAM



APPENDIX 'B'

Forecast Dissemination

The utility of flood forecasts is dependent on both accuracy and timeliness. The organisations responsible for fiood-protection, warning and fiood-fighting works should be informed about the incoming flood as early as possible so that the

required action is planned and activities set into operation with least possible time delay.

A " Flood Forecast" received too late to take the necessary flood fighting measures is of "No" use. It is, therefore, imperative to take minimum time in dissemination of forecast.

Forecast Bulletins

Flood forecasts and warning which are formulated by various flood forecasting centres are supplied in the form of "DAILY WATER LEVEL AND FLOOD FORECAST BULLETINS" to concerned Civil and Engineering Authorities on Wireless/Telephone / by Special messenger/Priority Telegrams, depending upon the urgency and available mode of communication media.

Control Rooms

Generally, the State Governments set up " Central Control Rooms" at State and District Headquarters which receive these forecasts and disseminate the warning to the affected areas and organise relief as well as rescue operations. The forecasting centres also send the forecasts to the **" All India Radio"** stations, **"Doordarshan"** and the local **"Newspaper"** for wider publicity.

On receipt of " Fresh Information" a revised forecast is issued, if the situation warrants. During high flood stages the "Control Room" of the forecasting centre works round the clock and keeps informed the flood fighting agencies about the latest river position. They work in close collaboration.

Modernisation of Flood Forecasting System

Flood forecasting methods are constantly reviewed and further improvements done to make flood forecast more reliable and timely. Modernisation involves installing automatic data collection system by means of sensors, transmission of data by latest techniques of communication by employing microwave, V sat or meteorburst and formulation of forecasts using computer based comprehensive models.

Modernisation of Flood Forecasting System on River Yamuna

A pilot project for improvement of river and flood forecasting system in India was commenced in 1980 as a UNDP/WMO aided project for the Yamuna up to Delhi. Data acquisition system using sensors have been installed and further improvement using Satellite communication technology has been introduced.

For formulation of forecasts various models like SSARR, HECIF, NAMS11 F, NLC and CWCFF1 have been tailor-made, calibrated and utilised for forecasting purposes.

APPENDIX 'C'

DISTRICT CONTINGENCY PLAN ACTION POINTS: FLOOD

1. Pre-flood arrangements:

- ✓ Convening a Meeting of the District Level Committee on Natural Calamities;
- ✓ Functioning of the Control Rooms ;
- ✓ Closure of past breaches in river and canal embankments and guarding of weak points;
- ✓ Rain-recording and submission of rainfall reports;
- ✓ Communication of gauge-readings and preparation of maps and charts;
- ✓ Dissemination of weather reports and flood bulletins issued by the meteorological Centres, central Water Commission, Flood Forecasting Orgarlisation;
- ✓ Deployment of boats at strategic points;
- ✓ Use of power boats;
- ✓ Installation of temporary Police Wireless Stations and temporary telephones in flood-prone areas;
- ✓ Arrangement for keeping telephone and telegraph lines in order;
- ✓ Storage of food in interior, vulnerable strategic and key areas;
- ✓ Arrangements of dry food stuff and other necessities of life;
- ✓ Arrangements for keeping the drainage system desilted and properly maintained;
- ✓ Agricultural measures;
- ✓ Health measures;
- ✓ Veterinary measures;
- ✓ Selection of flood shelters;
- ✓ Advance arrangements for army assistance;
- ✓ Training in flood relief work;
- ✓ Organisation of relief parties;
- ✓ Other precautionary measures; and
- ✓ Alternative drinking water supply arrangements.

APPENDIX 'D'

ARRANGEMENTS DURING AND AFTER FLOODS:

Organising rescue operations.

- Organising shelter for the people in distress in case the efforts of the civil authorities are considered inadequate, Army assistance should be requisitioned.
- Relief measures by non-official and voluntary organisations may be enlisted as far as possible.
- Organise relief camps.
- Provision of basic amenities like drinking water, sanitation and public health care and arrangements of cooked food in the relief camps.
- Making necessary arrangements for air dropping of food packets in the marooned villages through helicopters.
- Organising enough relief parties to the rescue of the marooned people within a reasonable time limit.
- Establish alternate communication links to have effective communication with marooned areas.
- Organising controlled kitchens to supply foods initially at least for 3 days.
- Organising cattle camps, if necessary, and provide veterinary care, fodder and cattle feed to the affected animals.
- Grant of emergency relief to all the affected people.
- Submission of daily reports and disseminate correct information through mass media to avoid rumours.
- Rehabilitation of homeless.
- Commencement of agricultural activities -desiltation, resowing.
- Repairs and reconstruction of infrastructure facilities such as roads, embankments, resettlement of flood prone areas.
- Health measures.
- Relief for economic reconstruction.

ROLE OF INDIA METEOROLOGICAL DEPARTMENT IN MITIGATING THE NATURAL

Dr.C.V.V.BHADRAM,
Ex-Director
Meteorological Centre, Hyderabad.

1. INTRODUCTION:

The Asia-Pacific Region comprising Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and SriLanka faces 60% of the natural disasters occurring in the world. Due to the geographical and climatic conditions India is exposed to one or other form of natural disaster, the more important ones are Cyclones, Floods, Earthquakes and Droughts which cause extensive damage to life and property in this region.

India has diverse agro-climatic regions with rainfall ranging from 150 mm in the northwest/west part of the Country to over 10,000 mm in north-eastern region. Two-thirds of the country comes under arid and semi-arid region and is prone to recurrent droughts. The vast Indian Coastal belt is frequently affected by cyclones during April-May and October-November months. Around 56% of the area is vulnerable to seismic disturbances. Particularly, the Himalayan region and North-Eastern India are highly unstable and subject to severe earthquakes. Over 40 million hectares of land area in the country experiences periodical floods. The Country's hilly region is prone to landslides and the Himalayan region to avalanches.

The recurrence of natural disasters causes major disruptions in socio-economic growth and development. Although it is not possible to prevent the occurrence of natural disasters, yet the sufferings of mankind can be minimized to a great extent by developing suitable warning systems, creating proper awareness among the people about the disasters and their likely impact and adopting appropriate advance measures for disaster reduction. In this respect, the united National General Assembly has designated the 1990s as the International Decade for Natural Disaster Reduction (IDNDR).

The important natural disasters and their mitigation are briefly discussed in the following sections.

2. TROPICAL CYCLONES

Tropical cyclones are one of the most destructive weather phenomena affecting the population along the coastal areas. The principal destructive elements associated with a tropical cyclone are (i) extremely high winds often exceeding 200 kmph, (ii) torrential rainfall of the order of 50 to 100 cm in 24 hours and (iii) high storm surges, which at times exceed 10 meters in height. Very strong winds damage installations, dwellings, communication systems, etc. resulting in loss of life and property. Heavy and prolonged rains cause flash floods and inundation of coastal areas. The storm surge is the most destructive element associated with a cyclone which causes inundation over vast stretches of the coast and washes away

all that comes in its way. About 90% of the total loss of life and property due to a cyclone are caused by storm surges alone.

There are two cyclone seasons in India, one from April to June and other, from September to December. About 5 to 6 cyclones form in the Indian seas every year out of which 2-3 hit the Indian coast. Mean tracks of cyclones in May and November are shown in Fig.1. Although the frequency of tropical cyclones in our region is small and their intensity is also less as compared to those forming in other parts of globe, but they are the deadliest of all when they strike the coastal areas bordering the north Bay of Bengal. This is so because these areas are prone to high storm surges. The monthly frequencies of tropical cyclones in the Bay of Bengal and the Arabian Sea are shown in Fig.2. The highest frequency is in November.

Cyclone Detection and Warning System

The India Meteorological Department (IMD) has an established well tested cyclone warning system which is now more than a century old. Cyclone forecasts and warnings are provided to the public, Government Officials and other user organisations, such as international and national Shipping, Fisheries, Ports etc. Cyclones over the Indian Seas are detected and tracked with the help of conventional meteorological observations, high-power cyclone detection radars and weather satellites. The Geostationary Indian National Satellite (INSAT) together with the ten high power cyclone detection radars installed along the east and west coasts of India provide continuous surveillance of the cyclones and no cyclone in the North Indian Ocean can now escape detection.

Cyclone warnings are issued in two stages. In the first stage, an “Alert” message is issued about 48 hours in advance of the commencement of adverse weather along the coast. The second stage, i.e the “Warning stage” starts about 24 hours before the cyclone is likely to strike the coast. Cyclone warnings are communicated by high priority telegrams, Police wireless Telex/Telephone, wherever possible, to the Chief Secretaries and Relief commissioners of the concerned States and collectors of the coastal districts likely to be affected by cyclone. Both the “Alert” and “Warning” messages are also repeatedly broadcasted by AIR stations and Doordarshan Kendras in the maritime States. The warning bulletins are issued at 3-hourly intervals, but as the cyclone comes closer to the coast, the bulletins are issued more frequently, at hourly or even half-hourly interval. On receipt of the warnings the State Government Officials take adequate precautions to safeguard the lives and property of the coastal population and if necessary, evacuate the people from vulnerable areas to safer places.

A Cyclone Warning Dissemination System (CWDS) for direct dissemination of cyclone warning to the users through INSAT Satellite has been installed along the east and west coast of India. This is entirely an Indian concept and is implemented indigenously. It enables the direct addressing of designated receiving stations in the coastal areas in local languages via satellite passing on vital warnings without any loss of time. The other advantages are: high reliability – when all land line communications fail and power break down occurs, this system works; selective addressing system – warning meant for a concerned district is given directly; warning message reaches instantaneously giving latest information

regarding cyclone and associated expected weather; and dewarning messages for concerned areas are also communicated. In all, there are 250 CWDS receivers installed, in phases, along the east and west coast of India.

Improvement in cyclone disaster preparedness

Over the years there has been a continuous improvement in observational tools, processing techniques and human resources in cyclone forecasting and warning system which has helped in considerable decrease of death toll due to cyclones in India. A comparison of major cyclone disasters which occurred in November 1977 and May 1990 clearly brings out the role of disaster preparedness strategy in minimizing the impact of cyclone hazards. The toll of 1990 cyclone was restricted to 967. The coordination mechanism at different administrative levels worked so accurately and timely that as many as 6.6 lakh people were evacuated from vulnerable areas well in time. The ability to warn in local dialect and communicate accurately the probable threat to life and property sufficiently in advance was the basis for successful management of the 1990 cyclone disaster.

IMD's responsibility for cyclone warning

IMD's responsibility for cyclone forecasting and warning covers almost the whole of North Indian Ocean besides the Indian coasts. As an active member of the WMO/ESCAP Panel on Tropical Cyclones IMD plays a leading role in cyclone warning services in this area through observations, cyclone advisories and information dissemination to the member countries of the Panel, namely Bangladesh, Myanmar, Thailand, Sri Lanka, Maldives and Pakistan. Considering the capabilities of IMD, New Delhi has been designated by the World Meteorological Organisation (WMO) as a Regional Specialised Meteorological Centre (RSMC) specialising in Tropical cyclones.

Like other advanced countries, IMD has developed computer based models for forecasting genesis, movement and intensity of cyclones besides a model for prediction of storm surge associated with cyclones.

3. EARTHQUAKES.

Earthquakes have been taking place in India from times immemorial. The Himalayas and the northeastern region are part of a world wide zone of earthquakes running along Pacific Ocean, Indonesia, Burma, Himalayas, Afghanistan, Iran, Turkey and the Mediterranean Sea.

The currently held geological views are that the earthquakes in Himalayas and northern India are caused by northeastward movement of the Indian landmass which is apparently slipping slowly beneath and colliding with the Eurasian landmass. This interaction, coupled with geological processes taking place at depth, causes earthquakes in northern India and Himalayas. Earthquakes of moderate to great intensity occur in the Himalayan regions from time to time.

Nodal agency for recording earthquakes

The India Meteorological Department (IMD) is the nodal agency of Government of India for seismic observations and research. IMD is responsible for determining and disseminating the epicentral parameters of earthquakes recorded in India and neighborhood. The epicentral parameters comprise geographical coordinates of the epicentre, time of origin of the earthquake and magnitude on the Richter Scale. These details of the earthquakes of magnitude 5.5 and above occurring in India are communicated to the Central Relief Commissioner, Cabinet Secretariat and Prime Minster'' Office besides the News media.

IMD maintains 36 seismological observatories in the country (Fig.3). Other agencies such as the Geological Survey of India, National Geophysical Research Institute, Northeastern Council, State Government Organisations, Universities and Research Institutes also maintain seismological observing and analysis outfits for their specific requirements.

Categorisation of earthquakes and seismic zoning in India:

In general term, earthquakes are categorised as follows :-

Earthquake of GREAT intensity	: More then 7.0 magnitude on the Richter Scale.
Earthquake of MODERATE intensity	: 5.0 to 7.0 magnitude on the Richter Scale.
Earthquake of SLIGHT intensity	: Less then 5.0 magnitude on the Richter scale.

Earthquakes of magnitude 5.5. or more would generally result in some damage.

On the basis of the past earthquake data and geological features, India has been divided into five seismic zones brought out by the Bureau of Indian Standards (Fig.4). This helps us to access the earthquake in different parts of the country and to design appropriate parameters for building earthquake resistant houses and other structures for the seismic zones.

Most of the damaging earthquakes occur in zones IV and V. It may be appreciated that earthquake related damage depends on many factors such as focal depth, nature of soil, type of buildings and structure, population density, time of occurrence etc. The magnitude of earthquake only one factor.

In the earthquake of Latur – Osmanabad districts in Maharashtra on September 30, 2993, it was found that this earthquake of moderate magnitude (6.3 in Richter Scale) occurred in an area which falls in Seismic Zone-I where, the probability of earthquakes of moderate and great intensity is rather low. The earthquake however caused extensive damage to buildings/structures which were built with stone and mud mortar. Very few well built buildings however suffered only partial damage.

Forecasting of earthquakes:

While the vulnerable seismic zones have been delineated on the basis of past data, there is no technique available at present anywhere in the world which can forecast the occurrence of an earthquake in space and time. Many claims appear in media from time to time but these have not been found to be correct even in general terms. Concerted research efforts for forecasting of earthquakes are being made at many institutions in India, such as the India Meteorological Department; Central Water & Power Research Station, Pune; National Geophysical Research Institute, Hyderabad; Wadia Institute of Himalayan Geology, Dehradun and University of Roorkee. The research approach is multi-disciplinary based on statistics, precursors like foreshocks, fault parameters, plate tectonics, gravity magnetic anomalies etc. Research based on animal behaviour has not been found of much usable value.

4. HEAVY RAINFALL AND FLOODS

India is traversed by large number of river systems. It experiences severe floods almost every year in one or the other part of the country causing tremendous loss of life, large scale damage to property and untold misery to millions of people. Floods are caused by excessive rainfall in river catchment areas during the southwest monsoon season, especially in north and central India. An area of 40 million hectares in the country is vulnerable to floods out of which about 8 million hectares is severely affected by floods each year. The flood prone areas in the country are shown in Fig.5.

Flood Forecasting in India

Flood forecasting and early warning for different river basins in India are provided by the Central Water Commission (CWC). CWC has set up a network of 157 flood forecasting and warning stations on most of the inter-State rivers in the country. The flood forecasts and warnings are formulated by the Flood Forecasting stations and supplied to the concerned State Government officials and other agencies connected with flood control and management work. The Government officials take immediate steps for rescue and relief operations, and evacuation of people from vulnerable areas to safer places. The forecasts and warnings are disseminated through the Electronic and Print media for the benefit of general public.

IMD provides meteorological support to CWC through its specialised centres known as Flood Meteorological Offices which are located in all important river basins. Information on past 24 hours average rainfall in river catchment areas along with quantitative precipitation forecasts for next 24 hours are provided. The Department also provides heavy rainfall warnings to the concerned organisations/authorities. These warnings are also broadcast through All India Radio and Doordarshan kendras.

5. SEVERE LOCAL STORMS AND TORNADOES

Severe thunderstorm known as severe local storm is another natural phenomenon which annually causes numerous deaths and considerable damage to property in India. They are known as ‘Local Storm’ due to their small extent in

space and time. The severe local storms are accompanied by high winds generally known as squalls, hailstorms, lightning and heavy rains. Most violent of these storms are the tornadoes which can generate wind speed of upto 500 kmph. Tornadoes are violently rotating storms of small diameter which are produced in very severe thunderstorms. The frequency of occurrence of tornadoes in India is, however, very small (1 to 2 in a year). Severe thunderstorms generally occur in India during the hot weather months of April to June. High thunderstorm activity is observed over (i) northeast India (ii) northwest India, (iii) central parts of the country and (iv) southwest Peninsula. Thunderstorms over eastern and northeastern parts of the country are more severe in intensity than those of other regions. These are know as 'Norwesters'. The frequency of thunderstorms over India based on data from 1931 to 1960 is shown in Fig.6.

Thunderstorm cells can be detected on the weather radars and an assessment of their severity and potential for producing heavy rain and hail can be made. INSAT satellite cloud observations also help in delineating active thunderstorm areas.

India Meteorological Department provides forecasts and warnings for high wind (squall, hail and heavy rain associated with thunderstorms) 24 hours in advance to the warness registered with different offices of the Department. These warnings are also broadcast through AIR stations for the benefit of the general public and other user agencies in the country.

6. LANDSLIDES

Landslides are a frequent recurring phenomena in the various hill ranges of India. Every year a large number of landslides cause extensive damages to roads, buildings, forests, plantations and agricultural fields.

Occurrence of landslides is primarily triggered by heavy rains, sudden cloud bursts, and earthquakes. These are random in nature both in time and location and are thus difficult to predict.

While all the hill ranges are affected by landslide incidence, the degree to which landslides have been found to occur can be broadly grouped as below:

(a)	Himalayas	Very high to high
(b)	Northeastern Hill ranges	High
(c)	Western Ghats and Nilgiris	High to moderate
(d)	Eastern Ghats	Low
(f)	Vindhyas	Low

A high degree of landslide incidence with attendant loss to property and life has been statistically observed to have a periodicity of the order of 4-5 years in the Himalayas. This arises due to two factors, viz. Variation in rainfall and progress of slope degradation. When a high rainfall year coincides with a particular degree of slope degradation resulting from man made or natural causes, a number of large landslides have occurred in the study areas, covering Jammu & Kashmir and Sikkim.

7. DROUGHTS

Droughts are different from other natural disasters in that they are caused by absence of rainfall over a long period rather than by some rapidly occurring phenomenon.

A drought is usually extensive in space and time. Its start cannot be readily identified and, in most cases, neither its termination. Droughts themselves do not usually cause death but they are the direct cause of famine which can kill hundreds or thousands of people and affect the livelihood of the millions.

India, being primarily an agricultural country, its economy is vitally lined with rainfall that occurs during the southwest monsoon season (June to September). The country has an annual aggregate precipitation of 117 cm, nearly 75% of which occurs during southwest monsoon season. Since 1875, 19 drought years have occurred in India. The drought of 1987 was one of the severe droughts in recent years, where the states of Rajasthan and Gujarat were the worst hit. About 60% area of the country had received below normal rainfall in this year and 285 million people were reported to be affected.

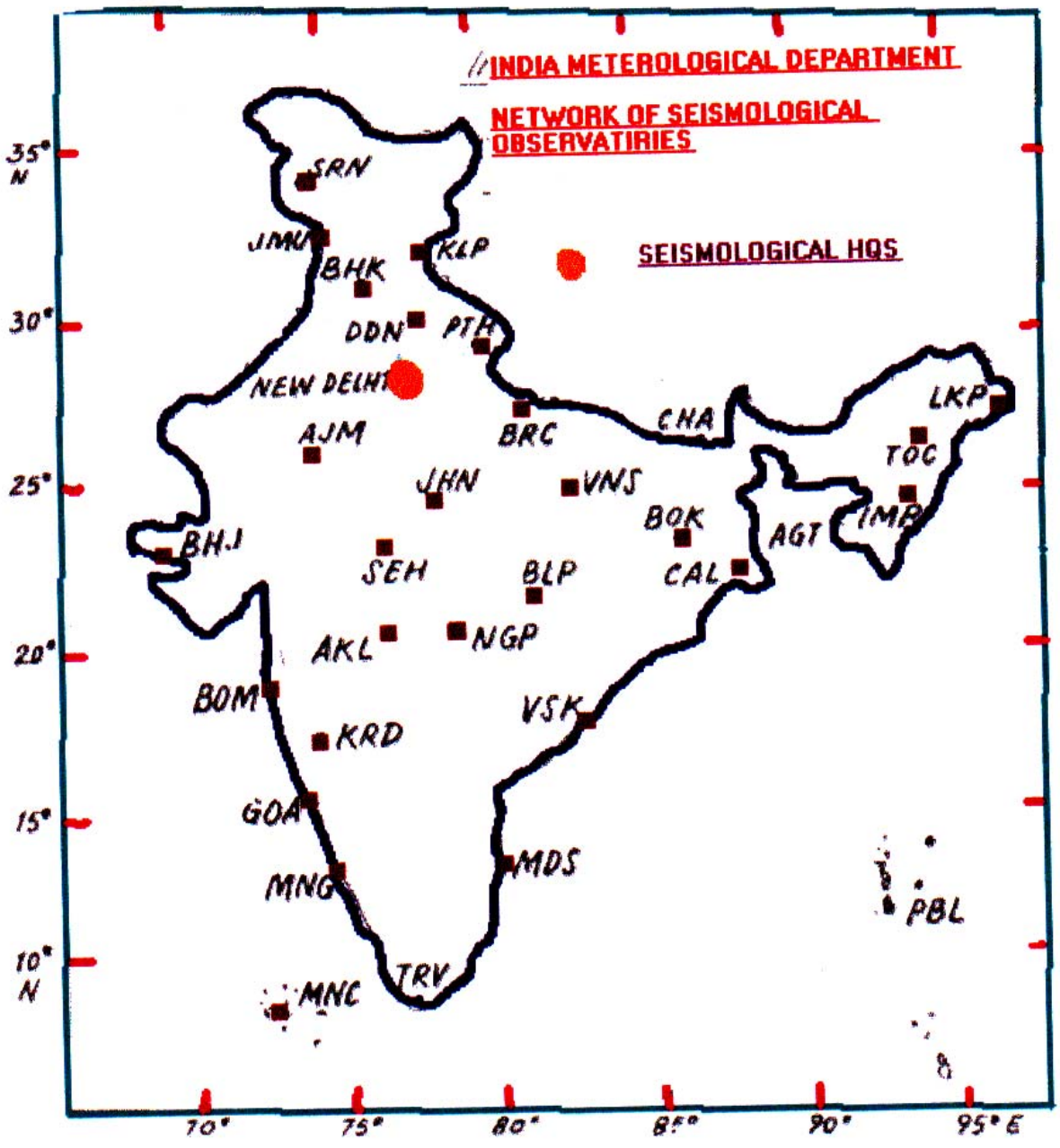
The prediction of drought still remains an unsolved problem not only in India but in many other countries of the world. In India a Long Range Forecast Model for southwest monsoon rainfall has been developed, which can be used for anticipating the drought. This technique has been found operationally useful during the past few years. Besides this, round the year rainfall monitoring upto the district level on a real time basis is carried out in the country. This helps in deriving advance information on the drought conditions occurring over one part or the other of the country.

7. SUMMARY

The Indian Sub-continent is affected by one or two major disasters every year besides a number of minor ones. Cyclones, floods, earthquakes, landslides and industrial disasters ravage the country quite frequently. A natural disaster calls for an effective information exchange between all emergencies – support organisations and functionaries at local, district and State levels for a systematic and integrated approach to disaster management.

India meteorological department has contributed significantly to the promotion of disaster prevention and preparedness activities and mitigation measures to help in the reduction of loss of life and destruction caused by natural disasters. Adequate warning systems have been developed for some of the natural disasters and at IMD's initiative the State Governments have adopted short and long term measures to mitigate the impacts of disasters. Some such measures are – construction of cyclone shelters, coastal afforestation, construction of embankments and dykes, improvement in coastal communications and better coordination between the warning specialists and disaster mitigation officials.

IMD also makes studies on the evaluation of disaster impact on country's economy. After every natural disaster in India, the affected areas are physically surveyed for the damages. The losses due to the disasters are documented in a report entitled "Disastrous Weather Events" published by IMD every year.


INDIA METEROLOGICAL DEPARTMENT
NETWORK OF SEISMOLOGICAL OBSERVATIRIES
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KLP
DDN
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NEW DELHI
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BRC
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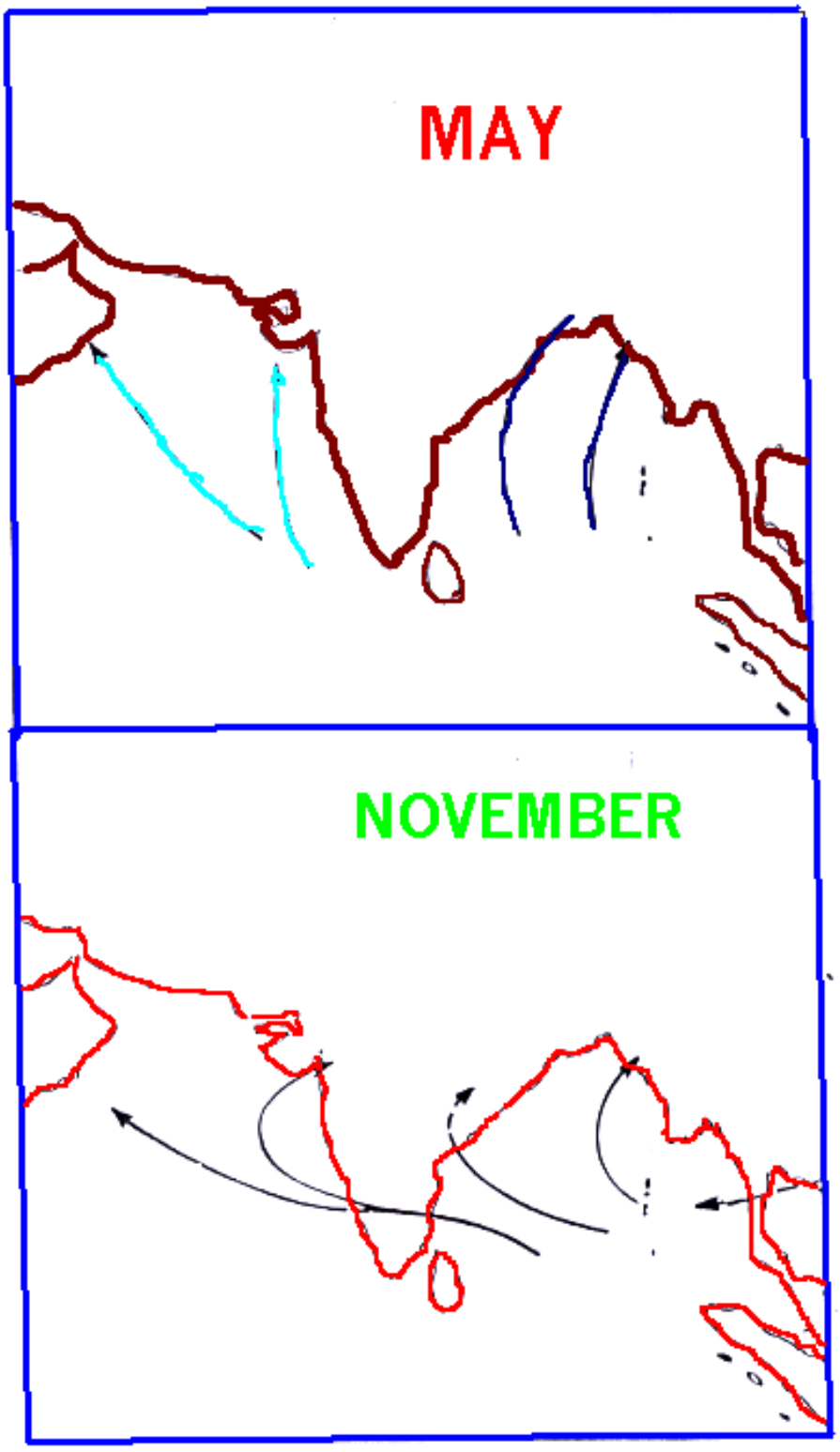
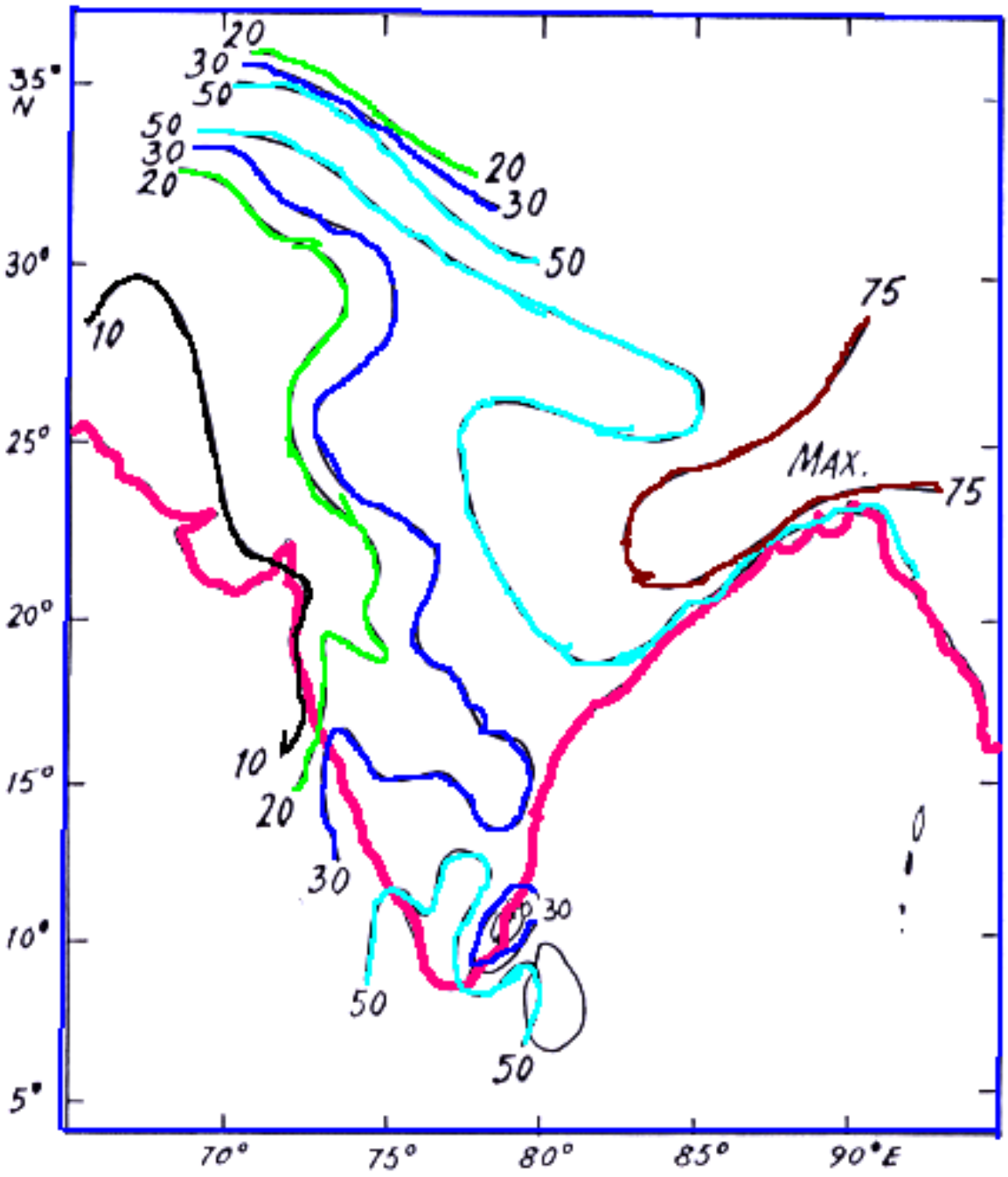
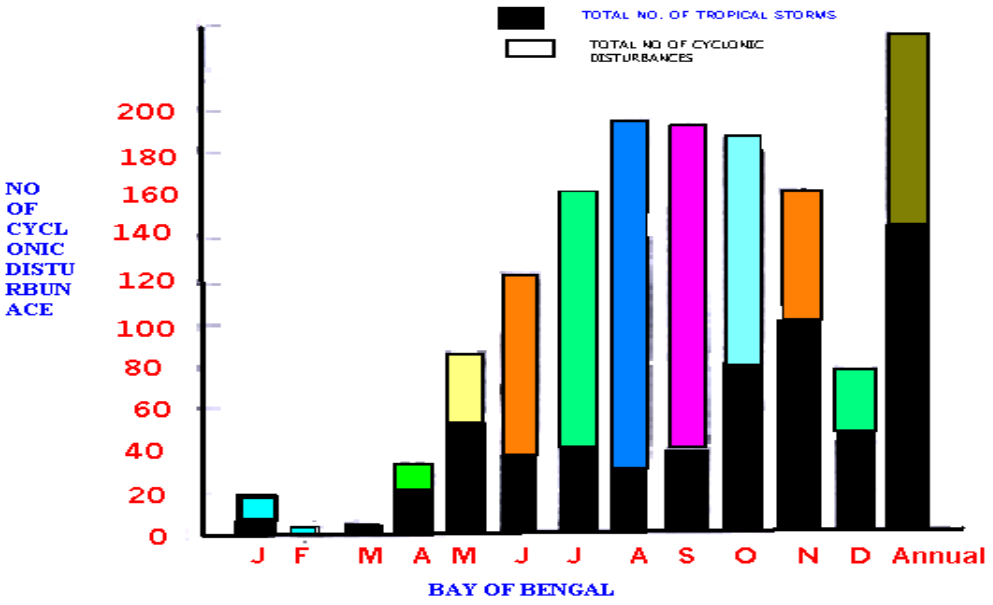


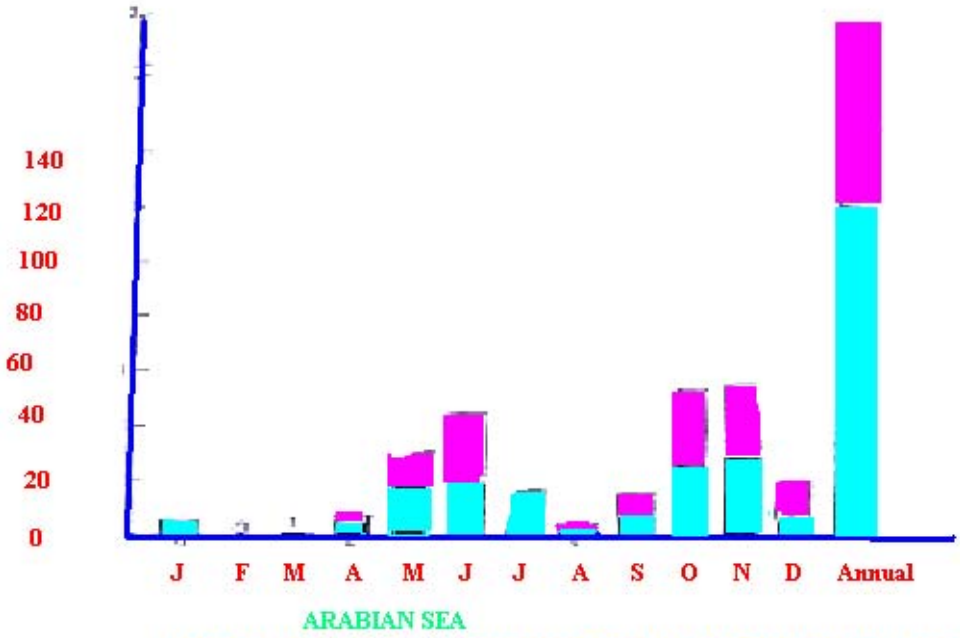
NORMAL CYCLONE TRACKS IN MAY & NOV

FIG. 1



MEAN ANNUAL NUMBER OF THUNDERSTORM DAYS OVER INDIA DURING THE PERIOD 1931-1961





MONTHLY DISTRIBUTION OF CYCLONIC DISTURBANCES AND TROPICAL STORMS FOR THE PERIOD OF 1891 - 1992

DISASTER MANAGEMENT : A CASE STUDY OF SUPER CYCLONE IN ORISSA

B.P. Acharya,IAS

1. INTRODUCTION :

The Super-cyclone that hit Orissa coast on 29th/30th October 1999, ranks as one of the worst natural calamities in the recent times. The sheer intensity of the disaster and the extent of the damage caused and enormity of human suffering did indeed pose an unprecedented challenge to the administration for mounting relief operations. Unfortunately, the State headquarters itself came under the eye of the storm and the Crisis Management Group, which would have ordinarily taken charge in a situation, such as this, found itself if total disarray, at least in the initial periods.

Responding to the challenges of relief operations in the neighbouring State, the Government of Andhra Pradesh decided to dispatch immediate help and as the former Relief Commissioner of the State, and as a native of Orissa, became the natural choice for coordinating the relief Commissioner of the State, and as a native of Orissa, became the natural choice for coordinating the relief activities for AP.

The Super-cyclone in Orissa and the way the administration responded to the challenge throws up significant aspects of the Disaster Management from which lessons need to be drawn for the future. I would attempt to briefly spell-out some of these significant lessons drawing on my personal experience as well the Disaster Management drill in operation in the State of Andhra Pradesh.

2. DESCRIPTION OF THE DISASTER :

Before describing the extent of the disaster, it would be in order to define different categories of cyclone, as per the meteorological classifications adopted by IMD (Indian Meteorological Department).

Description	**Wind speeds in KNOTS/KMPH**
Cyclonic storm	34-47/63-88
Severe cyclonic storm	48-63/89-117
Very severe cyclonic storm	64-119/118-221
Super cyclonic storm	120 and above/222 and above

The Super-cyclone of Orissa, which struck on 29th of October 1999, came at a time when many Coastal Districts of the State were barely recovering from a previous cyclone, which hit on the 17th October, 1999. By the sheer enormity of the disaster, as indicated below, this calamity was one of the worst in the recent memories :

- ❖ Wind speed of 260 KMPH
- ❖ Tidal wave over 25 feet
- ❖ Badly affected : 12 Districts including State capital
- ❖ Population affected : 10 million (one third of Orissa)
- ❖ Most fertile & prosperous coastal districts badly affected.

3. DISASTER PREPAREDNESS – PRE-DISASTER PHASE :

There is an interesting saying, often heard among the armed forces, which runs like this:

"We have to sweat in peace-time, so as to avoid bleeding during war".

This in a way, sums up the quintessence of the need for the disaster preparedness and the role of administration therein. The key areas that needs special attention, in this regard, and where the administration failed to evince timely response in Orissa, is a follows :

- ▪ Dissemination of warning : Early warning systems
- ▪ Evacuation
- ▪ Disaster Management System
- ▪ Community participation
- ▪ Preparedness drill – Dry runs.

4. POST DISASTER RESPONSE :

While one cannot avoid the natural disaster, by a well-planned disaster preparedness and co-ordinated post-disaster response, sufferings of the victims of the natural disaster can be mitigated to a large extent. Important tasks regarding immediate relief and relief rehabilitation are in the following areas :

a) Immediate Relief :

- o Quick assessment of damage and task on hand.
- o Rescue operations air-lifting
- o Air dropping of food to marooned
- o Communication network

b) Relief and Rehabilitation
Co-ordination the key input in relief operation

- o Timely distribution of relief
- o Relief delayed is relief deemed
- o Restoration of road links
- o Restoration of power supply and Telecom
- o Health & Sanitation – Deployment of Medical Teams
- o Enumeration of affected families
- o Networking of NGOs

5. RESTORATION AND LONG-TERM MEASURES

After the immediate relief and rehabilitation work is completed, the administration has to take up the task of restoration and planning of long-term measures for hazard mitigation. Among others, the activities which can be taken in this regard are :

- Construction of cyclone shelters
- Cyclone – Proofing of houses and Power Supply Systems as far as possible. (Example, World Bank aided Cyclone Emergency Reconstruction Programme (CERP) in Andhra Pradesh 1992-94, Hazard Mitigation Project of AP).
- Community awareness/participation

6. SUPER-CYCLONE IN ORISSA – RESPONSE OF A.P. GOVERNMENT

Immediately after super-cyclone hit Orissa on 29-10-99, the Chief Ministers of AP convened a high level meeting at his residence and instructed the Departments concerned particularly, Roads & Buildings, AP TRANSCO, Police, Health etc., to keep ready the men and material for Roads clearance, restoration of power and relief to the affected people on a war footing, Modalities were worked out in the meeting held by the Chief Secretary for different Departments for organizing relief, restoration of power and communications etc. Accordingly, I was deputed to coordinate relief and I reached Berhampur on 31.10.1999 and set up a Control to coordinate the activities of different Departments of Government of Andhra Pradesh in providing relief to Orissa. I visited Bhubaneswar on 01.11.1999 and met the Chief Minister, Chief Secretary and Relief Commissioner of Orissa Statee. I coordinated the relief activity and returned to Hyderabad on 6.11.1999.

Director General of Police sent 100 men with Sri J. Purnachander Rao, Superintendent of Police, Srikakulam. Sri Rao reached Bhubaneswar and established high-frequency communication. He camped at District Police Office of Superintendent of Police, Bhubaneswar. He regulated traffic from Khurda road to Bhubaneswar and then to Cuttack. He worked in coordination with the S.P. Bhubaneswar and Home Secretary, Orissa. The D.G. of Police also visited Bhubaneswar on 1.11.1999 and offered all help. A satellite phone was given to the Chief Minister of Orissa by the D.G.P. on the instructions of Chief Minister. Government of India was requested to send 5 companies of CRPF/BSF with ration including LPG stoves for 2 weeks.

Following relief measures were undertaken by different departments of A.P.

1. One company of 5th Battalion, A.P.S.P. consisting of 92 personnel deployed in Paradeep.

2. One company of 3rd A.P.S.P. consisting of 90 personnel deployed at Cuttack.

3. One company of 6th Battalion, A.P.S.P. consisting of 93 personnel deployed at Cuttack.

4. Communication Staff consisting of 34 personnel deployed in Orissa State.

5. Officers and other ranks of Srikakulam district force consisting of 121 personnel deployed in Orissa state.

6. One company of 4th Battalion consisting of 82 personnel deployed for protection of food grains, security at Airport and other emergency duties at Bhubaneswar.

7. One platoon and one section of 5th Battalion, A.P.S.P. consisting of 30 personnel deployed at Kalinga Stadium, Bhubaneswar, returned to their Battalion Headquarters on 8.11.99.

Thus 512 personnel of AP Police performed their duties of escorting and distributing of relief materials at Paradeep, Cuttack and other places in Orissa. They were provided with search lights/torch lights and other rescue related material and vehicles including 12 long distance high frequency communication equipment and 129 local communication hand sets.

8 Ham sets from the coastal districts along with operators were deputed to establish initial communication in the worst affected areas in consultation with Orissa authorities. The Government of Orissa commended the services rendered by the Ham Radio Operators who played vital role in helping the Relief Commissioner (Orissa) to establish communications with field level officers on Relief Duty in the most critical time soon after the cyclone attack.

The following medical officers/Para-medical officers who were deputed, helped Orissa Govt. in providing necessary Medical Aid to the cyclone victims in a big way :

1. No. of Medical Officers deputed	102
2. No. of Paramedical Staff deputed	144
3. No. of Drivers deputed.	22
Total	268

The A.P. Transco deployed he following personnel for restoration of power:

1. Number of teams	65
2. Number of persons	808
3. Number of vehicles	45
Total	918

The roads and buildings Dept. also played a crucial role in restoring Road Communication, which helped to facilitate relief operations.

30 Road Clearing Teams were deputed to Orissa. The approximate cost of these operations for about 10 days is about Rs.45.00 lakh @ lakh per day.

Civil Supplies Dept. procured and dispatched over 1000 Mts. Of food stuff and relief measures to Orissa in co-ordination with the District Collectors, APDDC Federation etc. for providing immediate relief.

8. CONCLUSION : LESSONS FROM THE SUPER CYCLONE IN ORISSA

Based on the experience of super-cyclone in Orissa and the parameters of Disaster Management as indicated above, the following important lessons may be drawn for the future :

- An unprecedented disaster calls for mounting of relief operations on an unprecedented scale.
- A core disaster management group at State and District levels is required for this.
- Reduction of response – time.
- Time is the essence and spells the difference between life and death.
- Need for a national policy on disaster management.
- Sharing of experience and expertise from different States and countries.

There is a growing awareness that disaster management should not be treated as an adhoc/interim administrative response, but should be integrated in the Planning process itself. This was the message of the UN Decade for Natural Disaster Mitigation, which is coming to an end during this year. Sooner we learn the significance of this, the better it would be for evolving a coordinated administrative strategy for Disaster Management.

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SOME ISSUES IN DISASTER MANAGEMENT

Dr. Shikhar Sahai

Disasters are generally considered as sudden occurrences or events or calamities that cause damage, loss of life, economic disruption and deterioration of health and essential services on a scale sufficient to warrant an extraordinary response from outside the community or area. They are classified into two categories - Natural (e.g., earthquake, cyclone, flood, famine, landslide, volcanic eruption, etc.,) and Man-made (e.g., industrial disasters, accidents, terrorist attack, war, refugee migration, etc.,). This conceptual formulation, however, is too simplistic to comprehend the nature and magnitude of disasters seen in a holistic perspective. 'Natural' and 'Man-made' disasters can no longer be seen as separate entities as many so called 'natural' catastrophic events within the environment are man-induced or atleast made worst by the intervention of man. Humankind is an important causative faction in most disasters.

There are patterns of development and human settlement which are linked to the severity with which the disasters strike. Increase in population combined with poor resource management have resulted in the conversion of forests to pasture and arable land as a result of which less water is stored in upper reaches of catchment areas making floods more frequent and severe Desertification and unwise land use contribute to the impact of drought. Underground testing of nuclear devices creates pressure which could effect the stability of parts of earth 's crust leading to earthquakes. Removal of vegetation cover accelerates the rate of soil erosion resulting in appreciable accumulation of loose unsorted material causing landslides. Many landslides or flooding disasters are closely linked to the rapid and unchecked urbanization which forces low-income families to settle on the slopes of steep hillsides or ravines or along the banks of flood -prone rivers.

Famines, too, are not natural events alone. As Amartya Sen's celebrated study on famines and hunger shows, in the scale of deaths, the Chinese famine of 1958-61 was about five to ten times as large as the largest famine in India in this century the Great Bengal Famine of 1943 in British India. The fact that there has been no large-scale famine in India since independence is a positive contrast with the Communist China experience. The main reason for this difference was the existence of political democracy in India. Given the political system in post independence India, it was extremely hard for any government in office to get away with neglecting prompt and extensive anti-famine measures at the first signs of a famine. The contrast with China is striking in this respect. Given its system of public distribution, China did not lack a delivery and redistribution mechanism to deal with food shortages as the famine threatened in 1958 and later. What was lacking when the famine threatened China was a political system of adversarial journalism and opposition. The Chinese famine raged on for three years without it being admitted in public that such a thing was occurring and without there being an adequate policy response to the threat. In fact, the precise feature of absence of adversarial politics and open journalism that contributed to the occurrence, magnitude and duration of Chinese famine in 1958-61 are also present in most Sub-Saharan countries today. (Hunger and Public Action, Chap.11).

Hence, Disasters are the consequences of the way societies structure themselves, economically politically and socially, the ways that societies and states interact and the ways that relationships between the decision makers are sustained. The traditional distinction between natural and human-induced disasters has to give way to emphasis on the interdependence of human activities and natural events in shaping the frequency and intensity of disasters.

The disastrous consequences of environmental pollution are being increasingly debated and discussed. Global warming, due to accumulation of 'greenhouse' gases in the atmosphere & depletion of ozone layer due to excessive release of CFCs are examples of disasters-in-the-making. Their immediate impact in terms of casualities and damage may be less dramatic in comparision to natural phenomenon like earthquakes and cyclones but their long term impact cannot be ignored in any disaster planning. In fact, the scope of human rights has been widened to include the right to a healthy & ecologically balanced environment as a 'third generation' right and the scope of disaster management has to be widened to include such 'slow-onset' disasters also.

There is yet another category of disasters which are simply over looked. They may be termed as invisible disasters. Thus, according to World Development Report 1992 (World Bank) about one billion people in developing countries do not have access to clean water and 1.7 billion lack access to sanitation. The effect on their health is shocking. This contributes to some 900 million cases of diarrheal diseases every year which cause the deaths of more than three million children.

DEVELOPMENT AND DISASTERS

The desirability of development is universally recognised - no society can afford to stay in a state of stagnation. But the adoption of any model of development is not a universally accepted ready-made recipe for progress, it has its pitfalls and pose serious dilemma . A long number of natural resources in the world are limited, non-renewable and may be exhausted if the present consumption levels of industrial system continue. A cautionary note in this regard was sounded by a report titled ' The Limits to Growth' produced by Massachusetts Institute of Technology for a project of 'Club of Rome'. The report contained, inter-alia, an interesting table which showed the known global reserves, the rate of consumption and projected growth etc for 19 non-renewal natural resources of vital importance to industrial societies. The report concluded that "Given present resource consumption rates and projected increase in these rates, the great majority of the currently important non-renewable resources will be extremely costly 100 years from now".

Moreover, developmental projects implemented without taking into account long term environmental hazards may prove disastrous. In other words, development process should be 'sustainable' in the long run. The term "Sustainable Development" was brought into common use by the World Commission on Environment and Development (the Brundtland Commission) in its seminal 1987 Report, Our Common Future. The idea of sustaining the earth has proved a powerful metaphor in raising public awareness and focussing of the need

for better environmental stewardship. The crux of the concept, according to the Commission, is "meeting the needs of the present generation without compromising on the needs of the future generation". Making the concept of sustainability precise, however, has proved difficult. It is not plausible to argue that all natural resources should be preserved. Successful development will inevitably involve some amount of land clearing, oil drilling, river damming and swamp draining. Some here argued that natural capital should be preserved in some aggregate sense with losses in one area replenished elsewhere. This approach has helpfully focussed attention on the need to estimate the value of environmental resources and on the importance of protecting certain essential ecological systems.

On a more practical plane, the debate over large dams presents an important issue of development process vis-à-vis its disaster potential. In India, the acrimonious controversy over the Narmada Project refuses to die down. For the supporters of the project, it will be the lifeline of Gujarat with immense potential of meeting the immigration and energy needs of the region. The opponents of the project regard it as an unmitigated environmental and human disaster resulting in submergence of large areas of forest wealth and displacement of lakhs of tribals uprooted from their ancient habitat where they lived for centuries. Even the technical feasibility of the large dams is questioned by these critics who vouch for the superiority of 'small' projects. Needless to say, there are no clear cut answers to such dilemma. The opponents of the dam clearly overstate their case when they dismiss totally the need for large dams, romanticize the idyllic simplicity of the tribals traditionally living in harmony with nature and espouse the cause of small dams in tune with the ideal of ' small is beautiful ' (which was the title of E.F. Schumacher famous book). At the same time, the inadequacy of rehabilitation measures and their disastrous consequences for the displaced people cannot be overlooked. Each case has to be decided on its merits keeping in view the whole issue in totality with minimum suffering for the affected people. Disaster Prevention has to be integrated as part of developmental planning.

INDUSTRIAL DISASTER MANAGEMENT

It goes without saying that industrial growth is an important index of the progress of the nation. At the same time, the environmental pollution caused by many industrial undertakings is also beyond doubt. Nuclear Plants have the potential to cause disaster of frightening consequences in more than one way. A Chernobyl type disaster could be bad enough but worst possibilities exist. Some nuclear experts fear that deepening economic and political upheaval in Russia has increased the likelihood that financially desperate specialists with access to nuclear material may be tempted to sell it in the nuclear black market as the security at nuclear sites will continue to corrode as fast as the beleaguered economy. Once the smuggled Uranium or Plutonium is sold to the highest bidder there is the possibility, terrorists or outlaw nations detonating a primitive nuclear device. Such fears may be exaggerated but not baseless.

Non-nuclear installations, however, are not free from disaster potential. A large number of industrial units hold noxious gases which on leakage in large quantities can cause serious damage as in case of Bhopal Gas Tragedy. A Steel Plant in Bhilai has a LD Gas Holder containing huge quantity of Carbon Monoxide Gas, a colourless & odourless gas which, if inhaled can cause paralysis of lungs and death. A fertiliser plant at Phulpur has a Ammonia tank whose leakage in large

quantity would make the place another Bhopal. Innumerable such examples can be cited. While adequate safety measures would be taken in such plants, the possibility of such vulnerable points subject to sabotage or bomb explosion by a terrorist cannot be ruled out. It would be an effective way for a terrorist to wreck havoc & destruction to thousands of people living in the vicinity.

The disaster management plans of such industries suffer from two serious drawbacks in India. Security personnel, particularly at the lower level do not have adequate working knowledge of the production process of the plants, its safety requirements and vulnerable points. The plant safety and security wings function as separate entities with little coordination between the two. Lack of a working technical knowledge would reduce the effectiveness of a security personnel both in preventing disasters and in tackling it. Integration of Security & Safety wings is the crying need of the hour.

The second lacuna is the lack of knowledge of hazards among the local population living in the vicinity of the industrial township. Most of the disaster management plan rehearsals are done by the plant management & workers in a routine manner within the premises of the industry and no serious effort is made to educate the local people who can become hapless victims of disasters. Community participation is necessary for effective industrial disaster management.

CONCLUSION

The following conclusions emerge from the above discussions;

1. Disasters are increasingly man-made. The impacts of even those disasters which are triggered by acts of nature are magnified by unwise human actions. Disasters also reflect the existing social & economic relationships & settlement pattern.
2. Disasters are not confined to sudden damages of large magnitude. They include long-term slow onset events too caused by environmental damage.
3. Disaster Management is something than an emergency response plan based on three Rs of **R**escue, **R**elief and **R**ehabilitation. It has a preventive dimension which should be a part of long term developmental planning.
4. Industrial disaster management requires integration of safety & security and community participation in order to be meaningful. A large number of industrial units are disasters-in-the-making if the safety & security requirements are ignored.

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PSYCHOLOGICAL DIMENSIONS OF DISASTER SITUATIONS

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Humans have tendency to think and plan their actions on the basis of the assumption of linearity and symmetry. But a passing glance at history and a systematic look at the nature as well as day-to-day affair of humans and their environment will show that above axiom is not true. The reality is that things do happen which are neither linear nor symmetrical. This realization that things may go wrong, calls for contingency measures to deal with any kind of eventuality. Inherent in this notion of contingency is disaster management planning.

Disaster situations, i.e. cyclones, earthquakes, flash flood, severe drought, land slides, fire, chemical and nuclear mishaps, and other major industrial disasters have two dimensions : (a) a physical dimension and (b) a psychological dimension. Thus, in such situation not only physical infrastructure like railroads, roads, telecommunication lines, parks, schools, market places, places of worship, dwelling units, means of livelihood (e.g. live stocks) get damaged and devastated, but also devastated and ravaged is psychological fabric and well being of individuals and community. The psychological ravage may vary from what is called "disaster syndrome (state of being stunned, dazed and apathetic) to severe psychotic disorders. It may, in some cases result in self-destruction by individual in form of suicide. All this entails that psychological support must be an integral part of planning, relief, rescue and rehabilitation efforts in disaster situations.

Disasters are exceptional occurring which often result in large number of death and injury and cause huge economic losses to the community and the Nation. Apart from such physical damage and destruction, such situation brings powerful emotions in the people.

Though the immediate effect of such psychological emotions and stress are not visible as physical destruction, yet overcoming such psychological scare may take as much time and resource of the community and family as the physical rehabilitation.

PSYCHOLOGICAL REACTIONS IN DISASTER (NORMAL)

People emotions and feeling in disaster situation may be categorized into two broad categories (i) Ordinary Cognitive, emotional, behaviour and somatic reactions in extraordinary situations which are slightly deviate from the normal

pattern of such reactions (called normal reactions), and (ii) Psychological distress reactions which overwhelm the coping capability of individual and community and which may affect the psychological well being of people.

The common cognitive reactions in disaster situation include dreams and nightmares about the disaster; continuous reconstruction of disaster situation in mind; inability in concentrating and remembering things; questioning one's faith and religious beliefs; flooding of thought or memories with disaster episodes etc. The disaster situation also put resource and data limitation on human thought process. It is well established fact that human performance is optimal under moderate level of anxiety. Disasters create high level of anxiety and stress rendering non-optimal conditions for utilization of resources of mind (called resource limitation of functions). Similarly, all kinds of relevant information necessary for taking optimal decision are not available to decision makers due to chaotic state of affairs, thus, there is obvious data limitation on cognitive function of decision makers.

The normal emotional reaction in disaster situation may include feeling numb, withdrawn or disoriented or experience uneasiness, anxiety and fear when disaster situations and things are revisited in mind, feeling of lack of zeal and commitment, feeling of depression, feeling of sudden hostility without warrant or on sight provocation, intense irritability or feeling of sense of emptiness, helplessness about the future. To summarize emotional feelings may broadly categorised as feeling of freezing or feeling of fighting.

Common behavioural response in disaster conditions may include being over protective of self and one's family, isolating oneself from others or seeking company of others to overcome the anxiety, showing alarm and startling response in ordinary conditions, problems in getting sleep or startling asleep; indulging in non-meaningful over activity to avoid thoughts related with disaster conditions, being tearful or crying. for no apparent reasons.

Normal schematic reactions may include insomnia, stomach aches, headaches, increased muscular tensions, increased heart beat and fluctuating body temperature. All this may worsen as sizes accumulate, even culminating in acute illness.

PSYCHOLOGICAL DISTRESS REACTIONS IN DISASTER

These common cognitive, emotional behavioral and somatic reactions are modulated by coping capabilities of the individual which in turn, are a complex mechanism conditioned primarily by experience of one's developmental process. Usually, developmental experience which fosters strong belief and philosophical orientation to life may help people cope better in disaster conditions. A large number of people, over the time with a little help of family and friends do overcome

these reactions. But some people are not able to cope with the disaster situations and they show symptoms of various psychological distress ranging from mild neurotic reactions to severely incapacitating psychotic reasons.

The major neurotic symptoms which can be noticed in a disaster conditions in a community are :

1. Anxiety neurosis: Anxiety is felt in so many situations that it appears to be free-floating and diffuse without any specific cause even often disaster might have been a long past.

2. Phobic neurosis: Extreme and irrational fear and avoidance of an object or situation which might have happen to related to disaster. For example, people ran away from the vicinity of Kandla Port in 1999 when they heard that a cyclonic depression is forming over Arabian Sea because their tragic experience with earlier cyclone.

3. Obsessive neurosis: Flooding of mind with persistant and uncomfortable thoughts. For example, people in earthquake hit area often report that they have feeling of earth shaking again.

4. Depressive neurosis : Abnormally prolonged dejection associated with inner conflict or personal loss.

Psycho-Somatic disorder are reaction that represent the visceral expression of affect which may be long prevented from by consciousness. These disorders may include common cold, Rhenitis (congestion of the nasal mucous membrane and blood vessels of the eyes), bronchial asthama, cardiovascular disorders, peptic ulcer, loss of appetite etc.

Disaster situations are characterized by scarcity of resources of day-to-day use. Such scarcity may result in psycho-pathic behaviour (e.g. abduction of responsibility, callousness, insincerity, incapacity for love and attachment, lack of empathy etc.) even in normal person. Such behaviour has to be stopped by intervention of significant other groups i.e. Police, NGOs, Psychologists, family and friends etc. because conditioning of such behaviour has high cost for community.

In extreme cases, a significant portion of people residing in disaster affected area may even show psychotic disorders i.e. schizophrenia (a disorder marked by delusions, hallucinations, expression of extreme inappropriate emotional response, and disturb behaviour which may include regression and withdrawal); manic depression (retardation of thought, pervading feeling of sadness, sleep disturbances, retarded motor actions or abnormal elation of mind; hyper activity etc.), and even in some cases suicide may also be committed by people to get out of their "meaningless existence or cumbersome life."

PHYSICAL SUPPORT

Both normal and psychological distress reactions in the disaster need psychological support so that people showing normal reaction under disaster condition may quickly get into the normal way of thought and action as exhibited by them in day to day life and people with high degree of psychological distress may be calmed. With the help of psychological professional such psychological disturb people can be assimilated in the community life.

Psychological support can be defined as the psycho-social help any one can give to other people in stressful, critical, traumatic or life threatening situation. This support must be client centered i.e. showing respect for person, active listening, taking care of the person and talking to person in such a way where he feel assured while walking through or exploring painful experience associated with disaster.

Thus psychological support can be provided by almost any one able to feel and show concern and empathy by understanding the experiences of those affected by the disaster. The need in such cases are considerate and empathatic listening and behaviour so that victim feel assured about talking about disaster and gradually he overcomes feeling and trauma associated with such situation.

Friends and family can provide most valuable kind of psychological support in cases of normal reactions. But in cases of acute psychological distress, the person has to be looked and treated by clinical psychologist or psychiatrist as the case happen to be. Figure-1 presents reactions to disaster situations and kind of psychological support which may be provided in such situations.

As can be seen from the Figure-1 for normal reactions, support from family and friends might be sufficient to come out of normal reactions to disaster situation to day-to-day normal way of thought and action. Similarly, mild form of neurotic behaviour and and psychopathic reactions may be tackled at the level of family, friends, NGOs and social support group or psychologist.

Psychological distress resulting in psycho-somatic or psychotic reaction would require professional treatment either by general physician or by psychologist/psychiatrists. These conditions may even require hospitalisation of persons affected by such psychological distress.

PSYCHOLOGICAL WELL-BEING OF RESCUE AND RELIEF WORKER

Another essential dimension of psychological support in disaster situation is need for psychological help to rescue and relief worker. In disaster conditions, workers engaged in rescue and relief works are called upon to work for long hours

without food and rest to mitigate the suffering of the community. Such stressful situations may sometime, threaten the well being of the rescue and relief worker. In such circumstances, the scene managers i.e. politicians, beaurocrats, police officials etc. must be sensitized to stress being faced by rescue and relief workers so that they can relieve any worker on the brink of nervous breakdown.

PSYCHO-PHYSIOLOGICAL REACTION TO STRESS

Here, it would not be out of place to discuss the psycho-physiological dimensions involved in stress in some detail. People in stress situation show general adaptation syndrome (GAS) which consists of three stages (i) Stage of alarm; (ii) Stage of resistance and (iii) stage of exhaustion.

Alarm reaction is essentially a biological defence mechanism. It has two phases. First, an initial phase of disorganized shock and second in which organism counters the shock by attempting to restore the homeostatic balance, primarily by release of hormone adrenaline.

In stage of resistance, the persons continued attempt to restore psychological balance is generally successful and an adequate adaptation to stress situation does happen.

In exhaustion stage, the person is not able to maintain the homeostatic balance due to addition of certain new stress or person coping capability giving way because of lack of psychological support. The person in such situation ends up fighting stress or and he is not able to retain homeostatic balance. The person may in such cases succumb to illness (physical as well as psychological) or in some cases death may also result.

This general reaction to stress clearly shows how critical is psychological support for people in disaster situation. Such psychological support in disaster situations help people in adaptation to stress, thereby, arresting their reaction to stage two (resistance stage) of GAS. Such support also help in restoration of homeostatic balance of the person.

To conclude, we may say that disasters are characterized by asymmetry and non-linearity. In such situation, physical as well as psychological support system of the community is suddenly uprooted. The psychological well being of the individual in such abnormal situation is product of individuals coping capabilities and psychological support provided by the significant ones.

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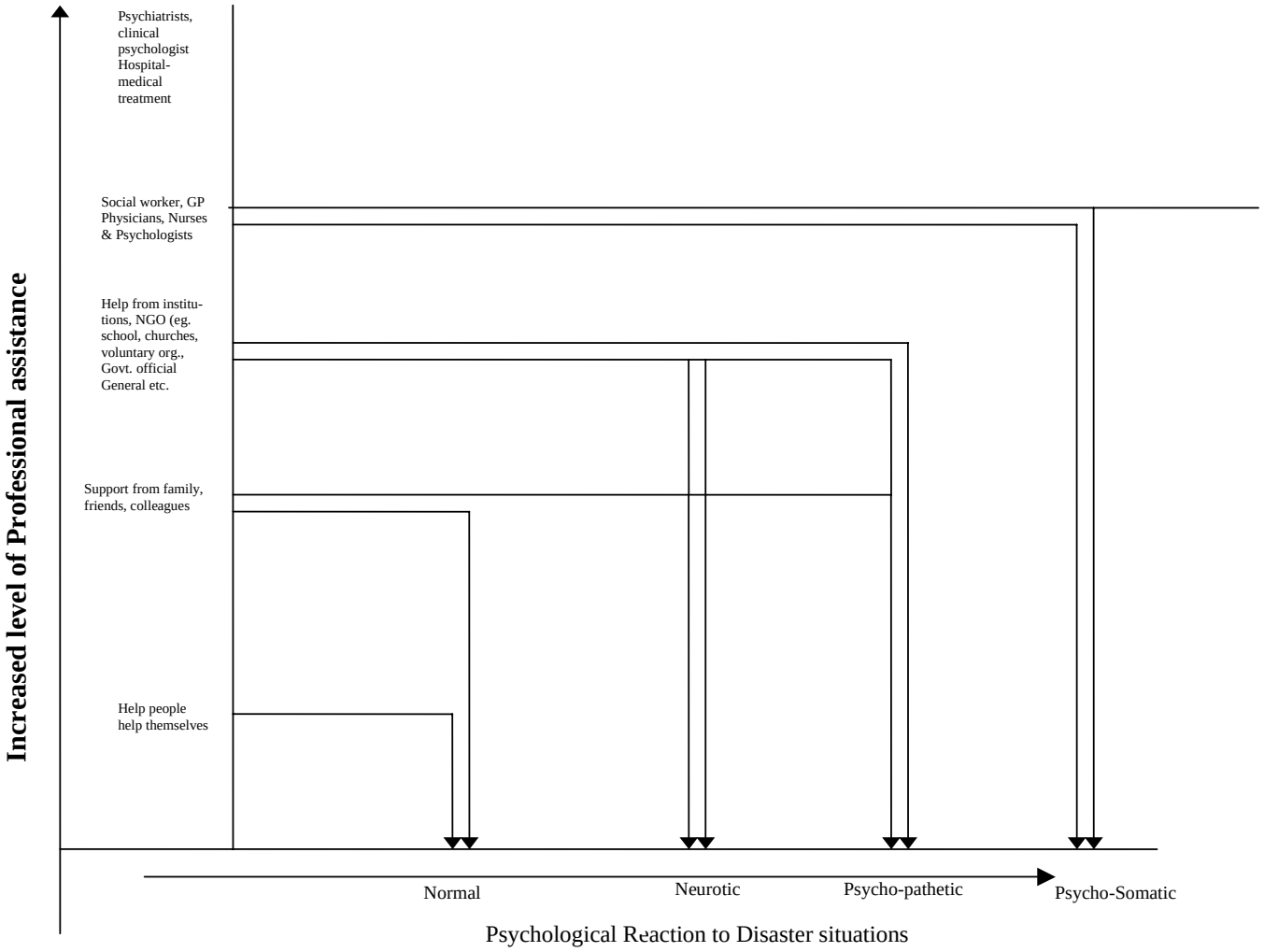

Figure1 – Psychological reaction to Disaster situations and Psychological Support System

DEVASTATION BY FIRE

R.C.Sharma

I. Fire Incident at Vizag Refinery (HPCL) on 14.09.1997

INTRODUCTION

The Hindustan Petroleum Corporation Limited (Vizag Refinery) is located at Malkapuram on outskirts of Visakhapatnam City. The Refinery is spreading in over 515 acres of land and additional 212 acres of land for additional Tankage Project. The Refinery at present is having capacity of 5.1 MMTPA and is under expansion to 7.5 MMTPA. It has also LPG Bottling Plant in the adjacent premises. The refinery is 10 km (approx.) North East of Visakhapatnam Steel Plant in the Industrial belt.

Fire broke out at 0640 hrs in storage facilities of the refinery and spread to marketing division LPG tank/Propylene tank/K. Oil and connected pipe lines. Fires on the tanks lasted for about 48 hour extinguished by 0600 hours on 16.9.97. It took 14 days to extinguish fire on relief valves & piping manifold of 2 of the Horton Spheres.

POSSIBLE SOURCE OF RELEASE OF HYDROCARBON VAPOURS ON BASIS OF AREAS INVOLVED IN FIRES

The enquiry committee constituted for the purpose went into various possible source of release of hydro-carbon, source of ignition, etc. and on the basis of the report following points were considered.

- Over Pressurisation
- Pipeline failure
- Failure of Hammer Head Blinds
- Release of LPG through water drain line

a) OVER PRESSURISATION

As over pressurisation could be verified from recorded readings, no evidence of over pressurisation was found.

b) PIPELINE FAILURE

Pipeline failure was also ruled out as lines were found having full thickness. No thinning due to corrosion was also observed. Line failure seen at few places was attributed to heat after the fire.

c) HAMMER BLINDS

The position of the side plug valve indicated that the Hammer Blinds were not subjected to over pressurisation by pumps.

The highest pressure in the system could have reached 24 kg/cm^2 being maximum shut off pressure. Since these were tested upto 77 kg/cm^2, this possibility was ruled out.

d) RELEASE OF LPG THROUGH WATER DRAIN

The incident occurred while the LPG was being off-loaded from a ship to one of the horten sphere in the storage area. The storage of LPG is located about 3.8 kms from Jetty and LPG is received through a 10" dia pipeline. This pipeline is normally kept charged with fresh water which is pushed out in the process of pumping LPG through same line and received in one of the horten sphere. The certain amount of LPG is also taken into sphere apart from the total water and some settling time is allowed. The water settles at lower level is drained out subsequently.

It was perhaps this process, which led to the serious incident, as about 50 tonnes of liquid LPG escaped into atmosphere. Incidentally the LPG received through ship was without the sweetening agent and, therefore, odourless. This could be one of the reason that public and other persons working in the plant did not get initial information about the leak through smell of the gas. They could imagine this only after they saw a large vapour cloud. This vapour cloud exploded on getting a spark from somewhere and lead to immediate destruction & fire in many areas.

TOTAL PROPERTY INVOLVED/ DAMAGED

The Damaged property included Refinery Storage Tank – 7, Terminal A Tank – 11, Terminal B Tank – 09 and Total Building – 15. This included Sub-stations, Control Rooms, Terminal Buildings, Large number of Pumps etc. Approximate Loss was Rs.80.0 crores.

DETAILS OF LPG SPHERE ON WHICH WATER DRAINING WAS CARRIED OUT

The Sphere 12 B was having following dimensions/capacity :-

Diameter	-	17 meters
Capacity	-	1200 MT
Relief valve setting	-	19.25 kg/cm^2
Nos of Relief valve	-	02 Nos.
LPG level indicators	-	02 (Float Type – 1 differential gravity – 1)

ACTIVITIES ON SPHERE 12 B PRIOR TO FIRE INCIDENT AS PER RECORDS

DATE	TIME	ACTIVITY
13.9.97	1900	LPG Loading commences at Sphere 12 B Top Pressure Reading 200 cm(50 T), 3 kg /cm^2
~	1900-2230	Water in the line & LPG received in 12 B
~	2230	Reading 750 cm 156 T (Top pressure 6.0 kg)
~	2230	Switching over of LPG from 12 B to 9 B

		9 B reading 568 cm (38 T) 7 kg/cm^2
~	2230-2400	Receipt of LPG in 9 B continuous
~	About 2330 hrs	Efforts to drain water proved futile as drain line was plugged
~	About 2345 hrs	Inter sphere transfer from 9 B to 12 B, using circulation line pump started in order to increase sphere level to facilitate draining of water
~	2400/0000	Change of Shift took place.
14.9.97	At about 0100	Transfer of LPG from 9 B to 12 B stopped, LPG unloading in 9 B continues

Position at 0100 hrs in Sphere

	12 B	**9 B**
Readings	800 cm	868 cm
LPG	670 T	755 T
Pressure	6.5 kg/cm^2	8.5 kg/cm^2

Reading at 0200 hrs

	12 B	**9 B**
Gauge	830 Cm	946 cm
LPG	707 T	855
Pressure	7.0 kg/cm^2	9.5 kg/cm^2

~	0200-0500	9 B continues to get LPG from ship & 12 B from 9 B.
14.9.97	0500-0600	Transfer of LPG 9 B to 12 B stopped at about 0515 and 9 B to 12 C started at 0600

Readings at 0600

9 B	12 B	12 C
1126 cm	1124 cm	339 cm
1076 T	1076 T	1860 T

DATE	TIME	ACTIVITY
		11.5 kg/cm2 11.5 kg/cm^2 4.5kg/ cm^2
~	0530	Shift Incharge opened 12 B ROV to check & drain the Balance water & to start lining up 12 B for tank wagon loading at 0600 hrs.
~	0600-0615	Unloading continues in 12 C
~	0615	Fire Service personnel saw the vapour cloud and left station without starting engine etc as advised. Canteen personnel also saw the cloud and left canteen after switching off all the flames/burners.
		Lab personnel also saw the vapour cloud and 7 of 9 persons moved out for safety

~	0620	Chief Operation Manager & DGM were informed by telephone operators about the LPG cloud and leak. The operator was asked to operate ESD & leave. He operated the ESD but could not leave & died on the spot. Merox Unit from which LPG was lined up to Sphere 9 A experienced back pressure Manager Production advised to shut down the unit & power plant
14.9.97	0640	Vapour cloud gets a spark & explosion and resultant fire starts.

Fire in Oil tanks continued and was extinguished after about 48 hours. Fire in LPG spheres & pressure relief valves continued for 14 days. Cooling operations continued during this time.

FUEL SOURCE

The position of ROV on drain line from Tank 12 B after fire was about 70 to 80% close. Malfunctioning of this ROV was ruled out as it functioned properly few hours earlier. It was felt that probably explosion took place, when valve was closing half way through.

The control room gauge needles which got stuck after explosion showed readings as below :

	9B	**12B**
0600	1126	1124.0
0640	1128	1000.6

It is therefore evident that about 50 Tons of LPG leaked from Sphere 12 B drain.

EIL report of Explosion model confirmed 25-50 Ton LPG Explosion.

SOURCE OF IGNITION

The possibility of source of ignition was considered out of following – Vehicle Exhaust, Hotwork welding naked flame in the Canteen, Lab, Power Plant, FCUI etc.

It was known that during the process of shut down a small fire occurred near regenerated catatylic (RC). U Band slide valve. The fire was extinguished but small fires were still continuing. It is felt that when cloud reached FCCU-1 the explosion took place.

REASON OF INCIDENT

The reason of incident was attributed to :

I. Not carrying out critical activity of water draining under supervision.
II. Non-activation of ESD in time, 12 B ROV remaining open.
III. Failure of Communication between control room & field.

A total of 60 persons died in the incident due to Burns & trapped in collapsed structures as per details given below :

CISF Security Wing - 09

HPCL Refinery - 14

Contract Personnel - 37

Most of the causalities occurred at Security Main Gate, Personnel in Canteen & Terminal B Marketing.

SAFETY FACILITIES

The loading/un-loading from ship was carried out from 1700 hrs on Friday to 0800 hrs on Monday. Hydrocarbon leakage detectors were installed for :

1st Alarm at 20% LEL, (Lower explosive limit), 2nd Alarm at 60% LEL

However, as reported by the operators, no alarm was received by them but in last test

carried out in July – 1997, the system was found O.K.

LPG Line is made of Carbon Steel and can fail at Temp of – 20^{o}C. Refrigerated LPG onboard this ship is heated at 10^{o}C before discharging in line. Temperature sensors(-5^{o}) are connected to ROV of Jetty & Water spray starts automatically. Temperature of LPG is recorded regularly while unloading from ship.

If temperature in the LPG storage area goes above 65^{o}C, the automatic sprinkler/deluge system comes in operation. Simultaneously following actions are initiated :

I. Audio & Visual Alarm will go to control.
II. ROV on liquid inlet/outlet of affected vessel will close.
III. LPG Pump will trip.
IV. ROV of vapour Balance and re-circulation will close.

FUNCTIONING OF ESD

If Emergency shut down switch is operated in Control Room, it will shut down all the systems in the plant. However closing of ROV takes about 30 seconds.

FIRE FIGHTING OPERATIONS

Fire Water pumps were started after the fire and fire on pipe track was first extinguished. LPG Spheres, K. Oil tank, Terminal A tanks were taken up for fire fighting after this. Units from APCL, CFL, HSL, HZL, VPT & VSP participated in Fire Fighting and cooling operations.

In the process of fighting Oil fires, about 500 KL of foam was used. As per adopted practices, controlled burning was allowed for LPG tank.

Fire on pipe track could be extinguished on 16.9.97 after the valve of K.oil tank 126 was closed. Other oil tank fire were also extinguished the same day by 0600 hrs.

RECOMMENDATIONS

Incident would not have occurred if following precautions required by procedure were observed :-

a) Carrying out draining water with continuous
b) Proper communication between control room & field operators.
c) Taking appropriate emergency action such as pressing ESD on 2nd Alarm.

UPHAAR CINEMA FIRE INCIDENT Dt. 13.06.1997

INTRODUCTION

The Uphaar Cinema with seating capacity of 1075 persons is a part of Commercial complex, having parking facility in the stilt (Ground) floor. On one side of parking area is Bank, Cafeteria & Booking office etc having entrance from outside and on other side are two Electric transformer rooms, switch rooms and a dispensary etc having access from inside. There are three staircases, one towards the cinema screen leading to a foyer behind screen, further leading to cinema hall through a door on either side of screen. Other two staircase, one on either side, lead to rear foyer of lower stall, Balcony foyer, Boxes & projector rooms etc. One of these terminates on the terrace and other around the lift (on right side) to offices on top floor.

There is a steel structure frame work at about 3 m level on balcony side, constructed in about 30% of floor out of Double height stilt floor unauthorisedly and demolished subsequently. At this level the staircase was segregated from stilt floor by a door sized glass frame serving as a partition between stilt floor and staircase.

There is a basement which is used for scooter parking, storage of seats, seat cushions and other furniture. DG set, AC plant and AHU are located towards balcony/foyers in the basement. AC ducts are in form of vertical masonry construction from basement to upper floors. The basement has got three entrances, one from ramp and others through the main staircases.

Lower stall of cinema is at 1st floor having two 10’ wide door, one on either side of screen leading directly on to the road. Another 2 double doors, one on

either side the screen, adjacent to the 10' doors lead to a common foyer behind the screen and then through a common stair to stilt floor (Ground floor).

Rear side of lower stall has two door leading to main stair cases & 3rd, central door leading to rear foyer.

Balcony has one central door on rear side opening into Balcony foyer and other door connected to front level of Balcony. The rear left side of balcony has one more door leading to Balcony staircase through a side gangway and right side has about 3' partition segregating balcony and box of capacity 8 seats. This box is having direct access to right side staircase. A Box of slightly bigger capacities, having 14 seats & having entrance from rear side common corridor connecting both staircases is on left side.

The projector rooms is located between two boxes. Above this floor are office/store rooms etc.

APPLICABLE CODE

The exhibition of films by means of Cinematography in the Union territory of Delhi is regulated by the provisions of the Cinematograph Act, 1952 and rules made there under in 1953. The construction of buildings was regulated by the provisions of Building Bye-laws 1967/1983 depending upon year of construction.

The Delhi Cinematograph Rules, 1953 provided the conditions for grant of licenses, inspection of premises, penal provisions etc. The first schedule of the Rules specified norms concerning building requirements, structural requirements, drainage, accommodation, seating gangway, stairway, exits, ventilation, parking arrangements, fire precautions, lighting and electrical installations.

The fire precautions as contained under section 16 of first schedule included: -

1. Fire extinguishing appliance suitable to he character of building as approved by the Licensing authority.
2. Fire Extinguishers, damp blanket and two buckets or dray sand in enclosure.
3. All fire extinguishing appliances shall be maintained in proper working order and available for instant use.
4. During an exhibition of film, all fire extinguishing appliances shall be in charge of a person.

THE ELECTRIC TRANSFORMERS

The Electric transformer was found to be the actual source and root cause of fire. The Delhi Vidyut Board receives electric supply from Green park sub station. This transformer, in addition to Uphaar cinema transformer, supplies electricity to local area also. Incidentally, this DVB transformer had a fire incident on the same morning i.e. 13th June 1997 also, through it was a minor incident, attended by Fire Services, the DVB maintenance staff did carry some repairs on it after this fire.

This transformer also had a serious fire incident on 7th July, 1989 which occurred during night show and luckily everyone escaped unhurt and there was no

causality or injury. But 13th June evening turned out to be very unfortunate for 59 of the cinema goers, who lost their life.

THE INCIDENT

As per records and reports, the call was received by DFS and Delhi Police at 1710 hrs and 1st response units 4 Water Tender and an Ambulance were sent from Safdarjung & Bikaji Cama Fire Station which are nearest. 1st Units reached in about 5 – 6 minutes at about 1716 hrs, started fire fighting operation and asked for further assistance at 1726 hrs. The fire incident was declare of medium category at 1731 hrs and serious at 1751 hrs. The required help was sent as asked for time to time including Hydraulic Platforms.

Fire was brought under control at about 1845 hrs and extinguished at 1915 hrs.

The fire was confined to transformer room and 15 to 20 cars and large number of scooters parked in front of the said transformer. The car in front of the transformer was just about only 1 foot away from the rolling shutter. The burning oil from transformer flowed below the cars as there was no door sill or oil catch pit provided to prevent the flow of oil outside the transformer room. The fuel contained in car tanks, seat cushions and tyres helped in quick spread of fire as well as obnoxious thick smoke, which resulted into low visibility and difficulty breathing conditions, further leading to chaos in the two staircases, which were the only means of escape for over 302 persons getting out of Balcony.

Due to slope of roof (up towards staircases) and water jets being applied to fight fire, the smoke was perhaps pushed towards rear side i.e. staircase leading to and from balcony. The broken glass partitions also helped hot gases and smoke to enter the stairs, further causing difficulty to the persons coming down. However, a total of about 160 persons were rescued, out of which about 60 were unconscious.

TRANSMISSION OF FIRE CALL & EFFORT OF THE CINEMA AUTHORITIES AND PUBLIC

It is indicated in the initial enquiry report that there appears to be some delay in transmitting call to fire station/police control. Call at both places was recorded at 1710 hrs, whereas the main Electric supply at Green park Sub Station tripped at 1658 hrs. It was gathered that after power supply tripped at 1658 hrs Cinema DG set came in operation automatically and screening of film continued while the fire was increasing.

It is further learnt that the cinema personnel tried in vain to extinguish the fire and used few fire extinguishers. They also tried to push out some of the cars. The public inside the cinema remained unaware of the fire for quite some time. People in balcony could sense some problem after they saw some smoke near screen and public in the lower stall started shouting and running outwards. It was only during this time that the DG set operator heard the noises outside and switched off the DG set. As a result, the power supply to cinema, Emergency lights, staircase lights, exit signs and PA system etc was also off.

The position of the smoke and charring of paint after fire indicated that one of the two panels on most of the doors remained bolted and indicated absence of cinema staff at this point of time. The persons inside the hall were left to fend for themselves in complete darkness with no one to guide them.

The public in the lower stall was lucky to find two wide door straight away leading to main road but it is quite likely that some of them might have used rear doors, further adding to the crowd coming from Balcony. As per eye witness account there were few, who were a part of the crowd coming down from Balcony but had to go back after some one shouted "there is a fire below, Go Back".

The unlucky ones decided to lock themselves in the toilets and few other made wise decision to make an attempt to walk down the staircase braving the smoke and succeeded in saving their life. Most of the causalities were found in the box, which was at the highest level in the cinema hall. The 14 bodies were removed from the box meant for 8 people. It was observed that two ladies and a girl removed in the last from front portion of balcony were still alive, perhaps for inhaling less smoke/gas.

The need of fully segregated staircase with self-closing smoke/fire check door, separating it from rest of building at each floor was very much felt for such buildings.

The other difficulty, which came to light was having the staircase light/exit light, foot lights and PA systems connected to DG set power supply. Having these facility from inverter supply could be more useful in such situations. The electric wiring and circuit for these facilities should be separate and independent.

NEED OF PUBLIC AWARENESS

The lack of public education and their behaviour in such circumstances i.e. not to lock inside and try to escape peacefully was experienced.

The escape of persons through half open doors could have lead to more commotion and delay in evacuation after the information about the fire incident came in. Timely help, direction to escape and timely announcement by Cinema Management in the 1st instance of the noticing the fire could have perhaps saved many lives.

DIFFICULTY FACED BY FIRE SERVICE

The traffic conditions after 1700 hrs becomes very heavy in Delhi and so was the case on this day. The subway construction work in front of AIIMS/Safdarjung Hospital also added to some delay in arrival of Fire Engines.

The rescue through staircases was perhaps not possible without having controlled the fire, which was feeding hot gases and smoke through staircases when the Fire Engines reached.

The Hydraulic Platform which is always sent for high rise building fires was not included in the standardized turnout for cinema hall fires. It was only after the 1st units reached the scene of fire its necessity was felt and it was requisitioned.

The Hydraulic Platform is subsequently made compulsory as a part of 1st turnout in case of cinema fires irrespective of height of the buildings.

The underground water tank in the cinema complex could not be used during fire fighting as crates of cold drinks and other materials were stored above the tank, which was fenced from all the sides. The water had to be therefore ferried from nearby building across the road & Overhead tank a few k.m. away from the scene.

CONCLUSION

The need of priority for evacuation of public, proper drill & training to act in emergency on part of Cinema staff, unobstructed and properly illuminated as well as segregated means of escape etc were some of the important factors which were considered essential after this incident. Need of having oil less transformers, segregated from rest of building or having independent access with required fire fighting/safety facilities was also felt and made applicable for future buildings coming up in Delhi. Accordingly DVB also issued certain directives to old buildings including Cinema Halls which are still in the process of implementation.

It was perhaps not, failure of one particular Agency/system but a combined effect of failure on part of many systems which lead to 59 deaths. Idea is to learn from past and not allow to re-occur such incidents in future.

NOTE

The paper is prepared on the basis of report of earlier enquiries, press reports and personal experience we had from the fire. Actual reasons will only be known once the judicial inquiry is completed.

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LANDSLIDES

Introduction

Landslides are simply defined as the mass movement of rock, debris or earth down a slope and have come to include a broad range of motions whereby falling, sliding and flowing under the influence of gravity dislodges earth material. They often take place in conjunction with earthquakes, floods and volcanoes. At times, prolonged rainfall causing heavy landslides block the flow of river for quite some time. The formation of river blocks can causes havoc to the settlements downstream on its bursting.

In the hilly terrain of India including the Himalayas, landslides have been a major and widely spread natural disaster that often strike life and property and occupy a position of major concern.

One of the worst tragedies took place at Malpa in Uttarkhand (UP) on 11th and 17th August, 1998, when nearly 380 people were killed when massive landslides washed away the entire village. This included 60 pilgrims going to Lake Mansarovar in Tibet. Consequently various land reform measures have been initiated as mitigation measures.

The two regions most vulnerable to landslides are the Himalayas and the Western Ghats. Studies carried out by the Central Road Research Institute indicate a high to very high rate of incidence of landslides in the Himalayas and a high rate in the Western Ghats. The Himalayan mountain belt comprise of tectonically unstable younger geological formations subjected to severe seismic activity. The Western Ghats and Nilgiris are geologically stable but have uplifted plateau margins influenced by neo-tectonic activity. Thus the two regions have different geological settings leading to characteristic types of landslides. Compared to the Western Ghats, the slides in the Himalayan region are huge and massive and in most cases the overburden along with the underlying lithology is displaced during sliding, particularly due to the seismic factor. In contrast landslide events in the Western Ghats are confined to the over burden without affecting the bedrock beneath and are generally in the nature of debri flows occurring mainly during monsoons. The effect, of course, is felt much more acutely because of a comparatively higher density of population.

Broadly the country has been divided into the following regions in term of incidence and severity of landslides.

Table of Incidences of Landslides in India

Region	**Incidences of Landslides**
Himalayas	High to very high
North-eastern Hills	High
Western Ghats and the Nilgiris	Moderate to High
Easter Ghats	Low
Vindhayachal	Low

Landslide Zonation Mapping is a modern method to identify landslide prone areas and has been in use in India since 1980s.

The major parameters that call for evaluation are as follows;

- Slope – Magnitude, Length and Direction
- Soil thickness
- Relative relief
- Landuse
- Drainage – pattern and density
- Landslide affected population

Causes of Landslides

Landslides can be caused by poor ground conditions, geomorphic phenomena, natural physical forces and quite often due to heavy spells of rainfall coupled with impeded drainage.

A Checklist of Causes of Landslides

1	**Ground Causes** Weak, sensitivity, or weathered materials Adverse ground structure (joints, fissures etc.) Physical property variation (permeability, plasticity etc.)
2.	**Morphological Causes** Ground uplift (volcanic, tectonic etc.) Erosion (wind, water) Scour Deposition loading in the slope crest Vegetation removal (by forest fire, drought etc.)
3.	**Physical Causes** Prolonged precipitation Rapid draw-down Earthquake Volcanic eruption Thawing Shrink and swell Artesian pressure
4.	**Man-made Causes** Excavation (particularly at the toe of slope) Loading of slope crest Draw-down (of reservoir) Deforestation Irrigation Mining Artificial vibrations Water Impoundment and leakage from utilities

An overall evaluation of the pattern and nature of landslide occurrences in the Western Ghats, that is parts of Kerala and its corresponding eastern flank falling within Tamil Nadu reveals the following main features: -

- Almost all mass movements occur during monsoons (SW and NE monsoon) in the western flank of Western Ghats and during occasional cyclonic events in the eastern flank indicating that the main triggering mechanism is the over saturation of overburden caused by heavy rains.

- There seems to be a relation between intensity of rainfall and slope failures.
- Majority of the catastrophic mass movements is confined to the overburden without affecting the underlying bedrock.
- Improper land use practices such as heavy tilling, agricultural practices and settlement patterns have contributed to creep and withdrawal of toe support in many cases.
- A common factor noticed in most of these vulnerable slopes is deforestation in the recent past, cultivation of seasonal crops and increase in settlements.
- In all the vulnerable slopes terracing/contour bunding is adopted mainly to prevent soil erosion and to enhance percolation during dry season for cultivation of cash crops as well as seasonal crops. Invariably, in all these cases, natural drainage lines on slopes are blocked or modified without adequate provision for surface drainage of excess storm water during high intensity rains prevalent in the area.
- In some areas developmental activities like construction of buildings, road cuttings, embankments, cut and fill structures cause modification of natural slopes, blocking of surface drainage, loading of critical slopes and withdrawal of toe support promoting vulnerability of critical slopes.

Settlement policy

Before dwelling upon the mitigatory measures, reference may be made to the policy that may be adopted for settlements. Drawing upon the Kerala study in parts of Western Ghats (referred to earlier), it has been felt that while permanent settlements should be avoided in high-risk zones, site selection even in moderately safe zones, especially in plateau edge regions should be made with caution. Diversion of stream channels in upper slopes, especially above settlements should strictly be disallowed. Adequate provision should be made to ensure drainage of storm water away from the high sloping terrain so as to reduce over saturation. Any contour bunding, or terracing adopted for seasonal cultivation or initiation of plantations in slopes of >16 Degree above settlements should have sufficient provision for storm water drainage. Further, in such areas the existing natural drainage channels and hallows are to be meticulously maintained without any attempt at blocking, division or modification.

Mitigatory Measures:

In general the chief mitigatory measures to be adopted for such areas are

i. Drainage correction,
ii. Proper land use measures,
iii. Reforestation of the areas occupied by degraded vegetation and
iv. Creation of awareness among local population.

The most important triggering mechanism for mass movements is the water infiltrating into the overburden during heavy rains and consequent increase in pore pressure within the overburnden. When this happens in steep slopes the safety factor of the slope material gets considerably reduced causing it to move down. Hence the natural way of preventing this situation is by reducing infiltration and allowing excess water to move down without hindrance. As such, the first and foremost mitigation measure is drainage correction. This involves maintenance of natural drainage channels both micro and macro in vulnerable slopes.

The universal use of contour bunding for all types of terrain without consideration of the slope, overburden thickness and texture or drainage set-up needs to be controlled especially in the plateau edge regions. It is time to think about alternatives and innovations, which are suitable for the terrain, to be set up. It need not be over-emphasized that the governmental agencies have a lot to contribute in this field.

Leaving aside the 'critical zones' where settlements could be avoided altogether and which could be preferably used for permanent vegetation, the 'highly unstable zones' generally lie in the upper regions, which are occupied by highly degraded vegetation. These areas warrant immediate afforestation measures with suitable plant species. The afforestation programme should be properly planned so that little slope modification is done in the process. Bunding of any sort using boulders etc. has to be avoided. The selection of suitable plant species should be such that can withstand the existing stress conditions in this terrain.

NATIONAL URBAN EARTHQUAKE VULNERABILITY REDUCTION PROGRAMME (NUEVRP)

BACKGROUND :

National disasters are a tragic interruption to the development process; lives are lost, social network disrupted and capital investments are destroyed. In recent years, development has been making the links between disaster and development, which seems inevitable when one considers the disproportionately high costs that developing countries pay for disasters.

In view of the global environmental changes, the frequency of disasters seems to be increasing the world over. India is one of the most disaster prone countries in the world and the earthquake problem in the country needs no introduction. The country had experienced four great earthquakes and a series of moderate earthquakes within a span of 50 years; but these earthquakes had localized impact and caused less human and properly losses. This failed to evoke a national response at the government level focusing upon long-term seismic mitigation.

The situation changed in the late 1980s, when earthquakes became big events in terms of human vulnerability. Six earthquakes had struck different parts of India over a span of 15 years, Bihar earthquake of 1988 (magnitude 6.4) Uttarkashi, Uttar Pradesh of 1991 (magnitude 6.6), Latur – Osmanabad, Maharashtra of 1993 (magnitude 6.4), Jabalpur, Madhya Pradesh easrthquake of 1997 (magnitude 6.3), Chamoli earthquake of 1999 (magnitude 6.9) Bhuj earthquake of 2001 Magnitude 6.9 and with the exception of the Bhuj earthquake (2001) all were of moderate intensity; yet they caused considerable loss to human life and property. The damages caused by these earthquakes reiterate the scale of vulnerability at the national level.

Human vulnerability to disasters has increased with growing industrialization and urbanization, which is reflected in the huge loss of lives and destruction of built

environment, social network and infrastructure. The deaths and destruction during earthquake are caused primarily because the man-made constructions do not comply with seismic safety requirements. Even today the country not have adequate enforcement mechanisms to ensure quality in structural design relating to seismic safety. III-practices, poor design substandard construction quality and rampant violation of building codes have made building more susceptible to seismic disturbances. While loss og human life and injury are the most tragic and intolerable consequences of earthquakes, their social and economic consequences are far-reaching, and provide a second powerful argument for earthquake protection. As consequences of this physical damage, people are rendered homeless, jobs and services are disrupted communication fails and administration breaks down. The extent of this social disruption depends both on the scale of earthquake damage and on the degree of preparedness of community. The awareness among the public and most decision makers on the implications of earthquake vulnerability is very limited. Thus, the need is felt to initiate a programmer at the national level towards reducing earthquake vulnerability.

SELECTION OF THE PROPOSED PROJECT AREA

The vulnerability atlas shows that 60% of the country is in Zone VII (Modified Mercalli Scale) or higher as per Indian Standard (IS:1893). Relating the vulnerability map of India with the cities with population above 5,00,000 would help in identification of cities for piloting a national project on earthquake vulnerability reduction.

List of the Cities in India with above 5,00,000 population and in seismic Zone (MSK V to IX)

Sl. No.	State	Name of City	Population	Latitude	Longitude	MSK Zone
1.	Andhra Pradesh	Hyderabad	5,533,640	17.20 N	78.30 E	V
2.	Andhra Pradesh	Vijayawada	1,011,152	16.31 N	80.39 E	VII
3.	Andhra Pradesh	Visakhapatnam	1,329,472	17.44 N	83.23 E	VI
4.	Andhra Pradesh	Warangal	577,190	17.58 N	79.40 E	VI
5.	Assam	Guwahati	814,575	26.11 N	91.47 E	IX
6.	Bihar	Patna	1,707,429	25.37 N	85.13 E	VIII
7.	Chhattisgarh	Durg-Bhilainagar	923,559	21.11 N	81.21 E	V
8.	Chhattisgarh	Raipur	699,264	21.15 N	81.41 E	V
9.	Delhi	Delhi	12,791,458	28.67 N	77.21 E	VIII
10.	Gujarat	Ahmadabad	4,519,278	23.03 N	72.40 E	VII
11.	Gujarat	Bhavnagar	517,578	21.46 N	72.11 E	VII
12.	Gujarat	Jamnagar	558,462	22.27 N	70.07 E	VIII
13.	Gujarat	Rajkot	1,002,160	22.18 N	70.56 E	VII
14.	Gujarat	Surat	2,811,466	21.20 N	72.82 E	VII
15.	Gujarat	Vadodara	1,492,398	22.00 N	73.16 E	VII
16.	Jammu & Kashmir	Jammu	607,642	32.43 N	74.54 E	VIII
17.	Jammu & Kashmir	Srinagar	971,357	34.09 N	74.79 E	IX
18.	Jharkhand	Dhanbad	1,064,357	23.47 N	86.30 E	VII

19.	Jharkhand	Jamshedpur	1,101,804	22.50 N	86.10 E	VI
20.	Jharkhand	Ranchi	862,850	23.23 N	85.23 E	VI
21.	Karnataka	Bangalore	5,686,844	12.58 N	77.38 E	V
22.	Karnataka	Belgaum	506,235	15.52 N	74.34 E	VI
23.	Karnataka	Mangalore	538,560	12.52 N	74.53 E	VII
24.	Karnataka	Mysore	785,800	12.18 N	76.42 E	V
25.	Kerala	Kochi	1,355,406	9.58 N	76.22 E	VII
26.	Kerala	Kozhikode	880,168	11.15 N	75.49 E	VII
27.	Kerala	Trivandrum	889,191	8.29 N	76.59 E	VII
28.	Madhya Pradesh	Bhopal	1,454,830	23.16 N	77.36 E	VI
29.	Madhya Pradesh	Gwalior	865,800	26.14 N	78.10 E	VI
30.	Madhya Pradesh	Indore	1,639,044	22.44 N	75.50 E	VII
31.	Madhya Pradesh	Jabalpur	1,117,200	23.10 N	79.59 E	VII
32.	Maharashtra	Aurangabad	891,841	19.53 N	75.23 E	V
33.	Maharashtra	Bhiwandi	621,390	19.30 N	73.05 E	VII
34.	Maharashtra	Greater Mumbai	16,368,084	18.55 N	72.54 E	VIII
35.	Maharashtra	Nagpur	2,122,965	21.09 N	79.09 E	VI
36.	Maharashtra	Nasik	1,152,048	20.02 N	73.50 E	VII
37.	Maharashtra	Pune	3,755,525	18.31 N	73.55 E	VII
38.	Orissa	Bhubaneswar	657,477	20.15 N	85.52 E	VII
39.	Orissa	Cuttack	587,637	20.28 N	85.54 E	VII
40.	Pondicherry	Pondicherry	505,715	10.55 N	79.52 E	VI
41.	Punjab	Amritsar	1,011,327	31.37 N	74.55 E	VIII
42.	Punjab	Jalandhar	709,255	31.19 N	35.18 E	VIII
43.	Rajasthan	Jodhpur	856,034	26.18 N	73.04 E	V
44.	Rajasthan	Kota	704,731	25.10 N	75.52 E	V
45.	Tamil Nadu	Chennai	6,424,624	13.04 N	80.17 E	VI
46.	Tamil Nadu	Coimbatore	1,446,034	11.00 N	77.00 E	VII
47.	Tamil Nadu	Madurai	1,194,665	9.58 N	78.10 E	VI
48.	Tamil Nadu	Salem	748,513	11.39 N	78.12 E	VI
49.	Tamil Nadu	Tiruchirappalli	847,131	10.50 N	78.46 E	VI
50.	Tamil Nadu	Tiruppur	542,787	11.05 N	77.20 E	VI
51.	Uttar Pradesh	Agra	1,321,410	27.10 N	78.05 E	VII
52.	Uttar Pradesh	Allahabad	1,049,579	25.28 N	81.54 E	VI
53.	Uttar Pradesh	Bareilly	729,800	28.22 N	79.27 E	VIII
54.	Uttar Pradesh	Kanpur	2,690,486	26.28 N	80.24 E	VII
55.	Uttar Pradesh	Lucknow	2,266,933	26.55 N	80.59 E	VII
56.	Uttar Pradesh	Meerut	1,167,399	29.01 N	77.45 E	VIII
57.	Uttar Pradesh	Varanasi	1,211,749	25.20 N	83.00 E	VII
58.	Uttaranchal	Dehradun	527,859	30.19 N	78.04 E	VIII
59.	West Bengal	Asansol	1,090,171	23.42 N	87.01 E	VII
60.	West Bengal	Kolkata	13,216,546	22.34 N	88.24 E	VII

Since at this point of time, the country does not have adequate infrastructure for a massive and large initiative on this front to include all these 60 cities, it would be better to consider the most hazard-prone cities.

List of the Cities with above 5,00,000 population & in MSK Zone - IX

Sl. No.	State	Name of City	Population	Latitude	Longitude	MSK Zone
01.	Assam	Guwahati	814,575	26.11 N	91.47 E	IX
02.	Jammu & Kashmir	Srinagar	971,357	34.09 N	74.79 E	IX

List of the Cities with above 5,00,000 population & in MSK Zone -VIII

Sl. No.	State	Name of City	Population	Latitude	Longitude	MSK Zone
01.	Bihar	Patna	1,707,429	25.37 N	85.13 E	VIII
02.	Delhi	Delhi	12,791,458	28.67 N	77.21 E	VIII
03.	Gujarat	Jamnagar	558,462	22.27 N	70.07 E	VIII
04.	Jammu & Kashmir	Jammu	607,642	32.43 N	74.54 E	VIII
05.	Maharashtra	Greater Mumbai	16,368,084	18.55 N	72.54 E	VIII
06.	Punjab	Amritsar	1,011,327	31.37 N	74.55 E	VIII
07.	Punjab	Jalandhar	709,255	31.19 N	35.18 E	VIII
08.	Uttar Pradesh	Bareilly	729,800	28.22 N	79.27 E	VIII
09.	Uttar Pradesh	Meerut	1,167,399	29.01 N	77.45 E	VIII
10.	Uttaranchal	Dehradun	527,859	30.19 N	78.04 E	VIII

List of the Cities with above 5,00,000 population & in MSK Zone –VII

Sl. No.	State	Name of City	Population	Latitude	Longitude	MSK Zone
01.	Andhra Pradesh	Vijayawada	1,011,152	16.31 N	80.39 E	VII
02.	Gujarat	Ahmadabad	4,519,278	23.03 N	72.40 E	VII
03.	Gujarat	Bhavnagar	517,578	21.46 N	72.11 E	VII
04.	Gujarat	Rajkot	1,002,160	22.18 N	70.56 E	VII
05.	Gujarat	Surat	2,811,466	21.20 N	72.82 E	VII
06.	Gujarat	Vadodara	1,492,398	22.00 N	73.16 E	VII
07.	Jharkhand	Dhanbad	1,064,357	23.47 N	86.30 E	VII
08.	Karnataka	Mangalore	538,560	12.52 N	74.53 E	VII
09.	Kerala	Kochi	1,355,406	9.58 N	76.22 E	VII
10.	Kerala	Kozhikode	880,168	11.15 N	75.49 E	VII
11.	Kerala	Trivandrum	889,191	8.29 N	76.59 E	VII
12.	Madhya Pradesh	Indore	1,639,044	22.44 N	75.50 E	VII
13.	Madhya Pradesh	Jabalpur	1,117,200	23.10 N	79.59 E	VII
14.	Maharashtra	Bhiwandi	621,390	19.30 N	73.05 E	VII
15.	Maharashtra	Nasik	1,152,048	20.02 N	73.50 E	VII

16.	Maharashtra	Pune	3,755,525	18.31 N	73.55 E	VII
17.	Orissa	Bhubaneswar	657,477	20.15 N	85.52 E	VII
18.	Orissa	Cuttack	587,637	20.28 N	85.54 E	VII
19.	Tamil Nadu	Coimbatore	1,446,034	11.00 N	77.00 E	VII
20.	Uttar Pradesh	Agra	1,321,410	27.10 N	78.05 E	VII
21.	Uttar Pradesh	Kanpur	2,690,486	26.28 N	80.24 E	VII
22.	Uttar Pradesh	Lucknow	2,266,933	26.55 N	80.59 E	VII
23.	Uttar Pradesh	Varanasi	1,211,749	25.20 N	83.00 E	VII
24.	West Bengal	Asansol	1,090,171	23.42 N	87.01 E	VII
25.	West Bengal	Kolkata	13,216,546	22.34 N	88.24 E	VII

The above lists include all the cities of India with population more than 5,00,000 and in seismic zones IX, VIII, and VII. It is proposed to include all these 37 cities in the project, which would lead to capacity building for bigger initiatives in the future.

Earthquake vulnerability reduction, however, will be a long-drawn process. At this stage, a modest project is proposed with emphasis on (a) development of earthquake risk management plan based on seismic vulnerability towards public infrastructure, and (b) awareness and capacity building of all stakeholders towards construction of safe housing/retrofitting of existing housing stock and develop expertise by the different stakeholders.

GOALS AND OBJECTIVES

GOAL :

Sustainable Vulnerability Reduction Plan towards earthquake risk management in some of the most-hazard prone cities of India.

OBJECTIVES :

1. **Mass awareness programme, education and strengthening the capacity at all levels** towards earthquake risk management and sustainable recovery. [Development of manuals and training modules, information, education and communication materials and their dissemination, awareness campaign strategy and implementation for earthquake vulnerability reduction and recovery].

2. **Strengthening institutional, administrative, financial and legal system for review of the zoning regulations and building codes** and regulatory mechanisms at National, State and City levels and suggest improvements, amendment of byelaws, regulatory mechanisms, if needed.

3. **Earthquake preparedness, response and mitigation plan** for earthquake risk management at the national, city and ward level for the most vulnerable 37 cities of India.

4. **Networking** knowledge on effective approaches, methods and tools for earthquake risk management, developing and promoting policy frameworks at National, State and City levels through lead institutes selected in and around each city.

Activities under Objective – 1 :

- Consultations with National and state governments, public sector (development authorities, ULBs), NGOs, training institutions, private sectors (real-estate firms, builders, contractors, etc.) and others for area specific earthquake risk management and mitigation strategies.
- Formulation of city specific awareness campaign strategies.
- Awareness generation programmes through voluntary organizations and students on earthquake management and mitigation

  - among the community through workshop/seminar/training, use of media (radio/TV/articles in common magazines, posters/leaflets in local language, wall painting, and observation of earthquake risk management day/week;
  - among school children on safety measures through audio-visual programmes, competitions, mock drills, etc; and
  - among real estate developer associations, builders associations, contractors associations, etc. through workshops and orientation programmes.

- Development of reading/activity-oriented materials and user-friendly manuals on

  - design and construction of earthquake-resistant houses/retrofitting;
  - earthquake risk management and response plans;
  - training manuals on dissemination of accurate warning, search and rescue operation, first aid, water & sanitation, shelter management, counseling and damage assessments for early recovery and response, proper utilization and better coordination of relief materials during crisis time.

- Documentation of appropriate retrofitting techniques and sharing of best practices, conference proceedings and articles in popular magazines.
- Training and orientation programmes for :

  - national and state government functionaries, public sector functionaries (development authorities, ULBs), NGOs, training institutions, private sectors (real-estate firms, builders, contractors etc.) in the process of development of ward based earthquake risk management and response plans;
  - selected engineers from some of the prominent govt. engineering departments (such as PWD, MES) on micro-zonation risk analysis and for deputation to concerned organizations till the latter develop in-house expertise;
  - practicing architects/engineers/licensed building surveyors on earthquake-resistant construction, safety and evaluation techniques and retrofitting.
  - Teachers, students in technical schools/engineering colleges on earthquake risk management, earthquake-resistant construction and retrofitting.

Activities under Objective – 2 :

- Orientation of Govt. officials in Urban Local Bodies – Development Authorities/Muncipalities/T & P Dept. Housing Societies/Housing Boards towards hazard zonation, risk evaluation and mitigation.
- Constitution of empowered committees at the national and city levels to review the zoning regulations, building codes & byelaws and regulatory mechanisms at national, city and ward levels (for newly developed areas, old ‘core’ area of the city

and slums) w.r.t. earthquake vulnerability reduction by making use of the various seismo-tectonic and seismic zoning maps prepared through various institutes in the country and recommend landuse policies, strategies, amendments and micro-zonation.

- **Activities under Objective – 3 :**

- Geographical Information System (GIC) based hazard and vulnerability mapping along with risk modeling of 20 cities with over 5 lac population and most prone to earthquakes in India.
- Identification and networking of nodal agencies and partners at different levels for implementations of the programme.
- Formation of City and Ward Level **Disaster Management Teams (DMT)** including all concern Government Depts. Senior citizens, National Cadet Corps (NCC)/National Social Service (NSS), Rotary and Lions Clubs, City Nagarik Committees, elected members, NGOs and other civil society response groups.
- Development of city and ward level earthquake risk management plans.
- Development of Inventory of resources at all levels for speedy response during emergencies-use of GIS to project the resources on the maps for immediate decision-making.
- Development of response structure from ward to city level.
- Specialized training of **Disaster Management Teams (DMT)** at ward and city levels.
- Disaster Response Mock drill at all levels-national, city and ward levels.
- Installation of information Technology (IT) based early warning system in the city disaster management information centers (control room) for dissemination of earthquake related information.
- Enable citizen's access to earthquake risk management and development related information through Information Centers.
- Support to concerned authorities with emergency kits [e.g. mobile control rooms, health units, debris clearing equipments, tents, etc.].

- **Activities under Objective – 4 :**

- Supporting the Ministry of Home Affairs for development of suitable mitigation strategy to cover a wide range of initiatives encompassing legal, financial technical and administrative system at national and city levels to reduce earthquake vulnerability.
- Capacity building of Research/Resource institutions at national and city levels for reviewing of existing earthquake management plan.
- Research and documentation on earthquake risk management index for each city.
- Regular studies, technical support, trainings and periodic assessments on earthquake vulnerability through the research/knowledge hub at national level.
- National database on earthquake risk management and disaster recovery response plan.
- Capability assessment and national training plan for earthquake risk management.
- Development of Risk and Vulnerability Reduction Indices and annual reports
- Documentation and sharing of best practices of India for earthquake risk management for wider circulation as part of training curriculum.
- Activities, approach, methods etc. can be developed as electronic document linked with the Web site of state and national Government and UNDP for knowledge network, which links the practitioners involved in the programme.

- GIS vulnerability database using for risk vulnerability reports as policy instrument to enhance national and state policy on earthquake risk management.

OUTCOMES

- Aware and informed community/students and teachers/building experts and practitioners, builders on earthquake risk management and mitigation in the most hazard-prone cities of the country.
- Review & amendment of the existing zoning regulations, building codes and bye-laws and sensitization of building experts about the same.
- Risk assessment plans for the selected cities based on detailed micro-zonation, development of community contingency plans formation of disaster management teams.
- Better prepared community /institutions towards earthquake management due to regular mock-drills being held at all levels.
- **Risk analysis of all public utilize, prioritization of the same in terms of need for retrofitting and resource (finance, manpower, etc.) need plan.**
- Sharing of information, manuals, training module, etc. for replication, best practices, etc. through well-established knowledge networking.
- Comprehensive National Plan for risk-assessment of all public utilities in the selected most hazard-prone cities and need for resource mobilization for retrofitting of the same.
- Greater participation of elected representatives of local self-governments in selected cities in the process of earthquake preparedness and risk management.
- A State and National Empowered Committee.
- Enhanced capacity in Ministry of Home Affairs for earthquake risk management.
- Enhanced capacity of the Government functionaries of the nodal agency at the state level and in all selected cities in development and updating the earthquake risk management and response plans for different hazards from time to time.
- Well-equipped earthquake risk management information centers in the selected cities.

INSTITUTIONAL ARRANGEMENTS

- **Coordination at the National Level :** The Ministry of Home Affairs, Government of India will be the nodal agency at central level for smooth execution of the programme with technical support from key resource institutions in the country. There would be a Programme Management Board (PMB) headed by the Secretary, MHA to provide overall guidance to the programme. A Programme Steering Committee (PSC) headed by the Joint Secretary [DM] in MHA would be constituted as proposed in the NDRM programme. The PSC will approve the formation of a National Earthquake Core Group Experts constituted of members from various resource institutions across the country as well as eminent specialists and legal experts. This will meet quarterly to review the progress of the programme.
- **Monitoring at the State Level :** In each state, a State Steering Committee (SSC) headed by the Chief Secretary will be constituted as a part of the NDRM programme. The SSC will approve of a State Earthquake Core Group Experts formed out of selected members of various resource institutions across the state/neighbouring state as well as eminent specialists and legal experts to review the project at periodic intervals. This will be the State Empowered Committee.

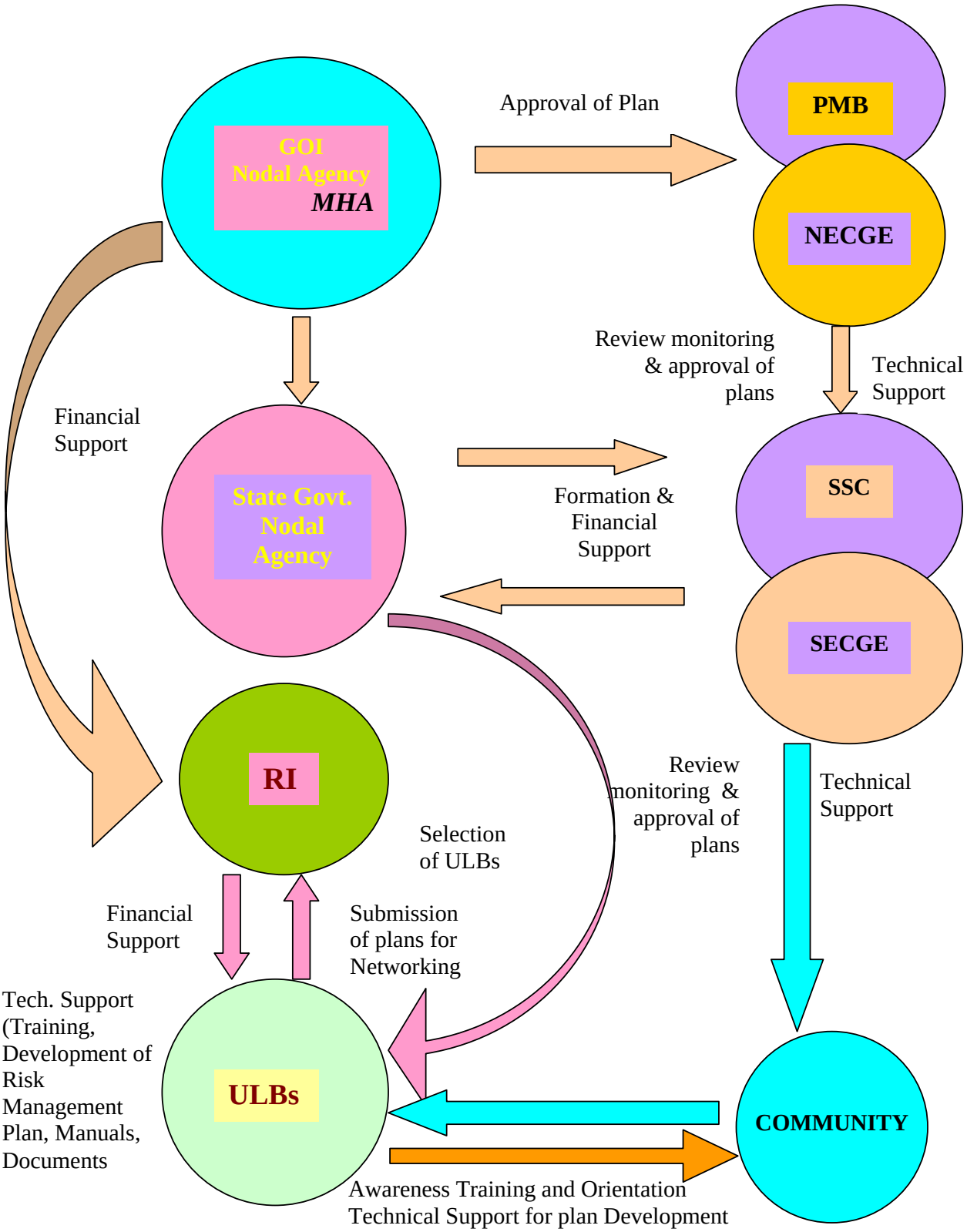
- The financial arrangement and audit would as per the guidelines of Department of Economic Affairs, UNDP guidelines and procedures established for Country Office Support agreements.

The UNDP Country Office, Delhi would liaise with Central government for smooth implementation of the programme and provide effective backstopping for planning, implementation, resource mobilization and financial management.

IMPLEMENTATION PROCESS

The Ministry of Home Affairs (MHA), Govt. of India will execute the programme under National Execution (NEX) guidelines. The MHA will ask the state governments to select the Urban Local Bodies (ULBs) for implementation of the project, after which the MHA will host a preliminary consultation meeting for all the selected resource institutions and the ULBs for finalization of strategies. The selected resource institutions will work in partnership and provide technical support to these ULBs.

The resource institutions will develop manuals and training modules, information, education and communication materials and risk assessment procedures. They will also conduct training programmes for the senior ULB staffs on use of risk management tools for micro-zonation and development of ward based earthquake risk management and response plans for public utilities, generate risk awareness along with use of earthquake-resistant construction, safety and evaluation techniques and retrofitting and earthquake mitigation strategies. The ULBs will subcontract the awareness and sensitization work to selected resident welfare associations, nagarik committee, ward committee, NGOs, etc. for preparation of micro/ward level risk management plans and training/orientation/sensitization of the community/practicing architects and engineers/real estrate developer associations, builders associations, contractors associations, etc. teachers and students in technical schools/engineering colleges towards following the amended zoning regulations and byelaws and adopting the safety and evaluation techniques for new constructions and retrofitting. Thus, for creation and structural strengthening of private assets, the community will get the opportunity to make use of the human resource for technical support and related user-friendly manuals.


GOI
Nodal Agency
MHA
Approval of Plan
PMB
NECGE
Review monitoring
& approval of
plans
Technical
Support
Financial
Support
State Govt.
Nodal
Agency
Formation &
Financial
Support
SSC
SECGE
RI
Review
monitoring &
approval of
plans
Technical
Support
Selection
of ULBs
Financial
Support
Submission
of plans for
Networking
Tech. Support
(Training,
Development of
Risk
Management
Plan, Manuals,
Documents
ULBs
COMMUNITY
Awareness Training and Orientation
Technical Support for plan Development

LEGEND :-

GOI	**: Govt. of India**
MHA	**: Ministry of Home Affairs**
PMB	**: Project Management Board**
NECGE	**: National Earthquake Core Group Experts**
SSC	**: State Steering Committee**
SECGE	**: State Earthquake Core Group Experts**
RI	**: Resource Institutions**
ULBs	**: Urban Local Boards**

The ULBs will review the zoning regulations, building codes and regulatory mechanisms and suggest improvements, amendment of byelaws, regulatory mechanisms, if needed in consultation with the resource institutions and the State Empowered Committee. This will be followed by an awareness programme for all real estate developer associations, builders associations, contractors associations, etc. on the amendments made.

The ULBs will also conduct the risk management of the city resulting in micro-zonation and development of city risk management and mitigation plans for all public utilizes, stating all the resources (finance, manpower, etc.) that would be needed to implement the plan. Once the plan is ready, it has to win the approval from the State Govt. and then from MHA and Ministry of Housing & Urban Development.

Through an enhanced networking system, there will be considerable sharing of experiences, research, database, documentation and best practices among various resource institutions and key resource institutions. This will also bring about amendment in national building byelaws and codes based on the recommended changes in all cities.

Duration : 2 years (Phase – I)

Budget : Total 3.7 million USD @ 100,000 USD for each city [provisional]

P.S. The role of all stakeholders vis-à-vis each objective is attached below.

A PROFILE OF AGENCIES INVOLVED IN DISASTER RESPONSE

SIMON LYNCH
UNNIKRISHNAN P.V.

There is a slow but noticeable veering around of the machinery of relief and rehabilitation assessment and response from immediate succour to long-term community empowerment and development.

There has been a substantial shift in the philosophy and practice of organizations that serve to provide disaster relief and rehabilitation in India. Since the 1980s, there has been a reorientation from providing response-based relief to ensuring long-term development and disaster mitigation. Relief organizations are increasingly focusing on empowering the community and incorporating disaster preparedness into larger scale development programmes. However, there is the ongoing need for organizations to be able to respond quickly and effectively to disaster situations: it is in this context that the lack of a government framework impairs the ability of organizations to assist in the early stages of disasters, when help in needed most urgently.

Government

The basic responsibility for the undertaking of rescue, relief and rehabilitation in the aftermath of a disaster is that of the state government, with the Central government providing supplementary physical and financial resources. The nodal agency for disaster relief for the Government of India is the Department of Agriculture and Cooperation (DAC), which exists within the Ministry of Agriculture. A Central Relief Commissioner (CRC) coordinates all relief operations for disasters, receiving information on the situation and passing it to the Secretary of the Ministry of Agriculture, the Cabinet and the Prime Minister. A Cabinet Committee may be convened to ensure the effective implementation of relief measures. The National Crisis of Management Committee gives direction to the Crisis Management Group (CMG) when required. It is also the responsibility of the CMG to conduct an annual review of the Contingency Action Plan.

The National Disaster Management Network

The respective state governments have their own CMGs. At the local level, the District Collector/Magistrate or Deputy Commissioner is responsible for directing, supervising and monitoring relief measures according to the contingency plan. During disaster situations, the powers of the collector are greatly increased. In addition, a Disaster Relief Committee is created and a disaster Control Room is established for the everyday monitoring of relief activities.

The traditional disaster management framework of the Government of India primarily involved relief operations. There has, however, been a substantial shift towards preparedness and disaster mitigation. The first of these initiatives is the creation of the National Centre for Disaster Management (NCDM) at the Indian Institute for Public Administration (IIPA), New Delhi. Established by the Ministry of

Agriculture in March 1995, the Centre provides the framework for national, state and district level administration in the event of disasters, coordinates various research activities, training programmes, and has database on natural disasters. Its main objective is to provide an information base on damage caused by natural disasters and resources spent on relief work, establish links with the nodal ministry dealing with natural disasters, and provide technical services to the national disaster management programmes.

NATURAL DISASTERS RESPONSE MECHANISM

International and National Non-governmental Organizations

Given the limited resources of the government, non-governmental organizations (NGOs) play a critical role in disaster relief and management. Traditionally, participation in rescue and relief operations is limited to the smaller, localized NGOs. Most are network with the larger NGOs which, in turn, provide more direct assistance to the reconstruction and rehabilitation of disaster-affected areas. Increasingly, NGOs are following up the initial disaster response phase with long-term development programmes incorporating disaster mitigation and preparedness.

Greater flexibility and interaction with the community has made it possible for disaster preparedness and mitigation to become integral with largescale development programmes. Relief operations are becoming increasingly coordinated, with more equitable distribution of materials. NGOs and development organizations are training and building awareness (for instance, on gender issues) amongst local communities for disaster preparedness. Initiatives have been undertaken to create and promote community funds, food stores and other resource accumulation.

CARE India

CARE India is committed to respond to mitigate human suffering and loss of support systems in disaster situations. CARE works closely with national and state governments, generally responding to disasters at their request, and its relief and development interventions aim at improving the socioeconomic conditions of the poor. In the event of a disaster, CARE activates its Emergency Response Unit at its headquarters in Delhi, a State Emergency Response Team at the state level, and an On-Site Emergency Response Coordinator.

Its organizational structure allows it to implement both regular development and emergency work down to the community level. CARE India is also the convenor of the Government of India NGO Committee on Emergency Preparedness.

The International Federation of the Red Cross (IFRC) and Red Crescent Societies

The IFRC is the world's largest humanitarian organisation. Its mission, broadly speaking, is to improve the situation of the world's most vulnerable people. The IFRC is represented in India through its South Asian Regional Delegation.

Over the past two years, the Federation has actively supported and jointly carried out a series of 10 Regional Disaster Preparedness Workshops with the Indian Red Cross Society (IRCS). Its Regional Programme Manager has been involved in this training since August 1997 and will continue till the end of 1999, by which time the IRCS is stated to have developed sufficient expertise and ownership to carry on this training with little or no expatriate involvement.

The implementation is being shared by IRCS, the Federation and the International Committee for the Red Cross (ICRC). The Federation will support a three-year training initiative to the IRCS staff and to volunteers in disaster preparedness, risk management, hazard identification, vulnerability, and community capacity analysis. These workshops will enable staff to conduct their own sub-branch and village-based training events and apply the skills to disaster situations. District plans will gradually be developed from the vulnerability and community capacity analyses. This database will provide the foundation for a state-level and, eventually, national-level, disaster preparedness plan.

International Committee for the Red Cross (ICRC)

Although the ICRC has been operating in India for the past 50 years, its South Asian regional office was established in New Delhi in 1982. the ICRC has responded to several conflicts in the region, including the Indo-Pakistan conflict (1948), assisting Tibetan refugees (1959), the Indo-Portuguese conflict (1960-01), the Sino-Indian conflict (1962-03), the second Indo-Pakistan conflict (1965-06) and the Indo-Pakistan/Bangladesh conflict (1971).

Recently, the ICRC has become increasingly involved in working with the victims of internecine conflict, such as, in the case of prisoners in Jammu and Kashmir, and violence against Dalits. Here, the ICRCs mandate is to ensure the fair and proper treatment of prisoners, which therefore interdicts its involvement in long-term development projects : natural disaster response is more the responsibility of the Indian Red Cross society, although the ICRC provides support where necessary. During emergencies, priority is given to the treatment and evacuation of the injured, especially those in the more marginalized groups – women and children. In South Asia, the ICRCs `tracing services' forwarded more than 16 million family messages and opened 20,000 inquiries to trace missing family members. In this region, the Committee operates on an annual budget of Swiss Franc 8 million.

Indian Red Cross Society (IRCS)

The Indian Red Cross Society was founded in 1920. It follows its own established disaster plan, the most basic being disaster relief. Through some 650 branches, the IRCS provides a well-knit and well-organised network countrywide. In the event of a disaster, the services of the Red Cross become auxiliary and/or complementary to that of the government. The district committee of the affected area immediately goes into action by initiating disaster relief operations. The state branch reinforces these efforts and informs the national headquarters of the situation, of the services, the quantity and type of materials required. There is close cooperation with the government and other NGOs.

Catholic-Health Association of India (CHAI)

The Catholic-Health Association of India (CHAI) is the world's largest voluntary healthcare organisation. Its disaster response is characterized by `holistic health through peoples empowerment'.[1] Following the Latur earthquake in 1993, CHAI not only provided relief but supported an ongoing `development process to lead to people's self-reliance and liberation'.[2] CHAIs first priority was to provide relief : it established one of the first camps in the area. It also insured that its activities were not in competition with those of other relief organizations, but rather filled in the gaps.

CHAI's main priorities are to provide medical aid and healthcare ; concentrate on physical social, emotional, and spiritual rehabilitation; attend to hygiene and sanitation; mobilize relief material for villages; and create economic development programmes that assist in returning to normalcy.

Voluntary Health Association of India (VHAI)

VHAI links 4,000 health and development organizations across India through 24 State Voluntary Health Associations. Its goal is to `make health a reality for the people of India'.[3] VHAIs long-term major objectives are the promoting social justice and human rights in health service, building up a people's health movement, and advocating a cost-effective, preventive, promotive, and sustainable healthcare system. At the macro level, VHAI acts jointly with health-planners, policymakers, parliamentarians, activists and other leading health organizations. At the micro level, it maintains grassroots contact through programmes designed to respond to local needs receiving feedback from the field about its concepts on community health and suggestions about the organisation's future direction.

Church's Auxiliary for Social Action (CASA)

CASA has been involved in relief and development since 1947, when the Government of India requested the Church to help provide relief to the Partition's refugees. CASA established the Committee on Relief and Gift Supplies (COR-AGS), and later extended its relief operations to victims of natural disasters.

In 1972, CASA became independent of the National Council of Churches and re-orientated itself towards development and disaster mitigation. Throughout the 1980s, emergency relief gradually dovetailed with development activity, and disaster preparedness became an integral part of the development progress. This involved community interaction and empowerment, ensuring in times of calamity the community's capacity to help itself, rather than promoting a relief psychology. For example, following the 1990 cyclone in Andhra Pradesh, members from an unaffected community that had earlier been assisted and trained by CASA extended help to neighboring villages that had been badly damaged.

Disaster Management Training Programmes. A close association with the government and a strong network within the Church and among grassroots NGOs has allowed CASA to pool resources and expertise from various sectors to provide a holistic approach to development and disaster mitigation preparedness and relief.

Evangelical Fellowship on India Commission on Relief (EFICOR)

EFICOR is a Church-based organisation that provides relief to all communities during times of calamity and supports long-term development programmes. EFICOR's first response was to the 1971 Bihar famine, with its primary role that of a `welfare organisation responding to need'.[5] In the 1980s, a review of the effectiveness of EFICOR's response reoriented it towards long-term development programmes and disaster preparedness. EFICOR still involves itself in disaster relief, responding to 30-35 disaster situations a year, but in a supplemental capacity to the efforts of the government and other NGOs.

When a disaster occurs, a member from EFICOR's Disaster Management Unit goes to the affected area to assess where it can `fill the gaps' of the relief effort. The organisation outlays Rs.1.5-2 lakhs for immediate disaster assistance. In workshops held twice a year, participants from partner NGOs are brought to a previously disaster-affected area to teach them to assess how relief was administered and to evaluate the redevelopment programme.

Action Aid

Action Aid has been involved in India since 1972 and `exists to facilitate the enpowerment of the poor in the process of social development'.[6] Recognizing that long-term development is where its core competence lies, Action Aid, through local NGOs, supports long-term (8-12 years) development programmes, with the aim of making the community self-sufficient and improving the life of the marginalized.[7]

Action Aid had also perceived any involvement in disaster-related work as another process perpetuating poverty. However, venturing into the heartland of poverty in India – which is also prone to disasters – it has had to develop strategies to systematically deal with disasters. In this context, Action Aid has recently produced an Emergency Strategy Paper (1998-2002).

Netherlands Organisation for International Development Cooperation (NOVIB)

NOVIB was founded in the Netherlands in 1956. The devasting floods in Holland in the early 1950s which killed over 2,000 people and the ensuing humanitarian aid from the rest of the world prompted secular philanthropists to found NOVIB.

Country operations in South Asia, particularly in India, began during late 1970s in the form of supporting relief-rehabilitation, basic needs satisfaction, and food security programmes like `food for work'. NOVIB started the disaster relief-related work in India following the 1977 cyclone along the AP coast.

NOVIB's disaster/emergencies-related work is primarily, but not exclusively, with the direct target group with whom its partner NGOs work. For example, it participated in the Latur earthquake relief work through its partner NGO Manavlok, the flood relief programme in the Triunelveli and Nagercoil districts through partner NGOs like the Centre for Appropriate Technology (CAT) and the Centre for Rural Technology (CRT), and the AP cyclone relief programme through Oxfam Hyderabad (1997-8). In the past, NOVIB's work has been emergency response rather than preparedness. It seeks to provide immediate relief such as food, cloth,

temporary shelter, health resources, compliment the work of government and other local institutions in long-term rehabilitation, strengthen the capacities of the communities to have access to local resources, and adopt appropriate technologies and influence policies.

Currently, the disaster/relief programmes are handled by one person in NOVIB's International bureau in close cooperation with the respective Country Programme Officers. NOVIB and Oxfam are also working to develop a policy framework and protocol regarding emergency relief.

There have been no separate allocations for India on the issue of emergencies. NOVIB's annual budget for India for the past three years has been about 8 million Dutch Guilders (roughly Rs.160 million, at the current exchange rate), with most of it earmarked for direct structural emergency relief/rehabilitation expenditure in India during the past three years is about Rs.25 million.

CARITAS India

CARITAS India, operating in India since 1962, is a development organisation of the Catholic Bishops conference of India. Initially, CARITAS focused on providing relief to the poor and suffering especially during times of calamity. However, this approach was deemed unsatisfactory and the thrust of its involvement shifted toward developing skills to enable higher income generation. Although effective, this approach was also found wanting as it benefited only those without it were further marginalized. CARITAS, therefore, redeployed itself to target the population as active participants in the development process rather than as passive recipients of aid.

The People's empowerment is the priority, in keeping with its motto of `building people through building homes and building homes through building houses'. During the past five years, CARITAS has released over Rs.439 lakh for relief, rehabilitation and long-term environmental programmes.

Save the Children

Save the Children began working in pre-Independence India providing relief during emergencies. The India office was established in 1975 to coordinate the existing relief operations to explore new areas and long-term development programmes incorporating disaster mitigation and preparedness. Relief operations also under-went a review, leading to better assessment of disasters and the needs of the people affected. Save the Children Fund works through partner NGOs by providing financial and technical resources and training assistance. It is currently involved with six programmes in 12 states, including child sponsorship and Tibetan refugees. Both these programmes are, however, to be phased out.

Catholic Relief Service (CRS)

CRS has been operating in India for nearly 50 years. It is closely affiliated to USAID and has a working partnership with the Indian government. When a disaster occurs, CRS is informed of the relief required by one of its local counterparts and has the capacity to immediately release up to 50 metric tones of food relief supplies, as well as other auxiliary relief resources such as blankets,

tarpaulins and cash. If the amount required exceeds 50 metric tones, it requests the US government for additional resources. CRS, which provides about US$ 350, 000 a year in food assisment that it be responsible for the transportation of the relief supplies to the affected area.

Luthern World Service (LWS)

LWS has operated in India since, 1974, when it responded to the needs of refugees following the Bangladesh war. LWS has since been implementing relief, rehabilitation and integrated development programmes in several India states, particularly in West Bengal and Orissa. All programmes are taken up at the government's request or on its own initiative in consultation with government authorities.

LWS works with disaster response at different levels. Relief operations are short-term initiatives in which disaster victims are given temporary shelter, materials and food. Rehabilitation programmes assist affected communities to rebuild damaged houses, construct school-flood shelters, develop safe water sources, as well as repair and strengthen other community assets. Disaster preparedness programmes are long-term initiatives to improve the coping capacity of disaster-prone communities.

BILATERAL ORGANISATIONS

Delegation of the European Commission in India

The European Unions is the world's biggest donor of humanitarian aid, which comprises of assistance, relief and protection operations. Such aid includes operations in preparation for, and the prevention of disasters. The activities of the European commission (EC) are co-ordinated through various mechanisms in partnership with NGOs and the specialized agencies of the United Nations.

The three mechanisms through which the EC operates are the European Community Humanitarian Office (ECHO), Food Aid and Food Security support operations, and Rehabilitation and Reconstruction operations. In India, the EC has provided Rs. 2.52 crores for the relief of the 1996 AP cyclone's victims. The EC finances disaster prevention, mitigation and preparedness in response to requests form NGOs and international organizations. There are more than 10 projects for food aid and food security that are being supported by the EC through partner NGOs. Long-term development in areas affected by disasters has also been undertaken.

Department for International Development (DFID)

The British government's Department for International Development provided $300,000 through Christian aid for emergency assistance to 10,000 flood-affected families in Northern India. In addition, DFID also provided $250,000 to the International Federation of the Red Cross and Red Crescent Societies for basic emergency assistance to 100,000 beneficiaries for up to three months. DFID is also funding Oxfam's North-East India flood response proposal, and providing support to a cyclone relief programme in West Bengal.

USAID

In the majority of cases, USAID does not involve itself in disaster relief other than monitoring and reporting on disaster preparedness and response activities. There may, however, be provision through partner NGOs for short-term food aid to disaster victims. In the event of a major disaster, or when the US government is requested/warranted, it is the duly of the Mission Disaster Relief Office to ensure that there is a adequate pre-disaster preparedness and response plan, to advise the ambassador on the mode of Us participation desirable, and to coordinate disaster relief operations as approved by the ambassador. During 1998, USAID provided a total of US$ 75,000 to victims of tornado-struck Orissa and West Bengal, victims of the Gujarat cyclone, and floods in northern and eastern India. In addition, a total of 4,962 tonnes of Title II commodities valued at approximately US$ 2.4 million were provided to 846,571 people affected by these disasters.

MULTILATERAL ORGANISATIONS

World Bank

The World Bank's (WB) Disaster Management Facility (DMF) was established to mainstream disaster prevention and mitigation initiatives into all its activities. The DMF has, therefore, under-taken the Market Incentives for Mitigation Investment project aimed at promoting market incentives for risk reduction. India has been selected for a pilot study for the following :-

- Disaster loss experience and vulnerability to sudden and slow onset disasters.
- Institutional and regulatory structure : regulations related to natural hazards/disasters and risk reduction, and regulations for the insurance industry.
- Structure of the insurance sector for casualty insurance : primary and reinsurance.
- Role of the insurance sector in motivating mitigation investment, risk-based premium, and public education.
- Role of public policy to support the insurance industry in mitigation.
- The role of the global reinsurance industry in risk reduction.
- The role of International Financial Institutions (IFIs) in risk reduction.

Between June and December 1996, heavy rains, floods and cyclones killed, 1,689 people in the subcontinent and caused an estimated US$ 2 billion in damage. In late November, 1996, the state government of Andhra Pradesh requested the WB's assistance in the recovery efforts. To ensure the sustainability of the state's future development, the focus of the WB's assistance has been to provide long-term disaster mitigation capability across the state. The project has an estimated cost of US$ 220 million. Its objectives are to assist the state government of Andhra Pradesh in preparing and implementing a hazard management programme in high risk areas ; and restoring public infrastructure according to hazard resistance criteria and to enhance the early warning capacity of the Government of India.

Following the 1993 Latur earthquake, the WB undertook a rehabilitation project to assist with reconstruction, increase the earthquake resistance of building and infrastructure through the development of improved standards for design and construction and to develop the ability of the state of Maharashtra to plan for and manage disasters. The project's estimated cost is US$ 328 million and its most important focus is the development of long-term disaster management capacity in the state.

World Health Organisation (WHO)

In 1995, an Emergency and humanitarian Action unit was established at WHO's South East Asia Regional Office in New Delhi. Its goal is to `provide assistance to the member states in developing and strengthening their emergency prevention, preparedness, mitigation and response programmes and to promote national self-reliance. The ERA also acts to strengthen the Regional Officers' emergency prevention, preparedness, mitigation and response programmes and to provide emergency assistance upon request from the member states'.[8] With each of the member states, the unit will focus on :

- National Health policy and legislation
- Planning, emergency preparedness and management
- Community-based emergency preparedness and management
- Emergency information system
- Human resource development and institutionalization, based on a multi-sectorial approach.

United Nations Development Programme (UNDP)

UNDP has been operating in India for 50 years. Its agreement with the Government of India does not allow it to participate in relief operations unless specifically requested. However, development programmes are often initiated following a disaster. The concept of disaster preparedness and management has been incorporated into its development programmes, particularly after the 1993 Latur earthquake.

Although not involved in immediate disaster relief, UNDP receives information on the extent of disaster damage and loss of life. Following the recent floods in West Bengal, UNDP was part of a joint agency mission to the Malda district to assess the damage and the response of UN agencies. The Focus on incorporating disaster management training and preparedness into development reflects the new found awareness that disaster planning has on large-scale development.

To strengthen the national capacity to mitigate, prevent and manage crises, UNDP's Emergency Response Division sponsors activities in two main areas. The first is preventive development, which includes:

- Assessing vulnerability to crises and natural disasters
- Establishing early warning systems
- Developing and maintaining a framework of development responses and other contingency disaster plans to be used if a crisis erupts

- Forming and strengthening UN Disaster Management Teams
- Integrating disaster preparedness, mitigation, prevention and response programmes into national development programmes
- Identifying and engaging the services of consultants to be placed at the disposal of the Resident Coordinator/Humanitarian Coordinator in crisis situations
- Preparing National Human Development Reports

The second activity is training in order to contribute to human resources development by improving capabilities in:

- ☆ Risk and vulnerability analyses
- ☆ Planning for contingencies
- ☆ Designing responsive structures
- ☆ Implementing preventing and mitigation strategies for disaster and crises

The training is provided through the Disaster Management Training Programme to Personnel from the government, NGOs, community leaders, and partners in the United Nations. UNDP excepts to deliver US$ 200 million in development-oriented assistance between 1997 and 2001.

United Nations Children's Fund, UNICEF

UNICEF has a long-term presence in India with a strong field-based structure. Through its 10 state offices, UNICEF is able to respond quickly and flexibly to disaster situations. Its response is subject to being requested by the Government of India (which has not asked for outside help since 1974). Thus, UNICEF can only help by donating funds to the Prime Minister's Relief Fund, an avenue that it feels is inappropriate.

However, requests from the state or district levels enable UNICEF to provide disaster assistance. When a disaster occurs, US$ 10,000 is immediately made available. In many cases, disaster relief is an extension of an ongoing programme (for instance, drinking water programmes may be altered to incorporate the bleaching of wells contaminated during a flood). Following the joint agency mission to Malda district, UNICEF produced four flood situation reports and also examined how children were severely traumatized during the floods. The fragmented response of the government, the United Nations, and NGOs is a major concern of UNICEF.[9] It is, therefore, meeting with the government in order to facilitate a more coordinated disaster response mechanism.

United Nations High Commission for Refugees (UNHCR)

The two main functions of UNHCR are to provide international protection to refugees, and to seek permanent solutions to refugee problems. UNHCR first establishment its office in New Delhi in February 1969 to assist the 100,000 Tibetan refugees in India. It has since provided assistance to over 10 million refugees from Bangladesh, 50, 000 refugees from Afganistan, as well as assisted the Government of India to repatriate Sri Lankan refugees fromTamil Nadu. UNHCR provides limited financial assistance, since it would prefer to help refugees become self-reliant. It encourages able-bodied refugees to participate in income generating

activities and it further investigating the possibility of micro-credits, cooperatives, and community development activities.[10]

Recommendations

When a disaster occurs, the weaker sections of society and the backward communities suffer the most. However, these communities are quite resilient and respond to relief. With encouragement and support to relief. With encouragement and support, they turn the losses associated with disasters into opportunities.

Disaster management and mitigation should therefore, be organized around local recovery efforts. Such a community-based model feature defined roles for each stakeholder, conceived on the basis of her or his respective strengths and weakness in order to most effectively work towards the common interest. The ultimate goal of such an approach is to enhance community capacity and to increase effectiveness of relief and rehabilitation.

It is recommended that a Delhi-based group of NGOs, nodal government ministries, and bilateral and multilateral organizations be found to promote the exchange of information to enable more effective assessments and response efforts and thus facilitate the new approach to disaster relief, mitigation and rehabilitation. The integration only to greater accountability, cost-effectiveness, and the raising of the performance standards of relief and mitigation measures.

It is evident that relief organizations are reorienting their operations towards community empowerment, disaster prevention, and preparedness. The immediate response following disasters is increasingly becoming more analytical and effective than in the past, and long-term development programmes are incorporating disaster preparedness and risk reduction.

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Earthquake Sensitization of School Children in India

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Background :

Some of the recent earthquakes in India have had very large number of deaths. For example, 7928 deaths in the 1993 Latur earthquake (magnitude 6.2) and 13805 deaths in the 201 Bhuj earthquake (magnitude 7.7). Similar earthquakes in say USA and New Zealand may lead to far lower number of causalities because such countries have taken effective steps in last several decades to reduce vulnerability to earthquakes. On the other hand not enough has been done in India to reduce earthquake vulnerability. There are several activities that need to be launched simultaneously in our country in this direction. These activities include mass awareness campaigns and the present proposal is directed at this component.

It is well known that the best way to sensitise the public about an issue is through school children. If helps in two ways : (a) What we learn in our childhood stays with us for rest of the life, and (b) The children share interesting things they learn in school with their parents and in the process sensitise the parents also. For instance, in the United States very effective programmes exist towards sensitizing school children towards earthquak safety.

IIT Kanpur with financial support from BMTPC (Ministry of Urban Development) is currently implementing a very successful mass awareness programme. In this two-year project a two-page **Earthquake Tip** is being released every month to educate the engineers and concerned citizens about earthquake safety of buildings. The Tips are being carried by major national newspapers **(The Hindu, The Statesman, The New Indian Express and The Tribune)** and numerous magazines/journals. More information about the project is available at : www.nicee.org/NICEE/News/IITK BMTPC.htm

The present proposal is a very modest attempt to start the process of sensitizing school children towards earthquake safety. For our country with a population of one billion people, several such initiatives at different levels are needed over long periods. However, it is important that we urgently start a project in this direction based on what is feasible and achievable as of now. As more experience is gained the scope needs to be enlarged.

Methodology :-

- The material to be prepared will keep in mind the background of class VIII students. However, the test discussed below will be open to students of class VI, VII, VIII and IX.
- About ten different posters will be prepared targeted at children. The posters will focus on science of earthquakes rather than engineering for earthquakes. The intent is to create curiosity and awareness. One or more posters may also be on earthquake safety issues.
- A network of about 1000 colleges of engineering and architecture, and polytechnics exist in our country. It is proposed to use this network for dissemination. It will have two advantages : (a) logistics will be easier, and (b) some of the teachers of these colleges and polytechnics will themselves become interested in the earthquake issues. All colleges (and Polytechnics) will be offered the opportunity to join this project.
- Each Colleges (Polytechnic) will be asked contact school in their area and seek willingness of about ten (10) schools to participate in the programme. They will then provide posters to the schools for display in the class rooms, in the science rooms, libraries, or other prominent locations.
- Sometime (say one to two months) after the posters are delivered to the schools, a national test will be conducted in these schools for the interested children. No fees will be charged to the students.
- The test will be conducted in the schools with the concerned engineering college (and Polytechnic) teachers coordinating the test.
- The test will be evaluated by the coordinating colleges and performance forwarded back to the project implementation unit.
- Certificates will be awarded by the project implementation unit to the children who do well in the test.
- To ensure effective implementation, at this stage the posters and test will be in English. After the project is successful and stabilized, it may be extended to the other languages.
- The country has about 870 Kendriya Vidyalayas. After the project is stabilized, efforts will be made to bring all of them under the scheme through a request to the Kendriya Vidyalaya Sangathan.

Cost Implications :-

At this time, it is difficult to gauge the interest and enthusiasm of the engineering colleges, schools and the children to this project. Depending on the funds available, the size of the project can be reduced or increased.

Role of each Stakeholder vis-à-vis the Objectives of the Project

Objectives	GOI	State Govt.	Resource Institutions	ULBs	Community
Awareness Programme and Capacity Building	# Conducting of the sensitization workshop for resource institutions and ULBs		# Formulation of city-specific **awareness campaign strategies** # Training of functionaries of ULBs towards developing earthquake risk management plans as well micro-zonation and earthquake-resistant construction and retrofitting measures. # **Training/Orientation of builders and all construction related associations** towards amendment in zoning and building codes, byelaws as well as seismic safety and evaluation techniques # **Documentation** and development of all related manuals, reading/activity – oriented materials on earthquake management and mitigation	# Receive training from Resource Institutions and train/ orient the community/builders/ school children re: earthquake preparedness and mitigation measures # Receive training from Resource Institutions for preparation of risk-assessment plans wrt. Public infrastructure (their need for retrofitting and the quantum of resources needed for their retrofitting).	# Receive orientation/ training from ULB functionaries about the need for earthquake preparedness

Objectives	GOI	State Govt.	Resource Institutions	ULBs	Community
Review of Zoning regulations & Building Codes	# Constitution of empowered committees at the national level to review the zoning regulations and amendments recommended in building codes and byelaws	# Constitution of empowered committees at the state level to review the zoning regulations and amendments recommended in building codes and byelaws	# Training/Orientation of govt. officials in ULBs towards hazard zonation, risk, evaluation and mitigation	# Prepare risk-zoning and micro-zoning and recommend landuse policies	# Sensitization of builder associations through ULBs about the amendments
Preparation of Earthquake Risk Management and Mitigation Plan	# Review and monitoring the risk management plans	# Review and monitoring the risk management plans	# Training on preparation of earthquake risk management plans # Review and monitoring the plans	# GIS based hazard and vulnerability mapping # Formation of DMTs from city associations/ clubs/committees in development of city and ward-level earthquake risk management plans	# Preparation of community contingency plans, formation of task-forces and be prepared through mock-drill, etc.

Objectives	GOI	State Govt.	Resource Institutions	ULBs	Community
Networking and Sharing of Information & best practices	# Develop suitable management and mitigation strategies to cover a wide range of initiatives – legal, financial, technical and administrative system at national and city levels to reduce earthquake vulnerability		# Sharing of information on research and development, database, training plans, best practices, GIS vulnerability database, etc.	# Sharing of information on awareness strategies, best practices, GIS vulnerability database, etc.	

POSSIBLE RESOURCE INSTITUTES FOR THE 37 CITIES

Sl. No.	State	Name of City	Population	Latitude	Longitude	MSK Zone	K R I s	RI (1)	RI (2)	RI(3)
01.	Assam	Guwahati	814,575	26.11 N	91.47 E	IX	IIT, Guwahati	North-Eastern University, Aizawal, Mizoram	Geological survey of India, Calcutta	
02.	Jammu & Kashmir	Srinagar	971,357	34.09 N	74.79 E	IX	IIT, Roorkee			
03.	Bihar	Patna	1,707,429	25.37 N	85.13 E	VIII	The National Information Centre of Earthquake Engineering (NICEE)	Geological survey of India, Calcutta		
04.	Delhi	Delhi	12,791,458	28.67 N	77.21 E	VIII	IIT, Delhi		Habitat Polytechnic	BMTPC
05.	Gujarat	Jamnagar	558,462	22.27 N	70.07 E	VIII	Gujarat Engineering Research Institute, Baroda			
06.	Jammu & Kashmir	Jammu	607,642	32.43 N	74.54 E	VIII	IIT, Roorkee			
07.	Maharashtra	Greater Mumbai	16,368,084	18.55 N	72.54 E	VIII	Indian Institute of Geomagnetism, Mumbai			
08.	Punjab	Amritsar	1,011,327	31.37 N	74.55 E	VIII	IIT, Roorkee			
09.	Punjab	Jalandhar	709,255	31.19 N	35.18 E	VIII	IIT, Roorkee			

10.	Uttar Pradesh	Bareilly	729,800	28.22 N	79.27 E	VIII	The National Information Centre of Earthquake Engineering (NICEE)			
11.	Uttar Pradesh	Meerut	1,167,399	29.01 N	77.45 E	VIII	The National Information Centre of Earthquake Engineering (NICEE)			
12.	Uttaranchal	Dehradun	527,859	30.19 N	78.04 E	VIII	IIT, Roorkee			
13.	Andhra Pradesh	Vijayawada	1,011,152	16.31 N	80.39 E	VII	National Geophysical Research Institute Hyderabad	Osmania University Hyderabad		
14.	Gujarat	Ahmadabad	4,519,278	23.03 N	72.40 E	VII	Gujarat Engineering Research Institute, Baroda			
15.	Gujarat	Bhavnagar	517,578	21.46 N	72.11 E	VII	Gujarat Engineering Research Institute, Baroda			
16.	Gujarat	Rajkot	1,002,160	22.18 N	70.56 E	VII	Gujarat Engineering Research Institute, Baroda			
17.	Gujarat	Surat	2,811,466	21.20 N	72.82 E	VII	Gujarat			

							Engineering Research Institute, Baroda			
18.	Gujarat	Vadodara	1,492,398	22.00 N	73.16 E	VII	Gujarat Engineering Research Institute, Baroda			
19.	Jharkhand	Dhanbad	1,064,357	23.47 N	86.30 E	VII	IIT Kharagpur	Geological survey of India, Calcutta		
20.	Karnataka	Mangalore	538,560	12.52 N	74.53 E	VII	National Institute of Rock Mechanics, Kolar			
21.	Kerala	Kochi	1,355,406	9.58 N	76.22 E	VII	Centre for Earth Sciences Studies, Trivendrum			
22.	Kerala	Kozhikode	880,168	11.15 N	75.49 E	VII	Centre for Earth Sciences Studies, Trivendrum			
23.	Kerala	Trivandrum	889,191	8.29 N	76.59 E	VII	Centre for Earth Sciences Studies, Trivendrum			
24.	Madhya Pradesh	Indore	1,639,044	22.44 N	75.50 E	VII	Geological survey of India, Nagpur			
25.	Madhya Pradesh	Jabalpur	1,117,200	23.10 N	79.59 E	VII	Geological survey of India, Nagpur			
26.	Maharashtra	Bhiwandi	621,390	19.30 N	73.05 E	VII	Indian Institute of Geomagnetism, Mumbai			
27.	Maharashtra	Nasik	1,152,048	20.02 N	73.50 E	VII	Indian Institute of	Geological		

							Geomagnetism, Mumbai	survey of India, Nagpur		
28.	Maharashtra	Pune	3,755,525	18.31 N	73.55 E	VII	Indian Institute of Geomagnetism, Mumbai	Geological survey of India, Nagpur	Amateur Seismic Centre, Pune	
29.	Orissa	Bhubaneswar	657,477	20.15 N	85.52 E	VII	IIT Kanpur	Geological survey of India, Calcutta		
30.	Orissa	Cuttack	587,637	20.28 N	85.54 E	VII	IIT Kanpur	Geological survey of India, Calcutta		
31.	Tamil Nadu	Coimbatore	1,446,034	11.00 N	77.00 E	VII	National Institute of Rock Mechanics, Kolar			
32.	Uttar Pradesh	Agra	1,321,410	27.10 N	78.05 E	VII	The National Information Centre of Earthquake Engineering (NICEE)			
33.	Uttar Pradesh	Kanpur	2,690,486	26.28 N	80.24 E	VII	The National Information Centre of Earthquake Engineering (NICEE)			

34.	Uttar Pradesh	Lucknow	2,266,933	26.55 N	80.59 E	VII	The National Information Centre of Earthquake Engineering (NICEE)			
35.	Uttar Pradesh	Varanasi	1,211,749	25.20 N	83.00 E	VII	The National Information Centre of Earthquake Engineering (NICEE)			
36.	West Bengal	Asansol	1,090,171	23.42 N	87.01 E	VII	IIT Kharagpur	Geological survey of India, Calcutta		
37.	West Bengal	Kolkata	13,216,546	22.34 N	88.24 E	VII	IIT Kharagpur	Geological survey of India, Calcutta		

PRECAUTIONS TO BE TAKEN BEFORE THE COMMENCEMENT OF CYCLONE SEASONS - DO's AND DONTs DURING A CYCLONE SITUATION.

(i) Check houses, secure loose tiles by cementing wherever necessary, repair doors and windows.
(ii) Check the area around the house - remove dead or lying trees, anchor removable objects like lumber piles, loose zinc sheets, loose bricks, garbage cans, sign-boards, etc.,
(iii) Keep some wooden boards ready so that glass windows can be blocked.
(iv) Keep a hurricane lantern filled with kerosene, flash light and enough dry cells.
(v) Promptly demolish condemned buildings.
(vi) Keep your Radio sets fully serviceable. In the case of transistors an extra set of batteries should be kept handy.

PRECAUTIONS TO BE TAKEN WHEN THE CYCLONE OCCURS.

(i) Do not remain on the top floors. It would be advisable even for those living in the first floor to take shelter on the ground floor. All doors, windows and openings should be firmly secured and barricaded.
(ii) Store extra drinking water in the suitable covered vessels.
(iii) Stock enough flour and essential consumer goods and provisions for children and adults to last for a week at least.
(iv) Keep handy lanterns, kerosene oil, candles and torches with dry cells.
(v) Do not take shelter near trees, dilapidated houses, old houses and insecure structures.
(vi) Do not stir out when cyclone rages outside.
(vii) Keep listening to the radio broadcastings and the weather forecasts. Do not believe in false rumors and convey to others only the authentic information heard by you over the radio.
(viii) Evacuate cattle from the low-lying areas. Cattle should immediately leave the place in good time lest that may get struck in the low lying areas on the way.
(ix) Keep boats and rafts tied at safe places.
(x) Keep furniture, implements, steel barrels, kerosene tins, garden tools and other articles in the house in secure places.
(xi) Shift to a secure place if the house cannot withstand the violent cyclone storm, if its foundation and roof are not strong enough or if the house is situated in a low lying area.
(xii) Do not stir out during the storm. Stay as far as possible near the place of shelter after storm calms down so that if the wind starts blowing from the opposite direction, to rush into the shelter without being caught in the wind.

If the centre or 'eye' of the storm passes directly over your place there will be a lull in the wind and rain lasting for half-an-hour or more. During this

period stay in a safe place. Make emergency repairs during the loss period if necessary, but remember that strong wind will return suddenly from the opposite direction, frequently with even greater velocity.

(xiii) Remain self-possessed in any circumstances. If you maintain patience and courage, others will be inspired thereby.
(xiv) Remain away from broken electric wires. In order to save a person struck with an electric wire use materials such as dry stick to push the wire off. If a wire is found hanging, information may be immediately communicated to the concerned authorities.
(xv) Be very careful while walking or driving a vehicle. It is possible that a tree and its branches may move in.

WHEN THE AUTHORITIES ADVISE EVACUATION OF PEOPLE TO FOLLOW THE FOLLOWING PRINCIPLES

a) Head for the proper shelter or evacuation point indicated for your area.
b) Do not worry about your left-over property as evacuated areas will be policed to prevent looting.
c) At shelter, follow instructions of person incharge.
d) Remain in shelter until informed that you may leave.
e) Keep calm at all times. If instructions are observed promptly, there is little personal danger involved.

PRECAUTIONS AT THE PORT

The following precautions shall be taken at the ports when the storm signals are exhibited:-

a) All vessels should be brought into the sheltered water and moored firmly and masts should be lowered down.
b) Immediate precaution to safeguard electrical installations such as sub-stations should be taken by barricading the doors, windows and other openings.
c) It may be safer to cut off the power supply to avoid casualties due to falling down of electric poles and exposure to live wires. If possible, strengthening supports to the transmission towers and transformers should be provided.
d) Booms of all cranes etc., should be lowered and rested on the ground.
e) Windows, doors and other openings of all godowns should be firmly secured and extra barricading may be done, if possible.

(**Cyclone Contingency Plan of Action : Chap VI, Govt. of AP).**

DO'S AND DONT'S

WHAT TO DO BEFORE, AFTER AND DURING AN EARTHQUAKE

WHAT TO DO BEFORE AN EARTHQUAKE?

- Learn about causes and effects. Speak about them in a calm and composed manner.
- Keep a torch light and a working transistor radio with spare batteries.
- Keep a list of telephone numbers like Doctor, Fire, Police, MRO, Ambulance, Water, electricity etc., on a card and all your family members should know them.
- Arrange your home in such a manner that it is easy to move around.
- Attach shelves, gas cylinders, flower pots etc., to the walls of the room.
- Place heavy objects on the floor or in lower shelves.
- Teach all members of your family how to turn off electricity and gas supply.

WHAT TO DO DURING AN EARTHQUAKE?

∧ Keep calm and keep others calm.

If you are at home or inside a building or auditorium

υ Do not rush to the doors or the exits: Keep well away from windows, mirrors and furniture.

υ Protect yourself by staying in the vacant space next to a bed, table. Do not get under tables , furniture, beds as you are likely to be crushed.

If you are on the road in a built up area.

μ Walk towards an open place, in a calm and composed manner. Do not run and do not wander in the street or on the roads for sight seeing. You must keep the roads free for movement of rescue & relief teams.

μ Keep away from buildings, especially old, tall buildings or detached buildings, electricity wires, slopes and walls. They are liable to collapse.

If you are driving

υ Stop the vehicle away from building walls, slopes, electricity wires/cables and get out of the vehicle and stand next to it.

υ

WHAT TO DO AFTER THE EARTHQUAKE

- Keep calm, switch on the transistor radio and obey any instructions you hear on the radio.
- Expect after shocks.
- Do not turn on switches if you have electric connection in your house.
- Use your torch.
- If there is a fire try to put if out with help of people around you.
- Clean up any spillage of inflammable material like kerosene, oils, paints, alcohol etc.,
- If people are buried under the debris, call for help of the rescue teams and render your help. Do not attempt rescue all by yourself. You might injure yourself or worsen the situation of the persons under the debris.
- Avoid places where electric wires are handing loose and do not touch any metal object in contact with them.
- Do not drink water from open sources/containers without filtering or purification.
- Eat something to make you fell better and more capable of helping others.
- When you can move out of the house carry with you essential food, water container, torch, transistor radio and medicines you normally use at home.
- Do not go near damaged structures or enter badly damaged buildings.
- Do not go sight seeing or wandering in the streets aimlessly to see what is happening around. Keep the roads clear for the movement of relief/rescue teams.

(Earthquake Contingency Plan, Govt. of AP).

ACTIVITIES AND DEPARTMENTS INVOLVED DURING EARTHQUAKE

ACTIVITIES	REVENUE	POLICE	MED & HEALTH	ARMY	AIR FORCE	P.R. ENGR	ROADS & BLDGS	I & PR DEPT.	FIRE BRIG	CIV DEF/ H/GUARD	FOREST	INFO CENTRE	NGOs	IRRIGATION	CIV SUP	TRANS PORT
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CORDONING OF AREA	Y	Y														
SEARCH AND RESCUE	Y	Y		Y	Y	Y	Y	Y	Y	Y			Y			
AERIAL RECONNAISANCE	Y	Y			Y					Y						
EVACUATION	Y	Y		Y	Y				Y	Y						Y
TRAFFIC MANAGEMENT & SECURITY OF PROPERTIES	Y	Y		Y			Y									Y
MEDICAL AID (TREATMENT OF INJURIES & SURGICAL OPERATIONS)	Y		Y	Y						Y			Y			
HEALTH & SANITATION	Y		Y	Y						Y			Y			
TEMPORARY SHELTERS	Y			Y		Y	Y			Y	Y		Y			Y
ENUMERATION	Y												Y			Y

DISPOSAL OF DEAD (RETRIEVAL, PANCHANAMA, AUTOPSY,BURYING /CREMATION AS PER CUSTOMS)	**Y**	**Y**	**Y**						**Y**	**Y**	**Y**		**Y**			
PUBLIC INFORMATION	**Y**							**Y**								
RELIEF DISTRIBUTION (COOKED FOOD,WATER,GRATITUOUS RELIEF, CLOTHING, UTENCILS ETC.,)	**Y**			**Y**	**Y**	**Y**							**Y**		**Y**	**Y**
RECEPTION/INFORMATION CENTRES	**Y**							**Y**				**Y**	**Y**			
RELIEF SUPPLIES	**Y**												**Y**			**Y**
CONSTRUCTION MATERIALS	**Y**					**Y**	**Y**				**Y**					**Y**
RESTORATION OF INFRASTRUCTURE	**Y**	**Y**		**Y**	**Y**	**Y**	**Y**							**Y**		**Y**

(Earthquake Contingency Plan, Govt. of AP).

Your Family Disaster Supplies Kit

After a disaster, local officials and relief workers will be on the scene, but they cannot reach everyone immediately. You could get help in hours, or it may take days. Would your family be prepared to cope with the emergency until help arrives?

Your family will cope best by preparing for disaster before it strikes. One way to prepare is by assembling a Disaster Supplies Kit. Once disaster hits, you won't have time to shop or search for supplies. But if you've gathered supplies in advance, your family can endure an evacuation or home confinement.

To prepare your kit

Review the checklists in this document.

Gather the supplies that are listed. You may need them if your family is confined at home.

Place the supplies you'd most likely need for an evacuation in an easy-to-carry container. These supplies are listed with an asterisk (*).

Disasters happen anytime and anywhere. And when disaster strikes, you may not have much time to respond.

A highway spill of hazardous material could mean instant evacuation.

A winter storm could confine your family at home. An earthquake, flood, tornado or any other disaster could cut off basic services--gas, water, electricity and telephones--for days.

Water

Store water in plastic containers such as soft drink bottles. Avoid using containers that will decompose or break, such as milk cartons or glass bottles. A normally active person needs to drink at least two quarts of water each day. Hot environments and intense physical activity can double that amount. Children, nursing mothers and ill people will need more.

- Store one gallon of water per person per day (two quarts for drinking, two quarts for food preparation/sanitation)*
- Keep at least a three-day supply of water for each person in your household.

Food

Store at least a three-day supply of non-perishable food. Select foods that require no refrigeration, preparation or cooking and little or no water. If you must heat food, pack a can of sterno. Select food items that are compact and lightweight.

*Include a selection of the following foods in your Disaster Supplies Kit:

- Ready-to-eat canned meats, fruits and vegetables
- Canned juices, milk, soup (if powdered, store extra water)
- Staples--sugar, salt, pepper
- High energy foods--peanut butter, jelly, crackers, granola bars, trail mix
- Vitamins
- Foods for infants, elderly persons or persons on special diets
- Comfort/stress foods--cookies, hard candy, sweetened cereals, lollipops, instant coffee, tea bags

First Aid Kit

Assemble a first aid kit for your home and one for each car. A first aid kit* should include:

- Sterile adhesive bandages in assorted sizes
- 2-inch sterile gauze pads (4-6)
- 4-inch sterile gauze pads (4-6)
- Hypoallergenic adhesive tape
- Triangular bandages (3)
- 2-inch sterile roller bandages (3 rolls)
- 3-inch sterile roller bandages (3 rolls)
- Scissors
- Tweezers
- Needle
- Moistened towelettes
- Antiseptic
- Thermometer
- Tongue blades (2)
- Tube of petroleum jelly or other lubricant
- Assorted sizes of safety pins
- Cleansing agent/soap
- Latex gloves (2 pair)
- Sunscreen

Non-prescription drugs

- Aspirin or nonaspirin pain reliever
- Anti-diarrhea medication
- Antacid (for stomach upset)
- Syrup of Ipecac (use to induce vomiting if advised by the Poison Control Center) Laxative
- Activated charcoal (use if advised by the Poison Control Center)

SUPPLIES

There are six basics you should stock in your home: water, food, first aid supplies, clothing and bedding, tools and emergency supplies and special items. Keep the items that you would most likely need during an evacuation in an easy-to-carry

container--suggested items are marked with an asterisk(*). Possible containers include a large, covered trash container; a camping backpack; or a duffle bag.

Tools and Supplies

- Mess kits, or paper cups, plates and plastic utensils*
- Emergency preparedness manual*
- Battery-operated radio and extra batteries*
- Flashlight and extra batteries*
- Cash or traveler's checks, change*
- Nonelectric can opener, utility knife*
- Fire extinguisher: small canister, ABC type
- Tube tent
- Pliers
- Tape
- Compass
- Matches in a waterproof container
- Aluminum foil
- Plastic storage containers
- Signal flare
- Paper, pencil
- Needles, thread
- Medicine dropper
- Shut-off wrench, to turn off household gas and water
- Whistle
- Plastic sheeting
- Map of the area (for locating shelters)

Sanitation

- Toilet paper, towelettes*
- Soap, liquid detergent*
- Feminine supplies*
- Personal hygiene items*
- Plastic garbage bags, ties (for personal sanitation uses)
- Plastic bucket with tight lid
- Disinfectant
- Household chlorine bleach

Clothing and Bedding

- Include at least one complete change of clothing and footwear per person.
- Sturdy shoes or work boots*
- Hat and gloves
- Rain gear*
- Thermal underwear
- Blankets or sleeping bags*
- Sunglasses

Special Items

Remember family members with special needs, such as infants and elderly or disabled persons.

- For Baby*
- Formula
- Diapers
- Bottles
- Powdered milk
- Medications
- For Adults*
- Heart and high blood pressure medication
- Insulin
- Prescription drugs
- Denture needs
- Contact lenses and supplies
- Extra eye glasses
- Entertainment--games and books.
- Important Family Documents
- Keep these records in a waterproof, portable container.
- Will, insurance policies, contracts, deeds, stocks and bonds
- Passports, social security cards, immunization records
- Bank account numbers
- Credit card account numbers and companies
- Inventory of valuable household goods, important telephone numbers
- Family records (birth, marriage, death certificates)

SUGGESTIONS AND REMINDERS

- Store your kit in a convenient place known to all family members. Keep a smaller version of the Disaster Supplies Kit in the trunk of your car.
- Keep items in air-tight plastic bags.
- Change your stored water supply every six months so it stays fresh.
- Rotate your stored food every six months.
- Re-think your kit and family needs at least once a year. Replace batteries, update clothes, etc.
- Ask your physician or pharmacist about storing prescription medications.

CREATE A FAMILY DISASTER PLAN

To get started...
Contact your local emergency management or civil defense office and your local American Red Cross chapter.

- Find out which disasters are most likely to happen in your community. •Ask how you would be warned. •Find out how to prepare for each.

Meet with your family.

- Discuss the types of disasters that could occur.
- Explain how to prepare and respond.
- Discuss what to do if advised to evacuate.
- Practice what you have discussed.

Plan how your family will stay in contact if separated by disaster.
Pick two meeting places:

1) a location a safe distance from your home in case of fire.
2) a place outside your neighborhood in case you can't return home.

Choose an out-of-state friend as a "check-in contact" for everyone to call.

Complete these steps.

1. Post emergency telephone numbers by every phone.
2. Show responsible family members how and when to shut off water, gas and electricity at main switches.
3. Install a smoke detector on each level of your home, especially near bedrooms; test monthly and change the batteries two times each year.
4. Contact your local fire department to learn about home fire hazards.
5. Learn first aid and CPR. Contact your local American Red Cross chapter for information and training.

Meet with your neighbors.

Plan how the neighborhood could work together after a disaster. Know your neighbors' skills (medical, technical). Consider how you could help neighbors who have special needs, such as elderly or disabled persons. Make plans for child care in case parents can't get home.

Remember to practice and maintain your plan.

(The above guidelines are issued by Federal Emergency Management Agency (FEMA), a US Organisation whose Community Family Preparedness Program is among the nationwide efforts to help people prepare for disasters of all types. The above matter is downloaded from internet and edited.)

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SELECTED LIST OF WEBSITES ON DISASTER MANAGEMENT

1. CEOSDIS@NOAA/NESDIS - Committee on Earth Observation Satellites Disaster Management Support Project

www.ceos.noaa.gov/

CEOSDIS@NOAA/NESDIS - Committee on Earth Observation Satellites Disaster Management Support Project

2. Welcome to the Disaster - Emergency Management Web Page

www.disaster-emergencymgt.com/

The Mahoning County Emergency Management Office, in conjunction with the Board of Mahoning County Commissioners, developed a planning system for the first 72 Hours of an emergency. The Federal Emergency Management Agency recognised this program.

3. Disaster Prevention and Management

www.mcb.co.uk/dpm.htm

This journal gives you the information you need to act effectively in crisis situations, mitigate damage and loss of life and plan emergency service action both during the crisis and in its aftermath.

4. Disaster Masters crisis management. The right people to know before things go wrong.

www.theplan.com/dmi

Disaster Management is the oldest crisis management firm in the USA. We are an organisation who provides end to end disaster services. Preparation to recovery. We train, teach and perform all aspects of risk management and business continuity.

5. Natural Disaster Management

www.ndm.co.uk/

Natural Disaster Management is the official commemorative volume for the International Decade for Natural Disaster Reduction (IDNDR), 1999-2000, a United Nations initiative to reduce the negative effects of natural disaster

6. Disaster Management Center

www.ngdc.noaa.gov/seg/hazard/resource/soc/informan2.html

Descriptions of and hypertext links to information and research contors providing nature.

7. Disaster Preparation & Management Index

www.metrokc.gov/health/disaster/disindex.htm

Disaster Preparation & Management Index Public Health - Seattle & King County.

8. 10th World Conference on Disaster Management, June 25-28, 2000 In Hamilton

www.wcdm.org/html/register_online-10th_world-co.html

9th World Conference on Disaster Management, June 20-23 1999 in Hamilton (Ontari Real Solutions)

9. Natural Drought Mitigation Center

enso.unl.edu/ndmc/

The National Drought Mitigation Center provides information to help people and institutions reduce vulnerability to drought, stressing prevention and risk management.

10. Disaster Management - Warning Response and Community Relocation

info.greenwood.com/books/0899300/0899300782.html

Disaster Management, By Ronald W.Perry and Alvin H.Mushkatel.

11. Disaster preparedness and management office, government in Great falls, Montana.

search.commerceinc.com/results/td20500_zp284.html

Page contains company list that have service on Disaster preparedness and management office, government in Great Falls, Montana.

12. Disaster Management Manual - InvestSearch, Wall Street Director, WSD.

www.wsdinc.com/products/p2924

Disaster Management Manual.

13. Disaster Prevention and Management - An International Journal

gort.ucsd.edu/newjour/d/msg02270.html

Newjour Home|NewJour:D|Search[Prev] [Next] Disaster Prevention and Management - An International Journal Sender:

Owner-newjour@ccat.sas.upenn.edu James Renfro wrote : From James Renfro <jrenfro@dolphin.upenn.edu> Subject: Disaster Prevention.

14. Emergency Management Director

hrrc.tamu.edu/hrrc/related-sites/STATEEMS.html

Emergency Management, hazard and disaster related agencies, listed by State.

15. Consolidated Services - Specializing in disaster recovery, distribution management, records management and imaging.

www.consolidatedservices.com/

Consolidated Services offers a wide range of warehousing and distribution services specializing in archives, imaging, data vault and records storage.

16. Welcome to the pacific disaster center

www.pdc.org/

About PDC/General Information/Disaster Information/What's Hot/Registration/Special Events The Pacific Disaster Centre is a federal information processing facility that supports emergency managers in the Pacific and Indian Ocean Regions.

17. Asian Disaster Preparedness Center (ADPC), Bangkok.

www.adpc.ait.ac.th/Default.html

This is the home page of Asian Disaster Preparedness Center (ADPC) Bangkok (Thailand). The ADPC is located in the campus of Asian Institute of Technology (AIT), Bankok (Thailand).

18. Utah Comprehensive Emergency Management

Comprehensive Emergency Management - Emergency Management - Disaster Preparedness - Utah Disasters - Earthquakes - Floods - Severe Weather - Storms - Making a Disaster Plan - The Utah Emergency Operation Plan.

www.cem.state.ut.us/

19. Contingency Planning Emergency Management Disaster Recovery Presentation

www.momentum.pt/momentum/emergency/sld003.htm

Momentum Inc Contingency Planning resource center page.

20. CEOS Disater management Matrix - Visit Often!

duc9.wwb.noaa.gov/matrix.html

Selected topics in Disaster Management examples of the uses of Space Remote Sensing in Disaster Management Remote Sensing Requirements for Disaster Reduction [Disclaimer] The imagery contained herein are public domain. Developed by the Home Page…….

21. Center for Disaster management and humanitarian Assistance

www.payson.tulane.edu/cdmha/Default.htm

Welcome to the CDMHA website ! This site is under construction. If you would like to be informed when the new site is posted please submit your e-mail. About the Center past events Disaster readings Centre's Focus Disaster early warning Board…….

22. Management

www.zdnet.com/pcweek/ExecConnect/2c6a.html

Calendar Career Complete Listing Consultants Hot Topics Industry Management Reference Shelf Sign up Technology Comments, concerns and feedback to ES Your Customers Disaster Recovery Planning Disaster Recovery Journal founded in 1987, the DRJ is ……

23. Mass Disaster Management

www.tambed.edu/DentalCE/html/mass_disaster_management.html

The Center|The College|Distance Education|Ask the Dentist|Clinician's Corner Mass Disaster Management Dr.Robert Willimams August 21, 1998 Course Flyer (Adobe.pdf.format). for more information about this Course, contact us.

24. Risk Management, safety program, disaster, policies, procedures, Consulting, Medical malpractice, Hospital

www.riskmanco.com/

Risk Management & Medical Malpractice Expert.

25. Disaster preventional landscape management

www.lzk.ac.at/lecture/boku/435237

435.237 Disaster preventional landscape management VP SS'00 4.0 To estimate dangerous potential of natural process. Based on an interdisciplinary point of view natural disaster prevention measures should be drawn off. Analysis of actual problems….

26. WDCM - 10th World Conference on Disaster Management, June 25-28, 2000 in Hamil.

www.wcdm.org/

10th World Conference on Disaster Management, June 25 - 28, 2000 in Hamilton (Ontario), Canada - Real Events, Real Leaders, Real Solutions…..

27. Disaster Management Unit UNDP project VIE/97/002.

www.undp.org.un/dmu/index.html

DMU: The Disaster Management Unit, UNDP Project VIE/93/031. General and specific information on natural disasters in Vietnam…..

28. Emergency .com-Crisis, Conflict and Emergency Service news, Analysis and Re…

www.energy.com/

Crisis, Conflict and emergency Service News, Analysis and Reference information…

29. Wilderness Emergency Medical Services Institute

www.wemsi.on.ca/

This site is best viewed with Netscape Navigator 4.0. Download Netscape now! Select some pleasant background music while you explore our site.

30. Welcome to CDERA on the WWW

www.cdera.org/

Welcome to the Caribbean Disaster Emergency Response Agency (CDERA) on the world Wide Web. Last updated on 26 January 1999.

31. ESA Earthnet on line Home Page.

earth1.esrin.esa.it/

You must have a javascript-enabled browser and javascript and stylesheets must be enabled to use some of the functions on this site.

32. Emergency.com - Crisis, Conflict and Emergency Service News, Analysis and re…..

emergency.com

Crisis, Conflict and Emergency Service News, Analysis and reference information….

33. Secondary include page

www.clmson.edu/working/index.htm

Working at Clemson University features faculty/staff/student directories, inside Clemson, calendars, library information and links to job and career…..

34. Bhopal Gas Tragedy

www.disastermanagement.org/

DMI, established in 1987 caters to development of professional and managerial capabilities in the field of disaster management in government, public…..

35. Wilderness Emergency Medical Services Institute

www.wemsi.org/

This site is best viewed with Netscape Navigator 4.0 . download Netscape now! Select some pleasant background music while you explore our site.

36. ESA Earthnet online Home page

uranus.esrin.esa.it/

You must have a javascript-enabled browser and havascript and stylesheets must be enabled to use some of the functions on this site.

37. Open Computing Technologies as Infrastructure for Disaster Management

www.opengis.org/disaster/MexicocCityFinal2orgsite/sled001.htm

Slide 1 of 33. Open Computing Technologies as Infrastructure for Disaster Management. James A.Farley, Technical director, University of Arkansas……

38. Water and Wastewater International - Water and Waste activties worldwide.

www.wwinternational.com/

Water treatment magazine reporting worldwide trends and technology on water quality, waste treatment, contamination, filteration and remediation for……..

39. Center of Excellence in Disaster Management and Humanitarian assistance.

coe.tamc.amedd.army.mil/

40. Examples of uses of Spareborne Remote Sensing in Disaster Management

ltpwww.gsfc.nass.gov/ndrd/examples.html

Examples of Uses of Spaceborne Remote Sensing in Disaster Management

41. Department of Defence Management and Security Analysis

www.rmcs.cranfield.ac.uk/depatments/ddmsa/dmc/dmc.htm

Disaster Management Centre.

42. Australian Disaster Management Information Network (ADMIN)

www.ids.ac.uk/eldis/data/d016/e01666.html

Australian Disaster Management Information Network (ADMIN). This page has been updated. Find the new page using the Eldis search page.

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