Training Module on

Cyclone Risk Management

GUJARAT INSTITUTE OF DISASTER MANAGEMENT

BUILDING RESILIENCE

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Published by: Gujarat Institute of Disaster Management, Gandhinagar

ISBN: 978-81-941697-6-5

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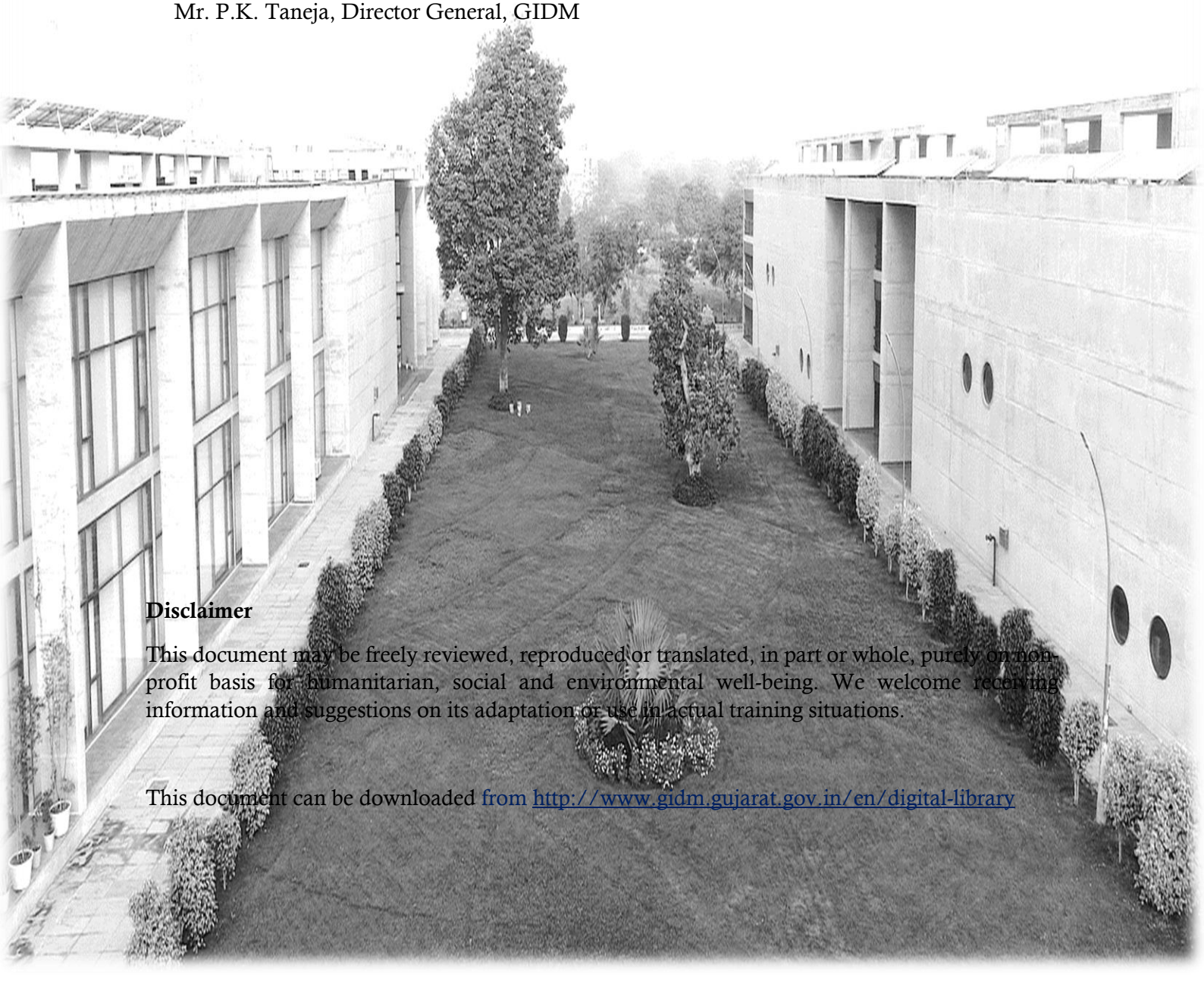


Message

Gujarat, having a coastline of about 1600 km, is highly prone to Cyclones. The Regional Climate Models (RCMs) predict an augmentation in the intensity of cyclonic activity in Gujarat which has been evident recently. The Year 2019 recorded one of the most active cyclone seasons as six cyclonic activities were observed in Arabian Sea out of which four cyclones were of intensity "Very Severe Cyclonic Storm" and above.

It is imperative to mainstream cyclone risk reduction in developmental planning and to adopt an inclusive approach towards risk reduction to ensure sustainability of developmental initiatives and to widen its reach to cover every citizen. GIDM has identified the need for implementation support and enhancement of capacity of institutions and individual dealing with Cyclone Risk Management. This module on Cyclone Risk Management enable facilitators to adequately equip themselves in conducting training programs more effectively.

I appreciate the dedication and commitment of Mr. Ankur Srivastava and Dr. Repaul Kanji, GIDM for working on the module and bringing the manuscript to its present form.

The module is designed to be a living document. As capacity development needs and trends change over time, updated versions of this document will be released to reflect those changes, as and when required. I trust that users will communicate their views to us.

I am confident that the module will add value to our continuing state, and local efforts aimed at building coping capacities in Gujarat.

March, 2020
Gandhinagar, Gujarat

(P K Taneja)
Director General

Abbreviations

BMTPC	Building Materials and Technology Promotion Council
CoR	Commissioner of Relief
ESCS	Extremely Severe Cyclonic Storm
EWS	Early Warning System
GIDM	Gujarat Institute of Disaster Management
GSDMA	Gujarat State Disaster Management Authority
HPC	High Powered Committee
IMD	India Meteorological Department
IRS	Incident Response System
MHA	Ministry of Home Affairs
MPCS	Multi-Purpose Cyclone Shelter
NCRMP	National Cyclone Risk Mitigation Project
NDMA	National Disaster Management Authority
NIO	North Indian Ocean
PIU	Project Implementation Unit
PMU	Project Management Unit
RSMC	Regional Specialized Meteorological Centre
SCS	Severe Cyclonic Storm
SEOC	State Emergency Operation Centre
VSCS	Very Severe Cyclonic Storm

Content

Introduction to the Module

"There is nothing called 'bad or rough weather'! It is just 'weather'. These are normal processes of nature. Ironically, if they occur, we call them 'bad'!"

About the module

Over the last few years, scientists have been observing unusual activity in the Arabian Sea. The oceanic basin to the west of the Indian sub-continent which usually sees low-intensity cyclonic activity has suddenly turned into a hotspot of sorts, churning out severe cyclonic storms one after the other. 2019 recorded one of the most active cyclone seasons in the North Indian Ocean (NIO). Six cyclonic activities were observed in Arabian sea out of which four cyclones were of intensity VSCS and above – VSCS Vayu, VSCS Hikaa, SuCS Kyarr and ESCS Maha. While Vayu, Hikaa and Kyarr did not make landfall in India, the western coast from Kerala to Gujarat witnessed heavy rains and strong winds, affecting normal life in several areas. Officials of the India Meteorological Department (IMD) as well as climate experts are expecting more tropical cyclonic activity from the NIO in coming years. It is crucial to understand the growing cyclone activity in the region.

The training module on Cyclone Risk Management has been developed for trainers to educate the commoners about the cyclone risks around them and intuitively train them to be prepared for it. The module has been designed in an interesting way to avoid the use of complex scientific/ technical terminologies and Disaster Risk Reduction (DRR) jargons, which usually becomes confusing to a commoner after a point. The training module focuses on all parameters of cyclones risk like cyclone hazard & vulnerability assessment, relevant exposure, mitigation measures and response/recovery plans without going into the technicalities. The ultimate objective of the module is to empower every participant to be able to assess cyclone risks and

be getting themselves acquainted with cyclone preparedness and response/recovery plan. This module aims to empower a common man to do the same, although not with such high precisions or on a large scale but with enough credibility to act upon it. Thus, in a way, the module aims to inculcate a culture of resilience among everyone. Doing what is being taught is perhaps the best way to ensure that knowledge is retained and this forms the guiding principle of this training module. The module has been developed by the Gujarat Institute of Disaster Management (GIDM) with inputs from professionals working in this sector and by referring to several research articles.

Who shall use the Training Module?

It can be used in trainings relevant to cyclone risk management for imparting training to anyone on the basics and fundamental understanding. The module can also be used for self-study by professionals or anyone who has interest in this field and intends to learn more about it. The following would be the expected target groups for the module:

- Civilians / residents.
- Undergraduate students; post-graduate students in the field of disaster risk management.
- Government authorities, either to foster their own interest in this subject or just as a part of being aware and prepared.
- NGOs working in this sector.

How to use the Training Module?

The module has been designed rationally to help the trainers or the self-learners to understand what cyclone risk is. The module is a step-by-step guidance system; it starts from explaining the basics and science behind cyclones. The use of technical meteorological terms or jargons has been avoided till the end so that the basics are not overlooked. Each session has been explained in detail, along with the session plan, content to be covered, methodology to be followed and instructions to trainers. The content of the module is expected to be inherently dynamic. The module also retains a degree of flexibility in the sense that the trainer can innovate on the methodology or activities according to the profile and need of participants.

Trainers' Guide

The trainer should consider the following guidelines:

- Registration of the participants should be electronic and must be made open on the eve of the program. This will help the trainer to understand the type of participants and he / she may consider making few last minute changes in the style of delivery.
- The program must start with public dissemination of risk information of the venue which should be audio-visual (preferably) and the participants must be made aware of the evacuation routes, assembly points etc.
- Instead of abiding by the traditional practice of trainer-participant introduction, the participants should be introduced to each-other and the trainer should come up with interesting ways to do so.
- Each lecture session should end in a discussion. This will not only help the participants to learn more from each-other but also the trainer to understand whether he has been capable enough to get his ideas across to the participants or not.
- If possible, a qualitative assessment of the trainer should be conducted at the end of every lecture session. The questions should focus only on qualitative aspects of the lesson and the trainer. Such an assessment would be an effective tool to measure the performance of the trainer.
- If the same trainer is taking more than one session, then, the test would be able to let the trainer know which sessions were good, which were average and which needs to be improved.
- If the same session has been taken by different trainers over a period of time, such a test would be an effective way of knowing which trainer is better in imparting training in that particular topic / subject.

- The trainer, therefore, should plan the session in such a way that the first-half of the day is dedicated to teaching / learning, while the second-half is more about exercising the concepts that have been taught.

Target Group

The training is targeted towards the common man. It would not be out of place to suggest that the generic understanding of disaster risk management is either flawed or incomplete or reactive. These are major impediments to fostering a culture of disaster resilience and it is exactly these impediments that the module intends to address. Thus, anyone who is keen on learning about the basics of disaster risk management can be the target group. The style of

delivery, however, may differ depending upon the target group. A group size of 25 - 30 people would be ideal.

Entry Behavior

Level of participants: Anyone

Age Group: Less than 50 years

Educational Qualification: Anyone who has a basic understanding of science

Disaster Experience: Not at all mandatory

Objective of the programme

The overall objective of the programme is to impart adequate knowledge and skill to the trainees to deal with cyclone risks in their respective spheres of life and empower them to formulate strategies/ action plan suitable to prevent risks and build resilience.

Methodology

The training will be conducted in an interactive mode with a judicious mixture of lectures, discussions, demonstrations, experience sharing, group work and case study analysis.

Teaching Aids

Training will have to be conducted with the help of the following:

1. Background reading materials / reference materials
2. Electronic handouts of presentations or additional material
3. Simulation exercise
4. A group is to be created on a social media to ensure that the participants are in touch and are actively sharing knowledge amongst each other. Such groups can also function as crowd based sources of data.

Training Materials and Equipment Required

The training will essentially be classroom based and for simulation exercises, the venue institute should be used. The training materials for classroom teaching like Computers, LCD projectors, flip charts, markers etc. would be required.

Seating Arrangements

The seating arrangements should preferably be four or five circular tables to facilitate group work and allow the trainer to move around the class for interaction.

Content Design

#	Session Title	Time	Methodology
Session: Inauguration & Pre-Training Assessment			
	Inauguration & Pre- Training Assessment	40 min	Interaction and Video
	Ice- breaker	20 min	Interaction and Video
Technical Session 1: Disaster Risk Management: Concepts & Perspectives			
LU 1.1	Hazard, Vulnerability & Risks: A Conceptual Approach to Disaster Risk Management	45 min	PPT and Discussion
LU 1.2	Managing Disasters to Managing Risks: An Overview	30 min	PPT and Discussion
LU 1.3	Dealing with Disaster: Post 2015 Global Frameworks for DRR	45 min	PPT and Discussion
LU 1.4	Building Resilience for All: Equity and Inclusion in DRR	45 min	PPT and Discussion
Technical Session 2: Understanding Cyclones			
LU 2.1	Basics & Science behind	45 min	PPT, Discussion and Video
LU 2.2	An Anecdote of Contemporary Cyclonic Events of Gujarat state	45 min	PPT, Discussion and Video
LU 2.3	Cyclone Hazard & Vulnerability Assessment	45 min	PPT and Discussion
Technical Session 3: Cyclone Risk Mitigation			
LU 3.1	Structural Measures	45 min	PPT and Discussion
LU 3.2	Bio shield & Coastal Zone Regulations	30 min	PPT and Discussion
LU 3.3	National Cyclone Risk Mitigation Project	30 min	PPT and Discussion
Technical Session 4: Preparedness & Cyclone Warning System			
LU 4.1	Cyclone Preparedness Task and Responsibility for Gujarat	30 min	PPT and Discussion
LU 4.2	Cyclone Warning Generation & Dissemination	45 min	PPT and Discussion
Technical Session 5: Institutional Response & Development of Recovery Strategy			
LU 5.1	Cyclone Action Plan	45 min	PPT and Discussion
LU 5.2	Institutional Response on Receipt of Early Warning: Case Study of VSCS ‘Vayu’	30 min	PPT and Discussion
LU 5.3	Development of Recovery Strategy: Case Study of ESCS ‘Fani’	30 min	PPT and Discussion
Session: Post -Training Evaluation & Conclusion		75 min	Discussion

Public Dissemination of Risk Information of the Venue (PDRIV)

In case the training is being conducted at GIDM or at any other physical venue, it is mandatory that an audio-visual clip be shown about the venue that informs the audience / participants about the hazards the venue or the surrounding is prone to, the risks, the escape routes or evacuation plan and emergency assembly points. The audio-visual clip to be shown must not contain mere presentations or verbal directions. It should be a visual document of the actual evacuation route from common points like corridors or lounges to the assembly points, which may or may not be within the same establishment.

Primarily, a venue may be exposed to various different types of hazards and for an event of a day or two, hazards like flood or drought may be irrelevant and in such cases more immediate hazards like fire or earthquake should be dealt with. The focus should be on preparing the audience for evacuation if such a need arises during the program. The clip may be allowed to run repetitively while the initial arrangements are being made on the day of inauguration or when the participants start coming in and settling down for the first session of the training program.

In addition to the audio-visual clip, along with the registration kit, a single-page document should be handed over to the participants with the evacuation routes marked and assembly points mentioned. Emergency contact numbers may also be provided if the participants come from other parts of the world.

Proper preparation in this regard on behalf of the organisers is also necessary. The venue selected for the training course must have a minimum standard of disaster preparedness measures. First of all, the venue must have a disaster management plan and an emergency evacuation strategy within it. For the evacuation strategy to be effective, proper signage should be placed on and around the campus premises. The evacuation strategy should have been a tested through mock-drills a couple of times keeping in mind the different groups and types of participants that might join the training program like differently-abled individuals or senior old-age personnel and for a mock-drill to be executed, the establishment must have a disaster management plan. Thus, everything is dependent on the other with the disaster risk management plan serving as the key document.

Inauguration and Pre Training Assessment

Need of the session

This is supposed to be an introductory plenary to prepare the participants for upcoming sessions and in order to convene them on same page. Participants from different organization have different understanding/confusions regarding cyclones. Their orientation about subject depends on their personal knowledge or whether they have worked in cyclone onset situation. Therefore, this session is aimed towards assessing the entry behaviour of participants. But it would not be the best case to directly plunge to the subject therefore the course-coordinator will have the job to informally introduce himself and facilitate the participants to introduce themselves. The first day of a course is essential to the success of the course. It is important to start the course on a positive note by making sure all of the participants feel comfortable and get to know each other as soon as possible. The course-coordinator shall use ice breakers at the beginning of a course to help the participants get to know each other. Following activity can be used for the purpose:

1. Provide a paper card to every participant.
2. Ask them to write their name on it and return to the coordinator.
3. The coordinator shall pick random cards to club the participants in 4-5 groups.
4. Now each group shall select a group-name for themselves condition being that it should have the first and last letter of the name of each member.

The introductory session can also be used to understand the expectations of the participants from the training. For this following activity may be used:

1. Give each group three-four minutes for discussion.

2. Ask each group to write their expectations from training on the chart paper.
3. Put all charts by the groups on a wall.
4. Write the common/relevant expectations on white board/flip chart.
5. Read out training objectives as mentioned in the beginning of the module.
6. Clarify that expectation outside the scope of training will be addressed where and when possible.

Objective of the session

This simple but elaborate session of around 90 minutes is expected to bring out:

1. The prior knowledge and understanding of the participants.
2. To build a rapport between the participants and the trainer or the course-coordinator and also among the participants.
3. Changes of content or delivery style that might be required on part of the trainer to meet the level of participants or their expectations from the course.

Duration: 60 mins (40 + 20)

Training aids

Paper cards, Flip charts, Markers etc.

Technical Session 1: Disaster Risk Management: Concepts & Perspectives

Need of the session

To understand risk or disaster risk, one must have a very clear idea of its constituent parameters, which are hazard, vulnerability, exposure and coping capacity. While coping capacity and vulnerability are literally intertwined and are complementary to each other, the other three parameters (hazard, vulnerability and exposure) are primarily what defines disaster risk. A hazard is not a disaster and yet we use these terms interchangeably very often and this is where we commit the first mistake. We, in general, have a tendency to link everything with a buzz-word and the current catch-phrase being climate change, there is trend of relating every phenomenon to climate change, global warming and such apocalyptic events. We simply ignore the science behind the genesis of hazards and go on to link it with bigger events. This is where we commit the second mistake. Ignorance is off-course a bliss but in disaster risk reduction and disaster preparedness, ignorance is a bane. This is where this unit comes in to bridge the gap.

Units of the session

Learning Unit 1.1: Hazard, Vulnerability & Risks: A Conceptual Approach to DRM

Learning Unit 1.2: Managing Disasters to Managing Risks: An Overview

Learning Unit 1.3: Dealing with Disasters: Post 2015 Global Frameworks for DRR

Learning Unit 1.4: Building Resilience for All: Equity and Inclusion in DRR

Objectives of the session

The primary objectives of this unit would be to:

- Explain to the participants what is Hazard, Vulnerability and Exposure.
- Exemplify how the scope of Managing Risks is broadening due to other global phenomenon.
- Inform the participants about the post 2015 global frameworks for DRR.

Duration

210 minutes. (45 + 30 + 45 +30) minutes for the sessions and 15-minute spill over time from each session.

Methodology

The methodology of this session is no different from the overall methodology of the training program. Every lesson or every unit must start with a question to intrigue the participants and foster discussion. Building up on such discussions, the trainer must start his presentation or lecture.

Training aids

Power-point presentation, Flip-charts, Markers etc.

Learning Unit 1.1: Hazard, Vulnerability & Risks: A Conceptual Approach to Disaster Risk Management

Flow of the session

1.1.1 Hazard

The trainer may begin by narrating a small story or incident and asking the participant to identify the hazard in it.

"An expert biker is riding his brand new bike on the Mumbai-Pune Expressway. It is the monsoons and the Western Ghat is looking absolutely stunning. All of a sudden, a small rock rolls down from the steep slopes and lands right in front of the biker. The biker, who was riding almost as fast as the wind, could not control his bike and skidded off the road"

The trainer will now have to instigate the participants to share their views on what the hazard in this particular example is. Interestingly enough, this particular example has two hazards; while one is evident the other one may not be so evident. Landslide, which caused the rock to roll down the slopes is itself a hazard and may be easily identifiable while the fact that the rock just happened to land in front of the biker while he was speeding is also a hazard. In fact, to understand the later proposition the trainer might have to explain that this would have been a hazard even if it was just a rock lying there on the road and not because of a landslide.

Similar examples can be discussed to understand that hazard is anything which may have adverse effect and the effects can be injury, health impact, damage to property, disruptions of any form and even loss of life. Hazard should also be understood in terms of probability of happening. In light of the above example, the rock on the expressway is life threatening but its probability of actually being a cause of an accident is a hazard. To understand this, one must consider a similar scenario in a deserted road; had the rock tumbled down from a slop or had it been just lying there, it would not have caused any accident or injuries or death. Although, it is still a hazard, but it is not contributing to anything dangerous. This perception of hazard is more meaningful in the context of disaster management and disaster risk reduction. The lesson should be concluded with a debate on whether the biker riding the bike at such high speed is a hazard or not?

Types of Hazards

The first substantial work in disaster management in India was done through the constitution of the High Powered Committee (HPC) in August, 1999, just a few months before the Orissa super cyclone in November, 1999.

Depending on the causal agent / phenomenon, the HPC classified disaster as given in table 1.

Water and climate related	Geologically Related	Chemical, industrial and nuclear related	Accident related	Biologically Related
Floods and drainage Management	Landslides and Mudflows	Chemical and industrial disasters	Forest fires	Biological disasters and epidemics
Cyclones	Earthquakes	Nuclear disasters	Urban fires	Pest attacks
Tornadoes and Hurricanes	Dam failures / dam Bursts		Mine flooding	Cattle epidemics
Hailstorm	Mine fires		Oil spill	Food poisoning
Cloud burst	Tsunami (added later)		Major building Collapse	
Snow avalanches			Serial bomb blasts	
Droughts			Festival relates	
Sea erosion			Electrical disasters and fires	
Thunder and Lightning			Air, road and rail Accidents	
			Boat capsizing	
			Village fire	

Table 1: HPC's classification of hazards

To end this lesson, the trainer may urge the participants / groups to take a piece of paper and write down the hazards, not necessarily the ones mentioned in the national plan but any sort of hazard, that is predominant in their area and correctly classify it.

Case in point: Gujarat

Earthquake*:* As per Indian Seismic Zone Map, Gujarat region lies in three zones- Zone III, IV and V. Kachchh region (about 300km x 300km) lies in zone V where earthquakes of magnitude 8 can be expected. A belt of about 60-70km width around this zone covering areas of North Saurashtra and areas bordering Eastern part of Kachchh lie in zone IV where intensity VIII can be expected mainly due to earthquakes in Kachchh and some local earthquakes along North Kathiawar Fault in Northern Saurashtra. The rest of Gujarat lies in zone III where intensity VII earthquakes can be expected due to moderate local earthquakes or strong Kachchh earthquakes.

Drought: Gujarat is one the chronic drought prone state of India, with an average annual rainfall about only 816 mm with more than half of the Talukas of Gujarat receiving rainfall within the range of 200 -400 mm. Substantial portions of the State are arid to semiarid. Falling water tables have added stress on crops and water supplies.

Cyclone: Gujarat falls in the region of tropical cyclone. With the longest coast line of 1600 km in the country, it is highly vulnerable to cyclone and its associated hazards such as floods, storm surges, etc. Two cyclonic storm seasons are experienced in Gujarat: May to June (advancing southwest monsoon) and September to November (retreating monsoon).

Flood: Majority of the area of Gujarat is flood prone, irrespective of the size of the catchment. The flood risk in Saurashtra is lower than that of the South Gujarat plains. The relatively flat plains in the lower basic areas with hilly catchments in upper parts of South Gujarat accentuate flood risks. Few villages in the North Gujarat are flood prone too.

Tsunami: Gujarat is prone to tsunami risk due to its long coastline and probability of occurrence of near and offshore submarine earthquakes in the Arabian Sea. Makran Subduction Zone-South West of Karachi is an active fault area which may cause a high magnitude earthquake under the sea leading to a tsunami.

Fire, Industrial & Chemical, Accidents, Heatwave, Epidemic, Stampede, etc. are also frequent in Gujarat.

1.1.2 Vulnerability

To understand risk or disaster risk, one must have a very clear idea of its constituent parameters, which are hazard, vulnerability, exposure and coping capacity. While coping capacity and vulnerability are literally intertwined and are complementary to each other, the other three parameters (hazard, vulnerability and exposure) are primarily what defines disaster risk. After the last unit, it is expected that a fair amount of understanding of hazards would have been developed. Hazard is not a disaster in itself but a phenomenon or an event which may cause some damage and it is the vulnerability of the individual or community or the system in consideration which defines the risk a hazard pose. It is to be noted that the word system to be used hereafter can refer to an individual, a community, an administrative unit, production house or even a nation depending on the context.

The trainer may begin by reminiscing the example cited in the first unit.

"An expert biker is riding his brand new bike on the Mumbai-Pune Expressway. It is the monsoons and the Western Ghat is looking absolutely stunning. All of a sudden, a small rock rolls down from the steep slopes and lands right in front of the biker. The biker, who was riding almost as fast as the wind, could not control his bike and skidded off the road."

The hazards in this example has already been discussed and now the trainer should probe the participants as to state the vulnerabilities in the given scenario with a prior understanding that vulnerability is basically the potential of any event or phenomenon to cause damage. Similar examples can also be cited to involve the participants. The following questions can be posed by the trainer to instigate the participants:

- Was the unstable slope of the Ghats a vulnerability?
- Was the weather (monsoon) a vulnerability?
- Depending on the experience of the rider, can one comment on the vulnerability?

The trainer should understand that each of these questions affect the vulnerability of the rider and each of these question reflects parameters from different dimensions of vulnerability. Thus, it is the responsibility of the trainer to steer the participants into asking that how these above mentioned facts are vulnerabilities.

The concept of vulnerability being a degree or extent of impact is also to be illustrated here. To understand this, one must consider different simulations of the same example. If the rider is an expert and he was wearing a proper gear, would his vulnerability be lessened? Even if his

bike skidded, if there was a hospital nearby so that he could just walk to the hospital or be carried by some passing by vehicle, would his vulnerability be lessened? These questions, targeted at the participants, would give them a feel that vulnerability has so many aspects and this would lead on to the next lesson.

At the end of this lesson, the participants must have a clear idea of how vulnerability is the extent of damage an event is caused and how broad its scope is.

The lesson should be concluded with a debate on whether the biker riding the bike at such high speeds is a vulnerability or not? This question should spark a debate as in the last unit the same question was posed to the participants asking whether the speed is a hazard or not.

1.1.3 Exposure

Exposure is, perhaps, the most important parameter when it comes to determining disaster risk. One needs to understand that hazard, which is an event or a phenomenon, will always be there and most of the time we can do very little to prevent it, but if we are exposed to it, it will surely impact us and then it is only our vulnerability which decides whether we would be severely, moderately or mildly impacted. To start with, the scope of exposure is anything tangible that may be susceptible to the impact of a hazard. It can be human life, property, farms, production houses etc. This is what the basic of exposure is, however, one needs to delve into depths to understand the true bearings of exposure. When considering human life, one needs to consider the demographics of the community or the area. Different age groups, or different sexes would have different levels of vulnerability to the hazard. Imagine a small town that has been setup by the coast just for the old people so that they can relax and enjoy their life after retirement. A cyclone hits this town. The loss would have been much lesser had this town been filled with youngsters because the old-age population is more vulnerable. This is how demographics change the scenario. Even if it had been a school filled with children, the exposure of the school would be much more devastating than an office being exposed as the small children may not know how to act and react.

The trainer must be able to explain that exposure must account for the demographic divisions because vulnerability is ultimately decided by the demographics.

The next step would be to explain that it is exposure which actually contributes to the calculation of losses. If a farm is exposed to a hazard like flood, then the per hectare yield of the farm multiplied by the area of the farm exposed would be the resultant loss. Similarly, if an

industry is exposed, then the worth of all of its processes, would be realised as the loss. However unethical it is, if a value can be assigned to human life, the numerical value of the population exposed to a hazard multiplied by the value of life would amount to the loss.

The last statement is indeed disturbing and the trainer must take care of whether to go with that or not. The basic idea is to explain that it is exposure which contributes toward calculation of losses.

Objectives of the lesson

The primary objectives of this lesson would be to:

- Explain what Hazard, Vulnerability and Exposure is
- Explain the ways in which all these are perceived and understood

Duration

45 minutes depending upon the potential of the trainer to fan discussion and debate.

Methodology

An animated clip can be used to depict a similar scenario and then the participants may be asked to depict the hazard in the scenario.

If the participants have already been divided into groups, then each group can be handed out a sheet of paper and asked to write down all the hazards they can find out in the given scenario. After completing the session, just for a competitive flavour, the team who identifies the hazards correctly, may be given a score or a recognition.

Training aids

Power-point presentation, flip-charts, A4s, markers, pens etc.

Learning Unit 1.2: Managing Disasters to Managing Risks: An Overview

Flow of the session

The trainer may start this session inviting reference to the example of the biker. The risk of the biker is defined by the hazard of the rock tumbling down, vulnerability of the biker and off course, his exposure to the situation. The trainer can move on to citing similar examples so as to explain the concept of disaster risk better. In case of an avalanche, there is a hazard, but there is no exposure and hence there is no disaster risk. If there is an earthquake, say in the night, there is a hazard and a school building is exposed to that hazard, but it has no vulnerabilities except the structural one. If the school building is also well constructed, then there are no vulnerabilities at all and hence there is no risk and the school can resume the next day without any impediment. The trainer can go on to ask participants if they can come up with similar situations where there is a hazard but the overall risk is negligible.

The trainer should take this opportunity to establish the fact that disaster risk is nothing but a probability; in fact, probability of loss expressed in any desired unit. Disaster risk is dependent on hazard which is actually the probability of occurrence of any event that may cause damage, vulnerability which is the degree of damage the hazard can wreak and exposure which is the quantity of tangible elements exposed. Thus overall, disaster risk is a probability or a chance of loss if the said hazard strikes.

Intensive risk is disaster risk associated with low-probability, high-impact events, whereas extensive risk is ***associated with high-probability, low-impact events.***

The above statement means that the risks are higher for hazards which have lower chance of occurrence and yet have the potential to create maximum damage; earthquake of higher magnitudes for example have a very high return period but when they occur they are catastrophic.

Disaster risk has many characteristics. In order to understand disaster risk, it is essential to understand that it is:

- Forward looking: it talks about the likelihood of loss of life, destruction and damage
- Dynamic: it can increase or decrease according to our ability to reduce vulnerability

- Invisible: it is comprised of not only the threat of high-impact events, but also the frequent, low-impact events that are often hidden
- Unevenly distributed around the earth: hazards affect different areas, but the pattern of disaster risk reflects the social construction of exposure and vulnerability in different countries
- Emergent and complex: many processes, including climate change and globalised economic development, are creating new, interconnected risks

The trainer can end this session with busting a myth; **there is no such thing as natural disasters but disasters often follow natural hazards**. In addition to this, the trainer can also use the following statement:

Disasters threaten development, just as development creates disaster risk.

The key to understanding disaster risk is by recognising that disasters are an indicator of development failures, meaning that disaster risk is a measure of the sustainability of development. However, the trainer must allow the participants to interpret this on their own through discussions.

In addition to this, there is also acceptable and residual risk. The trainer may want to introduce the participants to these terminologies.

Hence, interpreting risk would be to incorporate the idea of perception of risk.

1.2.1 Coping Capacity

Coping capacity is ideally the capacity of a system (the connotation of system is the same as used during the illustration of vulnerability) to deal with a given risk. The system can be an individual, can be a community or even an organisation, institute or authority for that matter. It is obvious that when the capacity of the system is not enough to handle the risk, the consequences of the event are grave.

Coping capacity can be understood under similar heads as illustrated for vulnerability; i.e. physical, social and institutional. In fact, the ideology of vulnerability is counter-intuitive. If a particular system is vulnerable with respect to a particular parameter, the coping capacity of the system in regard to that parameter is low. For example, while talking about structural vulnerability within the physical dimension of vulnerability, if a building in zone 5 is not built according to the relevant building code and standards, structural vulnerability is prominent and

hence coping capacity of the system is also questionable. However, if an important building in zone 4 is built according to the standards and regulations of zone 5, structural vulnerability is negligible and it can be said that the building has the capacity to cope with an earthquake of a certain intensity of earthquake. Not only for physical dimension, same analogies can be drawn in other dimensions as well.

If a flood prone community with agriculture as its main source of income has invested in crop-insurance or the residents have enrolled in some sort of micro-insurance scheme, the financial burden on the community after an event would be very less. Thus, it can be said that the community has the financial capacity to cope with the economic fallout of the event, i.e., flood in this case.

The trainer can carry forward the session by giving several other examples to the participants to clarify the concept of coping capacity and its inverse relationship with vulnerability. The trainer can even perform a verbal exercise with the participants; the trainer can point out a very particular aspect in one of the dimensions of vulnerability and ask the participants to illustrate an example of how that aspect can contribute to vulnerability and how taking care of that aspect can increase the capacity. For example, the trainer can ask the participants to mention one aspect of socio-cultural dimension, the lack of which contributes to vulnerability and addressing it leads to improved capacity.

When the impending risk is beyond the coping capacity of the system, the consequences are grave. In fact, when the risk exceeds the coping capacity, the event is regarded as a disaster provided there are human, material, economic and environmental losses and impacts.

Thus, to put it mathematically for understanding, a disaster risk will remain a risk if the coping capacity of the system under consideration is substantially high, but, if the coping capacity is not upto the mark, the disaster risk would eventually become a disaster or a massacre.

$$\textit{Disaster Risk} \propto \frac{\textit{Hazard X Vulnerability X Exposure}}{\textit{Coping Capacity}}$$

Understanding of disaster is often left to perception. One may even identify a small event as a disaster like fire in an apartment; such an event may be a disaster for the affected family but on a larger perspective, it cannot be termed as a disaster. Thus, it would not be incorrect to suggest

that the understanding of disaster is dependent on the scope of the system under consideration. Usually, the scope of consideration is not less than a community.

1.2.2 Disaster Management to Risk Management

Now that the participants have a clear understanding of disaster, they are to be explained what disaster management is all about. This is to be done using the disaster management cycle. The trainer must make sure that he / she explains the disaster management cycle in the most intuitive manner possible; the participants are to be told that disaster management, however technical it might sound, is actually very logical and rational. The different phases of the cycle logically follow each other and the science can be found only within this phases and not between them.

The participants must also be given a flavour of how they can manage disasters at their own level, preferably at the family level or community level. This is to be done by introducing the participants to the bow-tie analysis tool. Once the participants feel empowered, they must be enlightened about the paradigm shift that is occurring; from disaster management to disaster risk management which circumscribes disaster risk reduction.

The trainer may begin by introducing the participants to the disaster management cycle

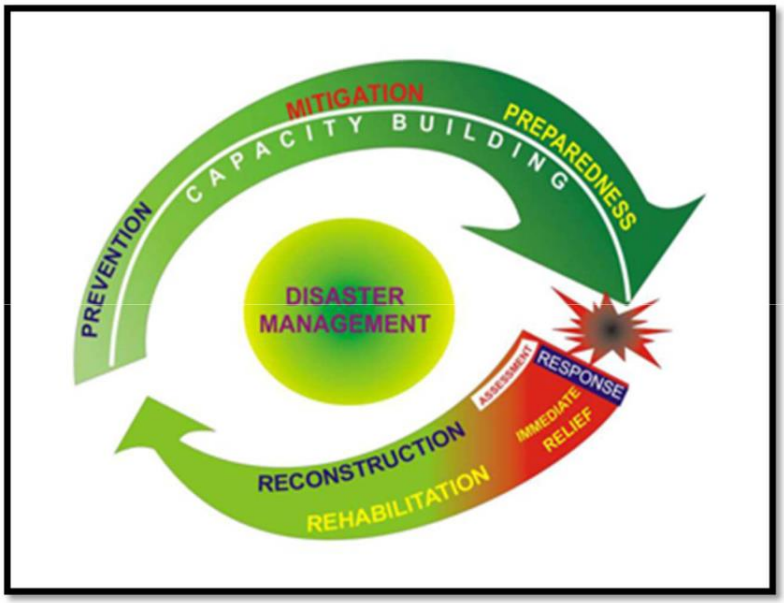


Figure 1: Disaster Management Cycle

One may find different versions of the disaster management cycle from different sources, but it is the responsibility of the trainer to explain to the participants that the core rationale behind all such version is the same and is very rational for one to follow.

Phase I: Prevention and mitigation

If it is known that a system (community, area, village etc.) is prone to or likely to be affected by a hazard or if it is established that there exists a risk, the first and the foremost logical thing to do would be to prevent the occurrence, if possible, or to mitigate the risk. This is what constitutes the first phase. Risks of hazards like earthquake cannot be prevented but they can be mitigated by ensuring physical (structural and non-structural), social and institutional vulnerabilities are addressed and the system is endowed with adequate capacity to deal with the risk. Fire risks can generally be prevented by taking care of points of failures (vulnerabilities); for example, in an organisation with a risk of fire hazard, fire alarms are to be installed, fire extinguishers are to be placed at regular intervals, staffs are to be trained on how to use extinguishers and what to do in case the alarm rings etc. If a fire occurs, due to any random reason, even with such steps of prevention, the magnitude of loss will be reduced many folds. Thus, the idea here is to ensure prevention or mitigation of the impact of loss in any terms.

The trainer can then go about giving examples of what steps are generally taken in this phase. Care is to be taken that such examples are primarily from Gujarat so that the participants can easily relate to. Examples can be cited of the Heat-wave Action Plan prepared by the Ahmedabad Municipal Corporation every year. The National Cyclone Risk Mitigation Project can also be explained by the trainer in this regard. In fact, the prevention and mitigation part of all the state and national level plans can serve as a good resource material for this phase as well this entire section.

Phase II: Preparedness

Once all steps have been taken to prevent or mitigate the impact of losses, the second phase is all about readiness; to put it in terms of management and administration, this phase is about the preparedness of the system such that its leanness and agility is not compromised during the event.

The trainer can then go about giving examples of what steps are generally taken in this phase. Care is to be taken that such examples are primarily from Gujarat so that the participants can easily relate to. For example, the Gujarat School Safety Week Initiative is one of the most well-known exercises carried out in this regard. Preparation of school disaster management plans, carrying out mock-drills based on that etc. are various steps that are taken to prepare the school

community to respond to any unforeseen event. Similarly, training programs that are conducted by state and national institutes to build the capacity of different stakeholders is a crucial aspect of preparedness. The trainer can use this opportunity to emphasise the role of Gujarat Institute of Disaster Management in preparedness through capacity building initiatives.

Phase III: Response

After the first two phases, it is expected that the community or the system (speaking, generally), is ready to respond to any event. Off course, no one can predict the exact unfolding of events but then the first two phases of the cycle is all about preparing the system to respond to an event with the capacity to adjust to anything that exceeds the preparation. Everything that the system has been trained for is put to use in this phase and the failure to do so will actually make the effort put in the previous phases futile.

The trainer can give examples of prepared responses and un-prepared responses as seen in Gujarat over the years. For example, the response in the 2001 earthquake can be compared to the response of any subsequent quakes. Response to floods as seen in Sabarkantha can also be exemplified here. The trainer must also emphasise on the fact that this phase constitutes of three prime activities; search, rescue and relief. Even these sub-phases are intuitive in their discourse; one must search for a victim and then rescue him and finally, transfer him to a safe haven / shelter / relief camp, where he will be treated.

Phase IV: Recovery

After the immediate response to the event, what primarily becomes the objective of all and every operation is to reinstate normalcy. To put it in terms of management and administration again, the aim is to ensure business process continuity; the business here may refer to the day-to-day working of a community (district / state) and even the day-to-day life of an individual or a family. The core idea is however not just reinstating normalcy; it is more than that; the idea is to build back from the ruins to a system which would have the capacity to deal in a better way. Examples can be cited from the recovery projects undertaken after the Bhuj Earthquake of 2001.

1.2.3 Build Back Better

The trainer must lay emphasis on the fact that restoring normalcy, i.e., recovery is not the end. In fact, it is just the beginning of a new cycle. In the recovery phase, it is essential to find out the causalities of the disaster, the points of failure or simply put, the vulnerabilities and ensure

that while recovering or ‘building back’, efforts are put to ‘build back better’. The basis of this lies in the fact that if normalcy is restored or the system is recovered to the state it was before the disaster hit, the vulnerabilities will also be a part of it and that may result in similar consequences.

The trainer may then categorically go ahead and explain the role of science and technology in steering the shift. The role of IMD, INCOIS as agencies of early-warning and their super-efficient prediction and dissemination system may be elaborated upon. New technologies that are being used for structural safety can also be shared with the participants. In this context, the trainer may introduce the participants to the concept of green and sustainable technologies. The core idea behind this is that disaster and development goes hand in hand; resources, the natural ones, are limited and full-fledged development can only be fostered when they are used along with the use of non-conventional sources. The depletion of natural resources or even their use and exploitation for the sake of development, will negatively impact the environment or the ecosystem and this will trigger the occurrence and recurrence of hazards. For example, building of dams is utmost necessary but their construction is always clouded with protests and negative impact assessment reports. Thus, development, in one way or the other, will trigger hazards, which, may or may not, become disasters. In fact, for a fast and steadily developing country like India, the use of natural resources is equally important as the use of non-conventional sources and thus, at the altar of development we are and we have to sacrifice, to some extent, the idea of not contributing to disaster risks. But, as is the case with so many other things, there is also a silver lining to this. Since development will beget disaster risk, why not look at it from the opposite perspective? In case of a disaster, the general tendency is to build back better, i.e., to develop in a better way. Thus, disaster begets development as well. Amidst this confusion, the best way out is to adopt a principle of development which ensures that the future generations do not suffer the wrath of exploitation and while we are at it, we must ensure that existing risks are mitigated or reduced and no new risks are created in the process.

This lesson in particular will remain the dynamic part of the module. It will be the responsibility of the trainer to make this lesson interesting through showing examples of the use of science and engineering in reducing disaster risk.

The trainer may also take this opportunity to explain the concept of acceptable risk and residual risk and the different sorts of measures that are taken in terms of risk management, i.e., corrective, prospective and compensatory.

Objectives of the lesson

The primary objectives of this lesson would be to:

- Explain what Disaster is
- Illustrate the importance of the Coping Capacity using the formulae
- Illustrate the Disaster Management Cycle
- Explain the overall relationship of Disaster Management to Risk Management

Duration: 30 minutes

Methodology

This session is an informative session which needs illustration through the equations of disaster risk, i.e.,

1. Disaster Risk ∝ (Hazard) X (Vulnerability)

2. Disaster Risk ∝ (Hazard) X (Vulnerability) X (Exposure)

The first equation talks only about the 'impact' of a hazard based on the probability of occurrence and the degree to which the hazard can cause damage.

The second equation helps in assigning a unit to disaster risk; if 'this' be the probability of occurrence and 'this' be the degree of damage it can cause and 'that' be the amount of assets costing 'this much', then the product of all these would give an idea of what damage and loss would be incurred by the hazard.

Training aids

· Power-point presentation

· Flip Chart

Learning Unit 1.3: Dealing with Disasters: post 2015 Global Frameworks for DRR

Flow of Session

In this session the participants would be introduced to coherence and mutual reinforcement of three post-2015 global frameworks for DRR i.e. the Sendai Framework for Disaster Risk Reduction, Sustainable Development Goals and COP21 Paris Agreement on Climate Change. The trainer will have the discretion to include as much as information as possible. On one hand he can restrict himself to the frameworks mentioned in the lesson and on the other hand, he can also update the participants about the parallel developments that are taking place in climate change negotiations, development goals of United Nations etc.

The adoption of SDGs – 'Transforming Our World: The 2030 Agenda for Sustainable Development' is a global transformative plan of action that has poverty eradication as an overarching aim. It has, at its core, the integration of the economic, social and environmental dimensions of sustainable development.

The Paris Agreement on global climate change points to the importance of averting, minimizing, and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events, and the role of sustainable development in reducing the risk of loss and damage.

DRR and resilience are recurring common theme in the three global agreements. All three agreements share a common aim of making development sustainable. **The most significant shift recognised in the Sendai Framework is a strong emphasis on disaster risk management in contrast to disaster management**. These three agreements recognize the desired outcomes in DRR as a product of complex and interconnected social and economic processes, which overlap across the agendas of the three agreements. Intrinsic to sustainable development is DRR and the building of resilience to disasters. Further, effective disaster risk management contributes to sustainable development.

Strong commitment to ambitious goals and accelerated implementation of these international agreements are global priority. Given the complementarities between the post-2015 agendas, synchronising and mutually reinforcing the actions in the three domains helps in better outcomes. Efforts must be made to ensure that each of them do not build in "policy risks" or,

contradictory policies, that generate more - rather than less - risk in development. Promoting coherence and mutual reinforcement in all three agreements requires political recognition, monitoring, reporting and supporting partnerships at various levels.

1.3.1 Sendai Framework for DRR

The Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030 marks a definitive shift globally towards comprehensive disaster risk management aimed at disaster risk reduction and increasing disaster resilience going far beyond disaster management. This approach calls for setting the overall goal as that of preventing new and reducing existing disaster risk through the implementation of integrated measures. The goal now is on DRR as the expected outcome, setting goals on preventing the creation of new risks, reducing the existing ones, and strengthening overall disaster resilience. In addition, the scope of DRR has been broadened significantly to focus on both natural and human induced hazards including various related environmental, technological and biological hazards and risks. The Sendai Framework acknowledges the interlinkages between climate change and disaster risks. Disasters that tend to be exacerbated by climate change are increasing in frequency and intensity.

Outcome: The substantial reduction of disaster risk and losses in lives, livelihoods, and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.

Goal: To attain the expected outcome, Sendai Framework seeks to prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience.

Priorities: The four priories for action under the Sendai Framework are:

1. Understanding disaster risk
2. Strengthening disaster risk governance to manage disaster risk
3. Investing in disaster risk reduction for resilience
4. Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction.

Targets: The seven global targets set by the Sendai Framework are:

1. Substantially reduce global disaster mortality by 2030, aiming to lower the average per 100,000 global mortality rates in the decade 2020–2030 compared to the period 2005– 2015;
2. Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 in the decade 2020–2030 compared to the period 2005–2015;
3. Reduce direct disaster economic loss in relation to global gross domestic product by 2030;
4. Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030;
5. Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020;
6. Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of the present Framework by 2030;
7. Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030.

1.3.2 Sustainable Development Goals

The Sustainable Development Goals (SDGs), adopted by the UN General Assembly on 25 September 2015, consisting of 17 Global Goals and 169 targets, are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity.

Sustainable development and disaster risk reduction are closely interlinked. A single major disaster or "shock" incident (i.e. a rapid onset disaster like an earthquake, storm, tsunami or landslide) can undo hard-won development progress and set back development by years. A "stress" incident (i.e. a slow onset disaster like drought, sea level rise, and salinity intrusion into groundwater stocks) can also cause long-term socio-economic harm. Climate change aggravates impacts from both natural hazards and human-induced vulnerabilities by acting as a threat multiplier. Driven by climate change, there is increase in the frequency and severity of extreme weather events (including storms, droughts, heat waves and cold "snaps"). Such events multiply the risks that people living in areas prone to natural hazards already face.

The possibilities of attaining SDGs are jeopardized because disasters undermine economic growth and social progress. No country or sector is immune to the impacts of natural hazards, many of which – the hydro-meteorological – are increasing in frequency and intensity due to

the impacts of climate change. While necessary and crucial, preparing for disasters is not enough, to realise the transformative potential of the agenda for SDGs, all stakeholders recognize that DRR needs to be its integral core. Progress in implementing the Sendai Framework contributes to the progress of attaining SDGs. In turn, the progress on the SDGs helps to substantially build resilience to disasters. There are several targets across the 17 SDGs that are related to DRR. Conversely, all seven global DRR targets of the Sendai Framework are critical for the achievement of the SDGs.

Figure 2: Sustainable Development Goals

Resilience is acknowledged both explicitly and implicitly in the SDG targets. The vision set out in the SDGs – for people, planet, prosperity and peace – will inevitably fail if shocks and stresses are not addressed. The pledge that 'no one will be le behind' requires a specific focus on the poorest and most vulnerable people, which is a key challenge: up to 325 million extremely poor people are likely to be living in the 49 most hazard prone countries by 2030. A focus on strengthening resilience can protect development gains and ensure people have the resources and capacities to beer reduce, prevent, anticipate, absorb and adapt to a range of shocks, stresses, risks and uncertainties.

1.3.3 COP21 Paris Agreement on Climate Change Action

The Paris Agreement was adopted on 12 December 2015 at the Twenty-first session of the Conference of the Pares (COP21) to the United Nations Framework Convention on Climate

Change (UNFCC) held in Paris from 30 November to 13 December 2015. The agreement builds upon the UNFCCC and brings together all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. The agreement aims at "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above preindustrial levels, recognizing that this would significantly reduce the risks and impacts of climate change". Article-7 dwells on establishing "the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change".

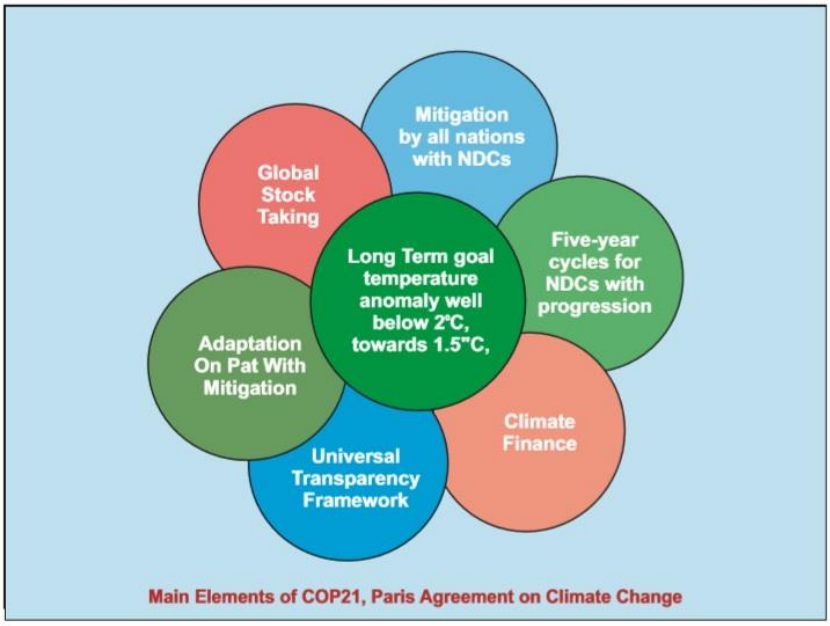


Figure 3: Main elements of CoP21

1.3.4 Coherence and Mutual Reinforcement

The presence of risk multipliers is a threat to the success of all development frameworks and coping with risks is a central to sustainable development. Given the changes in human demographics and trends in development, impact of climate change, and increasing exposure to disaster risks, there has never been a greater need to enhance coherence and coordination among all the major global iniaves to reduce risks, vulnerability to hazards and enhance resilience.

Effective reduction of losses and risks from natural hazards and climate extremes requires integrated actions at different levels of governance. One of the greatest challenges is of creating instituonal convergence that integrates global goals emanating from these agreements. DRR

and Climate Change Adaptation are part of key agendas being considered in all these recent global agreements. All three agreements share a common aim of making development sustainable. Strong commitment to ambitious goals and accelerated implementation of these international agreements must be a global priority. Given the complementaries between the post-2015 agendas, leveraging the total impact of these instruments creates shared value. Efforts must be deployed to ensure that each of them do not build in "policy risks" or, contradictory policies, that generate more - rather than less - risk in development. Taken together, the different priories, targets and acons in the three frameworks constitute a more comprehensive resilience agenda than when implemented independently without mutual reinforcement because building resilience requires action that spans the multiple domains of development, humanitarian iniaves, responding to climate change and disaster risk reducon.

Objectives of the lesson

The primary objectives of this lesson would be to:

- Inform the participants about the post 2015 global frameworks for DRR.

Duration: 45 minutes

Methodology

This session is an informative session which would involve the trainer doing most of the knowledge sharing. However, the trainer must also ensure that he helps the participants to correlate the concepts that have been already taught with the national and international definitions / terminologies etc. For example, after explaining the priorities of Sendai Framework, the participants should be informed that the steps of bow-tie analysis adhere to the priorities.

Training aids

· Power-point presentation

· Flip Chart

Learning Unit 1.4: Building Resilience for All: Equity and Inclusion in DRR

Flow of Session

Disaster management tend to view the affected people as a homogenous group – as internally undifferentiated 'victims' or 'survivors', particularly in the relief and recovery processes. This leads to an inherent inability to address the existing disparities and inequalities across gender, caste, or class. While hazards do not discriminate, people do. Disaster management could become unfair by being blind to prevailing inequities.

This chapter emphasizes the importance of DRR to address unequal disaster coping capabilities by recognizing that due to inequalities and social exclusions some sections suffer more than others in extreme events and disasters because of their place within the social system. Addressing the enormous challenges of social marginalization, social exclusion and other inequities are beyond the domain of DRR. However, DRR must take cognizance of social realities to ensure that every possible effort is made to make DRR as socially inclusive as possible.

The Sustainable Development Goals espouse the cause of social inclusion through its theme of 'Leave No One Behind'. The Sendai Framework for Disaster Risk Reduction 2015-30 recognizes the relevance of inclusion of all stakeholders as an overarching principle for disaster risk reduction. The Disaster Management Act 2005 (Chapter 11, Section 61) prohibits all forms of discrimination – be it based on sex, caste, community, descent or religion – in any activities related to disaster risk reduction, disaster relief or humanitarian assistance to the affected people. The preamble of National Policy of Disaster Management 2009 notes that the economically weaker and socially marginalized sections, women, Scheduled Castes and Scheduled Tribes tend to suffer more during disasters.

A community's vulnerability to disaster depends on the social, cultural, economic and political environment. A cycle of deprivation not only increases their vulnerability but also slowly alienates them from the decision-making process denying accessibility to the basic entitlements.

Exclusion is often most acute when people suffer multiple layers of discrimination and they are embedded in unequal relations of power. To make matters worse, they often remain

'invisible' in disaster reduction or emergency response programs, even in many cases where they constitute a significant proportion of population. The socially excluded groups have context specific and differentiated needs before, during and after a disaster, which are not taken into consideration in Disaster Management Plans. **Inclusive Disaster Risk Management is about equality of rights and opportunities, dignity of the individual, acknowledging diversity, and contributing to resilience for everyone, not leaving aside members of any community based on age, gender, disability or other**. In the Indian context, the added emphasis on social inclusion for DRR is on the following:

1. Gender-based Vulnerabilities
2. Scheduled Castes and Scheduled Tribes
3. Elderly
4. Children
5. Persons with Disabilities

1.4.1 Gender-based Vulnerabilities

A gender perspective to DRR helps focusing attention on the distinct gender-specific capacities and vulnerabilities to prevent, prepare, confront, and recover from disasters. Post-disaster reconstruction programs could render women more vulnerable when compared to the pre-disaster situation, defeating the very objective of building back beer. An increase in violence against women, domestic violence and divorce rates have been reported in the aftermath of disasters. They become more vulnerable to abuse in disaster situations. They face difficulty in accessing sanitation facilities. There is lack of privacy and increased risk of sexual assault. In some situations, there are risk of girls and young women being ensnared by traffickers or an increase in early marriages. There is a tendency to leave out women from accessing relief and recovery as they do not have control over resources and institutions. Women headed households, single women, and widows find it difficult to access information and necessary financial help for recovery and reconstruction. To promote gender equity, the reconstructed houses need to be registered in the joint names of husband and wife. Widows and single women, who do not have land titles, should not be left out from receiving shelters. Women feel more secure, confident and feel that they will never be without a roof over their head in their life. Owner Driven Reconstruction can be followed where women can take leadership role in monitoring implementation of safe housing technology. Programs shall be designed and aimed at empowering women through access to social security measures and income generation

activities. Women Self Help Groups can be formed for livelihood opportunities. It needs to go beyond traditional income generating activities and aim at enhancing skills as masons, carpenters, trading of local products, developing local shops for housing, sanitation and other materials, etc.

1.4.2 Sexual and Gender Minorities

To be truly gender-sensitive, it is necessary to address the concerns of persons of various sexual orientations including transgender persons. Transgender people are at a disadvantage in accessing resources, services and opportunities. In addition to social and economic vulnerabilities, the stigma and discrimination that they are subjected to, deprives them of many disaster mitigation/response programmes, hampering their ability to overcome the negative effects of a disaster. The approaches to disaster risk management, however, tend to overlook the needs and place of sexual and gender minorities. The institutional and legal frameworks geared towards reducing the risk of disasters are usually silent on such sections. It is only recently that a handful of case studies have highlighted the fate of sexual and gender minorities in disaster. Most of the research on disaster-related vulnerabilities faced by the sexual and gender minorities concur that they are often more severely affected by disasters because they face barriers or lack of access to the means of protection available to others. The highly marginalized conditions of sexual and gender minorities in everyday life thus places them at higher risk when confronted with disaster situations. Their vulnerabilities will be aggravated if DRR policies and practices remain blind to the social realities. There is greater likelihood of addressing the concerns of a marginalized group like transgender in disaster situations when they are specifically accounted for during implementation. For example, the need for ensuring inclusion of all such sections could be emphasized in the different phases of DRR.

1.4.3 Scheduled Castes and Scheduled Tribes

Most of the SC and ST communities tend to be poor living on marginal lands that are also highly hazard prone, such as floodplains, unsafe coastal tracts and unstable hillsides. The dwellings of scheduled caste and tribal communities are usually on the margins - be it in urban or rural areas. These settlements tend to be in the less served areas with poor availability of accurate information, lack of access to basic amenities and inadequate disaster resilient infrastructure. The housing is usually unsafe and of poor quality. In the urban areas they are usually on unsecure land tenure - often unauthorized slums. Combined with hazardous living conditions, chronic poverty and lack of amenities they are most likely to suffer the outbreak of

diseases in times of disaster. For women from the SC and ST communities, the gender-based discrimination and violence become intensified and more difficult to counter due to the caste-based social marginalization.

It must be ensured that in post disaster situations and in disaster mitigation planning and implementation activities full attention should be provided to ensure social inclusion practices in early warning, evacuation, relief support, rehabilitation and any other process so that the inherent systemic prejudices do not increase their vulnerability. For example, special efforts should be made to ensure that there are no instances of discriminatory practices in evacuation, distribution of relief material, damage assessment, allocation of housing plots, etc.

1.4.4 Children

In disaster situations children ought to be free from abuse, neglect, sexual exploitation or trafficking. Children are vulnerable due to their age and immature psychosocial understanding of the surrounding. In situations of emergency children face isolation, anxiety, trauma, some get separated from their families, loose their parent(s), face gender violence and trafficking. Some face the risk of getting recruited as child labourers. During disaster, children's bodily integrity is at risk when widespread and/or systematic violence occur. The children often face apathy leading to severe interruption of education and recreation, poor access to food and nutrition. In the post disaster situations, the *Anganwadi* and schools must open as soon as possible. In case of damage to the structures, temporary/ emergency provision must be created allowing children to access the services. The state governments may increase the food supplies so that the nutrition support can be doubled in the *Anganwadis* and primary schools. Many state governments have been doing this for a limited duration in disaster situations.

1.4.5 Elderly

The combination of extreme climate and disaster events coupled with the failure to adapt DRR responses to the ageing demographic trend has the potential to increase older people's vulnerability to risks and disasters. During disasters the elderly are usually the last in the line, likely to be lost in the crowd, and highly vulnerable. The greater vulnerability of the elderly compared to others during disasters needs to get more attention in all phases of disaster risk management. The elderly needs to be treated as priority group by proper design in the disaster management plans. The DRR planning needs to pay special attention to psychological vulnerabilities, impaired physical mobility, diminished sensory awareness, poor health conditions as well as weak social and economic limitations that severely limit the capacity of

the elderly to prepare for disasters, hinder their adaptability and constrain their ability to respond.

1.4.6 Persons with Disabilities

The Adoption of the Dhaka Declaration on Disability and Disaster Risk Management, in December 2015, acknowledges: "the importance of linking disability inclusive Disaster Risk Management with the Sustainable Development Goals on the understanding that inclusion builds the resilience of the whole of society, safeguards development gains and minimizes disaster losses".

DRR efforts must specifically address the vulnerabilities of PWD among the affected population, rather than clubbing them with others. Special attention must be paid to ensure that no PWD is abandoned after a disaster. Local community-based efforts and support system including promoting a buddy-system whereby each PWD have one or more persons in the neighbourhood who are responsible to act as a buddy to assist. It is also important for PWD to keep their helpers or buddies well informed about their special needs and for the helpers to remain in regular touch with those they are responsible for. A detailed disaster response planning at the local level must include lists of PWD in need special care. In the post disaster situation, the agencies responsible for disaster management may set up temporary facilities that are barrier-free and friendly to PWD.

Objectives of the lesson

The primary objectives of this lesson would be to:

- Inform the participants about importance and basis of social inclusion in DRR.

Duration: 45 minutes

Methodology

This session is an informative session which would involve the trainer doing most of the knowledge sharing.

Training aids

· Power-point presentation

· Flip Chart

Technical Session 2: Understanding Cyclones

Need of session

The second technical session aims to cover some components of Priority 1 of SFDRR 2015-30 i.e. Understanding Risk. The session would emphasise on letting participants understand basic postulations relevant to cyclonic systems. Understanding of basic terminologies and science behind cyclonic activities will enable the participants to decipher the information related to cyclones they hear around themselves in more perspicacious manner.

Let's consider a hypothetical situation where a news bulletin flashes

"*A Very Severe Cyclonic Storm (VSCS) will hit south-western coast of Gujarat in next 48 hours and eye of cyclone will cross Porbandar city*".

A person having knowledge of basics will interpret this bulletin as:

- the category of cyclonic storm is VSCS therefore gale will blow with intensity in range 118 – 165 kmph and,
- the maximum wrath of the event will be witnessed around Porbandar city and nearby areas.

Analysis of contemporary cyclonic events are included in the session to enable participants understand the nature of such events occurring in the Gujarat state and the risk they possess to local population and infrastructure.

As tropical cyclone cannot be tamed to reduce their adverse effects, one has to learn to live with them. Effective cyclone risk management plan requires a meticulous hazard and vulnerability analysis and planning at all levels to meet the exigencies. In this session we will cover hazards related to cyclones and vulnerability profile of Gujarat state.

Units of this session

The session is divided into 3 learning units:

Learning Unit 2.1: Basics & Science behind

Learning Unit 2.2: An Anecdote of Contemporary Cyclonic Events of Gujarat state

Learning Unit 2.3: Cyclone Hazard & Vulnerability Assessment

Objectives

- Explain to the participants the basic attributes associated with tropical cyclones like cyclone seasons, average frequency of tropical cyclones in the region.
- Convey the impacts of tropical cyclone on people, places and infrastructure and associated risk.
- To provide an idea about the hazards related to cyclone and vulnerability profile of Gujarat.

Duration

180 minutes (45 + 45 + 45) for the sessions and 15-minute spill over time from each session.

Methodology

The methodology of this session is no different from the overall methodology of the training program. Every lesson or every unit must start with a question to intrigue the participants and foster discussion. Building up on such discussions, the trainer must start his presentation or lecture.

Training aids

Power-point presentation, Flip-charts, Markers etc.

Learning Unit 2.1: Basics & Science behind

Flow of the session

The trainer may start the session by inviting the personal experience of participants about cyclones, its local nomenclature and historical incidents. It would be pertinent at this point if the trainer clarify that hurricanes and typhoons are other denominations of cyclones differentiated on regional basis, typhoons in the North West Pacific including the South China Sea, hurricanes in the North Atlantic including the West Indies and in the Caribbean Sea and the North East Pacific, the aboriginal name of Willy-Willies in North-Western Australia and tropical cyclones in the North and South Indian Ocean. Trainer may discuss huge storms that have occurred in past. Examples can be used of Super Typhoon Tip (Philippines, 1979), Hurricane Katrina (USA, 2005) and Tropical Cyclone Fani (India, 2019). Participants may be asked to investigate the difference between a tropical cyclone, a hurricane and a typhoon using map of the world, locating the geographical location where each name is used.

2.1.1 Cyclone Hazard

By this time participant would be well versed in differentiating between hazard and disaster and this opportunity can be utilised to further advocate the already mentioned fact that like all hazards, cyclonic storms are mere naturally occurring phenomena which roots when certain weather condition coincides and its only when the associated hazards (i.e. damaging wind and heavy rainfall) comes in tangency of human settlement and habitat, it havocs as a catastrophe. Trainer may further extrapolate the fact that strong onshore winds and flooding rains increases the threat of storm surge as sea levels can rise rapidly during landfall resulting in inundation of low-lying coastal areas during and after a cyclone. The heavy rainfall associated with cyclones can result in flash and broad-scale flooding. Communities who do not experience a direct tropical cyclone impact can still experience widespread flooding. At this point, the trainer should clarify here that it is not always necessary for a cyclonic storm to make landfall to consign its negative effects on the coast and there are examples of many powerful tropical cyclones that did not make it to land at all but completed their life cycle over water.

2.1.2 Terminology

A cyclone should be explained as a tropical weather system in which winds equal or exceed

‘gale force’ (minimum of 34 knot, i.e., 62 kmph) rotating around the low pressure centre in a counter-clockwise direction in the Northern Hemisphere and in a clockwise direction in the Southern Hemisphere. These are intense low pressure areas of the earth-atmosphere coupled system and are extreme weather events of the tropics.

The trainer at this juncture should be able to explain through videos how the cyclonic system incepts around a low pressure area and how through action of Coriolis force the system tends to rotate in clockwise and counter clockwise in respective earth’s hemisphere. A brief description of earth’s wind system at this point may help the participants to comprehend the same in more intelligible manner. However, the trainer should not stress on explaining the scientific facts with pin point detailing as it might take lot of time to clear all the intricacies involved in the topic and in the process it might tone off the purpose of training to be more theoretical than application. But the participants should be encouraged to do side reading and if required relevant literatures should be provided.

2.1.3 Structure of Cyclone

The structure of cyclone can be explained using the mentioned figure. The trainer should discuss what is meant by the Eye of storm, Eyewall and Rainbands. The size of each should be discussed to help participants understand the scale of a tropical cyclone.

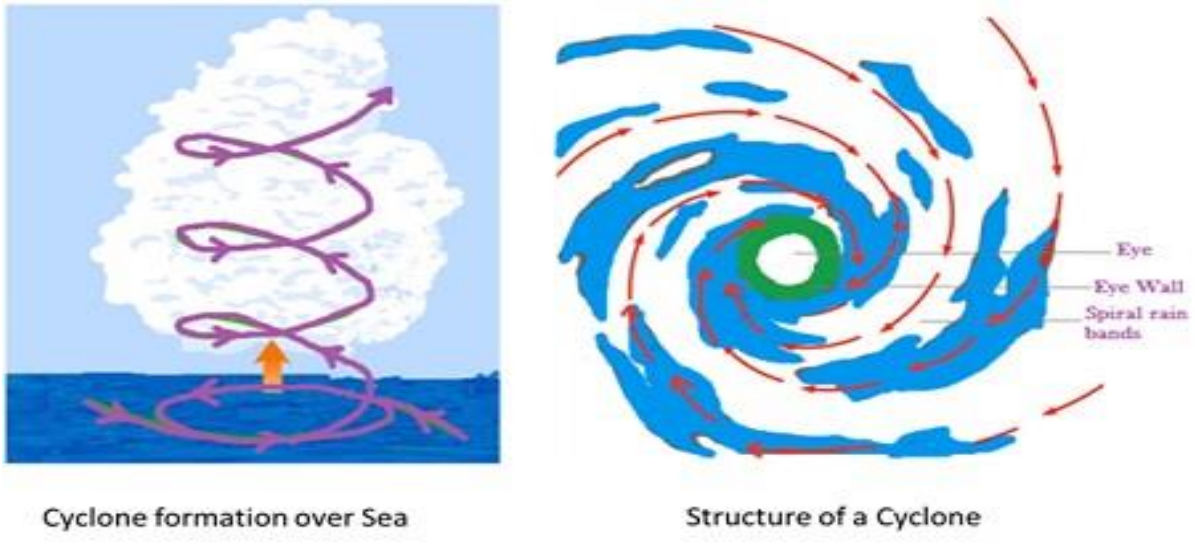


Figure 5: Structure of Cyclone

A full-grown cyclone is 150 to 1000 km diameter and 10 to 15 km height. Gale winds of 150 to 250 kmph or more spiral around the center of very low pressure area with 30 to 100 hPa below the normal sea level pressure.

***Eye of Cyclone**:* The eye is most spectacular part of a matured cyclonic storm it is found in the centre of the storm. The eye has a diameter of about 10 to 50 km, which is generally cloud free and is surrounded by thick wall clouds around it. It resembles an 'eye' when viewed in a satellite picture. 'It is a calm region with practically no rain'. It is warmer than the surrounding region.

Eyewall: Eye is surrounded by a 10-15 km thick wall of clouds where the maximum winds occur. This is the most dangerous part of a cyclonic storm. The height of the wall goes up to 10 to 15 km. The intense convection in this wall cloud region produces torrential rain, sometimes of the order of 50 cm in 24 hrs. 'The Storm surge associated with a cyclonic storm, responsible for 80% loss of human lives, occurs in the eye wall region'.

***Rain Bands**:* Rain bands within tropical cyclone are curved in orientation. The extent of rain bands around a tropical cyclone can help determine the cyclone's intensity. These bands are sometimes hundreds of kilometres long and a few kilometres wide.

Energizer: Participants can use the image of Tropical Cyclone Vayu (incepted in northern hemisphere) and Fay (incepted in southern hemisphere) to draw and label the main features of cyclone formation (include the eye, the eye wall, bands and arrows showing the rotation of the cyclone).

2.1.4 Cyclogenesis

Participants should be made aware about the meteorological conditions of North Indian Ocean basin (including Bay of Bengal and Arabian Sea) and how it acts as breeding ground of some of the world's most ferocious cyclones. As mentioned earlier that cyclonic storms incept only when certain weather conditions coincide. Listed below are some of the favourable conditions identified for the formation of tropical cyclones.

- A warm sea surface, temperature in excess of 26–27 degree centigrade.
- High relative humidity in the atmosphere.
- Atmospheric instability caused due to condensation of rising moist air.
- The presence of conditions that initiates and favours rotation of the air cyclonically.

<u>Questions to the participants</u>

1. Historical records show that Bay of Bengal witnesses more number of cyclones than the Arabian Sea. What could be the probable reasons for that?

2. Year 2019 witnessed unexpected increasingly number of cyclonic activities in Arabian Sea, is climate change is playing role in it?

Trainer should answer these question if not satisfactorily answered by the participants.

2.1.5 Cyclone Season

The North Indian Ocean cyclone season has no official bounds, but cyclones tend to form between March and December, with the peak from April to November. These dates conventionally delimit the period of each year when most tropical cyclones form in the northern Indian Ocean. **Two cyclonic storm seasons are experienced in Gujarat: May to June (advancing southwest monsoon) and September to November (retreating monsoon).**

Questions to the participants

1. Why do cyclones incept in the mentioned months only?
2. What possibilities that the monsoonal winds accelerate/decelerate the process of cyclone formation?

2.1.6 Cyclone Classification

Trainer must tell the participants that India Meteorological Department (IMD) is nodal agency for generating cyclone related warnings and the categorization followed by IMD for classification of low pressure systems in the North India Basin is based on associated maximum sustained winds at the surface level as presented in table below:

India Meteorological Department
Tropical Cyclone Intensity Scale

Category	Sustained winds (3-min average)
Super Cyclonic Storm	≥120 kt ≥221 km/h
Extremely Severe Cyclonic Storm	90–119 kt 166–220 km/h
Very Severe Cyclonic Storm	64–89 kt 118–165 km/h
Severe Cyclonic Storm	48–63 kt 89–117 km/h
Cyclonic Storm	34–47 kt 63–88 km/h
Deep Depression	28–33 kt 51–62 km/h
Depression	17–27 kt 31–50 km/h

Table 2: Classification of Cyclones

As depicted by Table, the systems with intensity level of depression and greater are coined as cyclonic disturbances.

2.1.7 Naming of Cyclone

Participants would be interested to know how the cyclonic systems are named, they always are. Trainer must ask participants to name at least 10 cyclones they have heard in recent times and ask them what are their literal meanings. Ask the participants the obvious questions like:

"Are cyclonic storms named randomly?"

"What agency is responsible for naming cyclones?"

"Why is it necessary to provide names to such events?"

If the questions are answered satisfactorily then it is fine but it is fair possibility that participants might not know answers. If so, the trainer should explain the process as follows:

Northern Indian Ocean Names (as of 2010)

Contributors	List 1	List 2	List 3	List 4
Bangladesh	Onil	Ogni	Nisha	Giri
India	Agni	Akash	Bijli	Jal
Maldives	Hibaru	Gonu	Aila	Keila
Mayanmar	Pyarr	Yemyin	Phyan	Thane
Oman	Baaz	Sidr	Ward	Murjan
Pakistan	Fanoos	Nargis	Laila	Nilam
Sri Lanka	Mala	Rashmi	Bandu	Mahasen
Thailand	Mukda	Khai Muk	Phet	Phailin

Contributors	List 5	List 6	List 7	List 8
Bangladesh	Helen	Chapala	Ockhi	Fani
India	Lehar	Megh	Sagar	Vayu
Maldives	Madi	Roanu	Mekunu	Hikaa
Mayanmar	Nanauk	Kyant	Daye	Kyarr
Oman	Hudhud	Nada	Luban	Maha
Pakistan	Nilofar	Vardah	Titli	Bulbul
Sri Lanka	Priya	Asiri	Gigum	Soba
Thailand	Komen	Mora	Phethai	Amphan

The RSMC tropical cyclones New Delhi will give a tropical cyclone an identification name from the above name list. The identification system covers both the Arabian Sea and the Bay of Bengal.

Table 3: NIO Cyclones Name

"Giving an official name to the cyclone is a recent phenomenon. Every region forms a committee of nations who are more prone to cyclonic activity and comes up with its own list

of names which is then examined by the governing body set up by the nations. For the Indian ocean region, the host nations constitute of Bangladesh, India, Maldives, Myanmar, Oman, Pakistan, Sri Lanka and Thailand and the governing body is Regional Specialised Meteorological Centre (RSMC), IMD, New Delhi. Each nation prepares a list of ten names which they think is suitable to be assigned to a cyclone. Out of these, RSMC, selects eight names from each country and accordingly prepares eight lists which consist of the names approved by the governing body."

The above table provide list of approved names from all 8 nations. According to the list, the first cyclone which occurred in the Indian Ocean in the year 2004 was named Onil. The second cyclone to hit the Indian Ocean was named Agni which was a name submitted by India. Since then, the cyclones have been named according to the list. Most of the names have been used by RSMC by now and new list is awaited (as of Jan 2020).

Objectives of the lesson

The primary objectives of this lesson would be to:

- To explain basic attributes and science behind cyclonic storm.

Duration

45 minutes depending upon the potential of the trainer to fan discussion and debate.

Methodology

We can use following activity.

A bulletin from RSMC is released which reads as follows:

TROPICAL WEATHER OUTLOOK FOR NORTH INDIAN OCEAN (THE BAY OF BENGAL AND ARABIAN SEA) VALID FOR NEXT 120 HOURS ISSUED AT 0600 UTC OF 02.10.2020 BASED ON 0300 UTC OF 02.10.2020.

BAY OF BENGAL: SCATTERED LOW AND MEDIUM CLOUDS WITH EMBEDDED INTENSE TO VERY INTENSE CONVECTION LAY OVER SOUTHWEST BAY OF BENGAL & SOUTH ANDAMAN SEA AND MODERATE TO INTENSE CONVECTION LAY OVER SOUTHEAST & WESTCENTRAL BAY OF BENGAL.

PROBABILITY OF CYCLOGENESIS DURING NEXT 120 HRS:

24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS
NIL	NIL	NIL	NIL	NIL

ARABIAN SEA: SYSTEM (1) OVER SOUTHWEST ARABIAN SEA THE LOW PRESSURE AREA OVER AREA OVER SOUTHWEST ARABIAN SEA AND ADJOINING EQUATORIAL INDIAN OCEAN LAY AS A WELL MARKED LOW PRESSURE AREA OVER THE SAME REGION AT 0000 UTC OF TODAY, THE 2ND OCT, 2020 AND PERSISTS THERE AT 0300 UTC. IT IS VERY LIKELY TO CONCENTRATE INTO A DEPRESSION DURING NEXT 12 HOURS AND INTENSIFY GRADUALLY INTO A CYCLONIC STORM DURING SUBSEQUENT 48 HOURS. IT IS VERY LIKELY TO MOVE NORTHEASTWARDS TOWARDS GUJARAT COAST DURING NEXT 72 HOURS MAKING LANDFALL NEAR PORBANDAR.

ASSOCIATED BROKEN LOW/MEDIUM CLOUDS WITH EMBEDDED INTENSE TO VERY INTENSE CONVECTION LAY OVER EQUATORIAL INDIAN OCEAN ADJOINING SOUTHWEST ARABIAN SEA BETWEEN LATITUDE 3.00N TO 10.0N & LONGITUDE 53.00E TO 60.50E

PROBABILITY OF CYCLOGENESIS DURING NEXT 120 HRS:

24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS
MODERATE	HIGH	HIGH	HIGH	HIGH

Each group of participants are required to read the bulletin carefully and answer the following questions:

1. Does the RSMC bulletin reports of any cyclonic activity in North Indian Ocean? If yes where is the cyclonic activity being reported?
2. What is the current speed of the cyclonic system and to what maximum value it can reach?
3. What would be the name given by RSMC to this cyclonic system?
4. Where is landfall of the system is expected

Training aids

Video clip, Power-point presentation, flip-charts, A4s, markers, pens etc.

Learning Unit 2.2: An Anecdote of Contemporary Cyclonic Events of Gujarat state

Flow of the session

The trainer may begin by discussing the 2019 North Indian Ocean Cyclone season. The 2019 cyclone season had witnessed some of the fierce cyclonic activity in the Arabian Sea. The oceanic basin to the west of the Indian sub-continent which usually sees low-intensity cyclonic activity had suddenly turned into a hotspot of sorts, churning out severe cyclonic storms one after the other.

Not only there is growing formation of cyclones in the Arabian Sea, these storms have also been increasingly severe in intensity. In 15 years (1998 to 2013), five extremely severe cyclones originated in the Arabian Sea. It is believed that among other factors, the ongoing climate emergency could be the reason for this abnormal activity in the Arabian Sea which is presumed to certainly aggravate the intensity as well as frequency of occurrence of cyclonic storms in the region.

Trainer can produce the following cumulative plot of all cyclonic storms of 2019 in NIO basin. It should be explained that it unusual to observe such cyclonic disturbances in Arabian Sea.

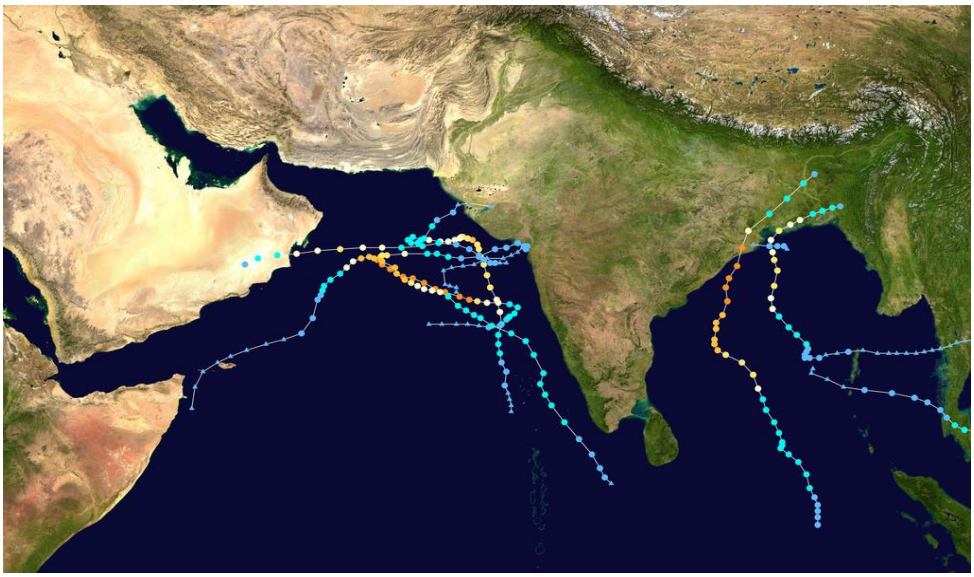


Figure 6: Cyclonic Disturbances in 2019 Cyclone Season

The trainer should specifically point out the fact that the Arabian Sea is said to be comparatively less prone to cyclonic storms than the Bay of Bengal and almost 50 percent of the storms do

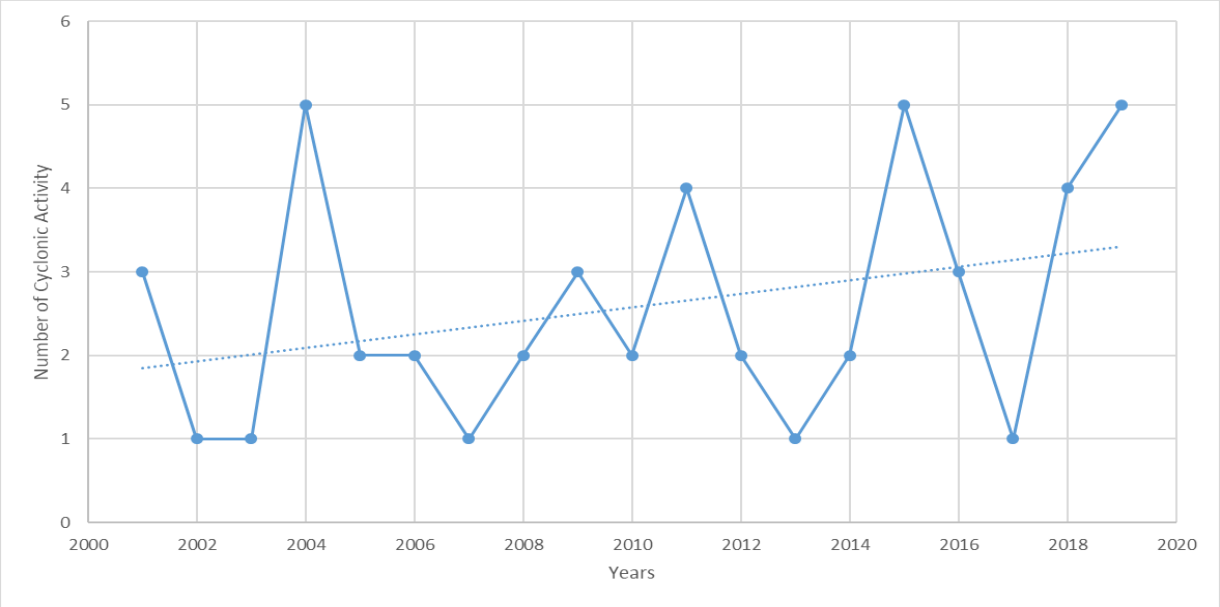
not sustain over its waters since the west-central and north Arabian Sea have a colder sea temperature than other adjacent regions. But the recent studies have led to fact that there has been rise in Sea Surface Temperature of Arabian Sea which has led to increase in number of cyclonic activity being recorded over the region. So, it is necessary that a lucid impression must be inscribed in the minds of the participants that current estimation vouch for increased cyclone risk for Gujarat in coming years.

At this point it would be nifty if the trainer seconds the details explicated above through some scientific literature. UN Intergovernmental Panel on Climate Change special report – 2019 would be ideal to this cause as it contains vivid description how the Arabian Sea is quickly responding to climate change signals and what could be possible aftermath of such reorientation. Trainer should make available the soft copies of the report to the participant and encourage them to glance it in a while.

To discuss about the increasing frequency and increasing intensity of cyclonic storms in Arabian Sea, the trainer can use the following graphs:

2.2.1 Year-wise Frequency of cyclonic activity in Arabian Sea (2001 – 2019)

The following graph has all cyclonic activity that incepted in Arabian Sea plotted against their year of inception. The trend line in Graph reveals increase in the number of cyclonic activity over the period of time.



Graph1: Year-wise Frequency of cyclonic activity in Arabian Sea (2001 – 2019)

2.2.2 Year-wise Intensity of cyclonic activity in Arabian Sea (2001 – 2019)

In order to have an idea of the intensity of cyclonic activity, weight is assigned to each cyclonic activity in following manner:

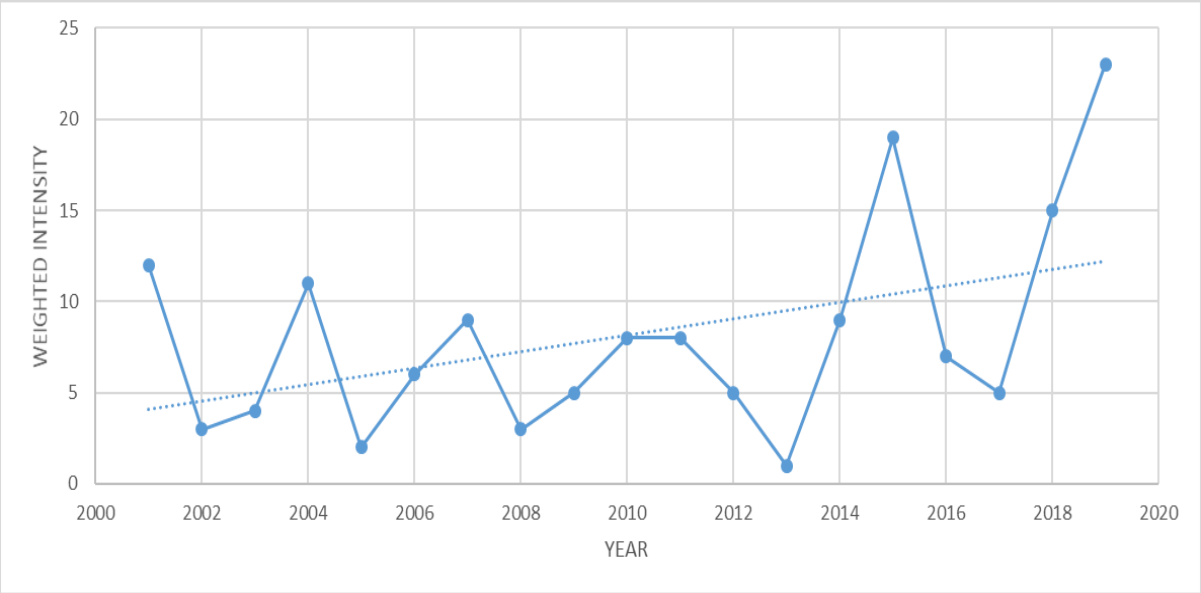
India Meteorological Department Tropical Cyclone Classification		
Cyclonic Activity	**Sustained Winds**	**Weight**
Depression (D)	31–50 km/h	1
Deep Depression (DD)	51–62 km/h	2
Cyclonic Storm (CS)	63–88 km/h	3
Severe Cyclonic Storm (SCS)	89–117 km/h	4
Very Severe Cyclonic Storm (VSCS)	118–165 km/h	5
Extremely Severe Cyclonic Storm (ESCS)	166–220 km/h	6
Super Cyclonic Storm (SuCS)	≥221 km/h	7

In order to calculate weighted intensity of cyclonic activity of each year summation of weights is performed.

Ex: Number of Cyclonic activity observed in year 2015 was 5 (Number of Deep Depression in 2015 – 2, Number of Cyclonic Storm in 2015– 1, Number of Extremely Severe Cyclonic Storm in 2015 – 2)

Therefore, Weighted Intensity of Cyclonic Activity for year 2015 is: 2*2 + 1*3 + 2*6 = **19**

Weighted intensity of all cyclonic activity of Arabian Sea between 2001 – 2019 is calculated and plotted against year of inception as follows:



Graph 2: Year-wise Intensity of cyclonic activity in Arabian Sea (2001 – 2019)

The trend line in second Graph reveals increase in intensity of cyclonic activity over the period of time.

Objectives of the lesson

The primary objectives of this lesson would be to:

- To discuss current status of cyclonic activity in Arabian Sea.

Duration

45 minutes depending upon the potential of the trainer to fan discussion and debate.

Methodology

The trainer may ask participants to use RSMC Delhi website to explore the size and damage caused due each cyclonic activity featured previously and determine how governments measure the cost of a disaster. Discuss fatalities, people injured, insurance costs, homes destroyed, etc. It might not be possible for the participants to perform the activity meticulously but the discussions done in the process will help them understanding the session ahead.

Extension: Participants consider a 'what if…?' scenario. Today we have scientists who predict tropical cyclones and the IMD is able to warn and provide advice to communities about

potential cyclones. What if these warnings had been available one or two hundred years ago? Participants use RSMC Delhi website (or alternative) to identify a cyclone that occurred in the past and think how outcomes would have been different had the cyclone occurred today? Consider fatalities, people injured, property destroyed, etc.

***In the Community*:** At this juncture Participants should start thinking about having a cyclone and/or flood drill for their office/professional premises. Having a drill scenario will help participants understand what they could do in an emergency situation and gives them the opportunity to provide input into risk management practices.

Training aids

Power-point presentation, flip-charts, A4s, markers, pens etc.

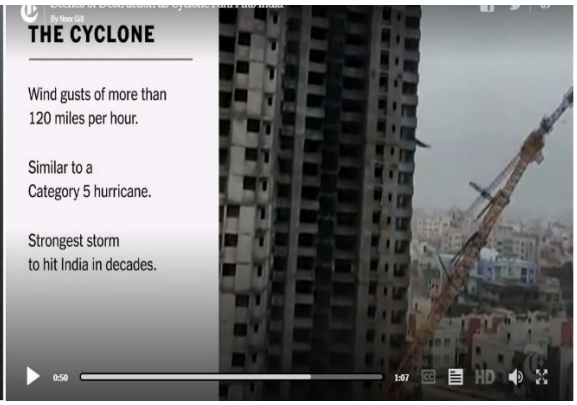
Learning Unit 2.3: Cyclone Hazard & Vulnerability Assessment

Flow of the session

Trainer should ask the participants what all hazards they have experienced during any cyclonic storm, if any and whether it is possible that the places which witness the landfall have different weather conditions than others, if so than why?

With brief introduction provided in learning unit 2.1 and by completing the activity mentioned in learning unit 2.2, participants by now would be able to decipher the hazards associated with cyclones and with what scale they hit the coastal regions. Even so, a video clip of cyclone may be played from internet and the participants be asked to point out the hazards they observe in the video clip.

Following are the stills from video that featured Cyclone Fani and hazards shown in it can be easily pointed out as heavy rainfall, destructive winds and storm surges.



2.3.1 Destructive winds: High speed winds damage residential buildings, power houses, communication towers, infirmaries, ration warehouses, bridges, conduits and vegetation owing to their violent velocities. The damage extent due to wind covers larger area than rainfall and storm surge. The impact of the passage of the cyclone eye, directly over a place is quite different from that of a cyclone that does not hit the place directly. The region lying in course of the eye passage experience frequent changes in wind direction that results in torque imposition. The torque developed can twist the building structures leading to basement failure. It causes uprooting of vegetation cover. Rest of the region bears unidirectional winds due to which leeward side is somewhat protected from action of direct winds. Violent winds also result in roof failures where roofing systems are revealed to sturdy lifting forces as shown in first snapshot of the video. Absence of roofing structure further leads to damage of walls either due to percolation of water or owing to lack of support mechanism which was initially provided by the roofing systems.

Figure 7: Cyclonic wind disrupting communication towers *(Source: SoP, RSMC Delhi)*

It is observed that wind with speed of 44 m/s disrupts telephone lines connection and causes misalignment of microwave towers. This affects local telephone and cellular services. Wind speed more than 52 m/s demolishes microwave and radio towers including large antennas and satellite communication dishes. Winds hinders rescue and logistics attempts as roadways are blocked with uprooted trees, power poles and lines, and debris falling on roads and blocking them.

Intensity	Damage expected	Action Suggested
Deep Depression 50 – 61 kmph (28-33 knots)	Minor damage to loose and unsecured structures	Fishermen advised not to venture into the open seas.
Cyclonic Storm 62 – 87 kmph (34-47 knots)	Damage to thatched huts. Breaking of tree branches causing minor damage to power and communication lines	Total suspension of fishing operations
Severe Cyclonic Storm 88-117 kmph (48-63 knots)	Extensive damage to thatched roofs and huts. Minor damage to power and communication lines due to uprooting of large avenue trees. Flooding of escape routes.	Total suspension of fishing operations. Coastal hutment dwellers to be moved to safer places. People in affected areas to remain indoors.
Very Severe Cyclonic Storm 118-167 kmph (64-90 knots)	Extensive damage to kutcha houses. Partial disruption of power and communication line. Minor disruption of rail and road traffic. Potential threat from flying debris. Flooding of escape routes.	Total suspension of fishing operations. Mobilise evacuation from coastal areas. Judicious regulation of rail and road traffic. People in affected areas to remain indoors.
Very Severe Cyclonic Storm 168-221 kmph (91-119 knots)	Extensive damage to kutcha houses. Some damage to old buildings. Large-scale disruption of power and communication lines. Disruption of rail and road traffic due to extensive flooding. Potential threat from flying debris.	Total suspension of fishing operations. Extensive evacuation from coastal areas. Diversion or suspension of rail and road traffic. People in affected areas to remain indoors.
Super Cyclone 222 kmph and more (120 knots and more)	Extensive structural damage to residential and industrial buildings. Total disruption of communication and power supply. Extensive damage to bridges causing large-scale disruption of rail and road traffic. Large-scale flooding and inundation of sea water. Air full of flying debris.	Total suspension of fishing operations. Large-scale evacuation of coastal population. Total suspension of rail and road traffic in vulnerable areas. People in affected areas to remain indoors.

Table 4: Wind speed along with associated Damage and Action Suggested (Source: IMD, 2013

The above table is taken from Standard Operation Manual of RSMC Delhi. It lists expected damage and suggested action against cyclone intensity.

2.3.2 Rainfall

Cyclonic Rainfall are widespread and generally very heavy, which results in release of excessive proportions of water within very minute span of time leading to flood like situations.

It has been observed that it can rain more than 300 mm in 24 hours during cyclones. Rains are worst nemesis for victims who became homeless in initial cyclonic activity and for the people involved in the rescue and relief operations. Rainfall disrupts and damages the life line infrastructures like water distribution, rail road connectivity and flood induced wrecks power transmission grids and communication systems. Rainfall induces widespread soil erosion as the water percolates down which causes it's softening and thereby making it vulnerable to withering. This adds to fragility of embankments and similar structure.

2.3.3. Storm surge

Storm surge is the major cause of devastation from tropical storms. Though, the deaths and destruction are caused directly by the winds in a tropical cyclone as mentioned above, these winds also lead to massive piling of Sea water in the form of what is known as storm surge that lead to sudden inundation and flooding of coastal regions.

Figure 8: Impact of storm surge caused by VSCS 'Nargis' (Source: IMD, 2013)

The surge is generated due to interaction of air, sea and land. When the cyclone approaches near the coast, it provides the additional force in the form of very high horizontal atmospheric pressure gradient which leads to strong surface winds. As a result, sea level rises. It continues to rise, as the cyclone moves over shallower waters and reaches a maximum on the coast near the point of landfall.

Question for participants

What are the similarities and differences between riverine flooding and storm surge.?

2.3.4 Cyclone Vulnerability Profile of Gujarat State

With clarity in the concept of vulnerability from previous discussion, participants by now would be able to identify the districts of Gujarat that are susceptible to cyclone risk. Trainer should make a list of identified vulnerable districts. After discussing with the participants the districts may be further categorised as high, medium and low on the basis of their degree of vulnerability. The categorization shall be validated by the successive discussions that follows ahead.

Cyclone Vulnerability analysis has been performed by IMD, Building Materials and Technology Promotion Council (BMTPC) and Gujarat State Disaster Management Authority (GSDMA). Brief summary of available vulnerability analysis is discussed ahead.

1. **Study on Cyclone hazard proneness of districts of India by IMD**

Degree of cyclone hazard proneness of districts was analysed based on the frequency and intensity of land-falling tropical cyclones along with all other hazards like rainfall, wind, and storm surge. The categorization of districts was based on the degree of proneness i.e. **P4 (Low), P3 (Moderate), P2 (High)** and **P1 (Very high**). Out of **16** coastal districts of Gujarat within 100 km from the coast line, **12** districts came under P2 (Highly Prone) and **2-2** districts came under P3 (Moderately Prone) and P4 (Low Prone) each. List of the districts with their degree of proneness is listed in Table 5.

Note: The study was conducted in the year 2015 therefore Table 5 doesn't list the proneness of Morbi, Devbhoomi Dwarka and Gir Somnath districts. The information regarding the same is listed in Table 6.

DISTRICT NAME	CATEGORY OF PRONENESS
Junagadh	P2
Ahmedabad	
Kutch	
Bhavnagar	
Jamnagar	
Anand	
Navsari	
Surat	
Bharuch	

Valsad	P2
Rajkot	
Porbandar	
Vadodara	P3
Amreli	
Surendra Nagar	P4
Kheda	

Table 5: Costal Districts of Gujarat with degree of proneness to Cyclone Hazard

Morbi	P2
Devbhoomi Dwarka	b/w P2-P3
Gir Somnath	P2

Table 6: New Costal Districts of Gujarat with degree of proneness to Cyclone Hazard

2. Gujarat Wind Hazard Map Published by BMTPC in 2015

BMTPC in 2015 published Wind Hazard Map of Gujarat State which divided the state into Very High Damage Risk Zone – B (Basic Wind Speed = 180 kmph), High Damage Risk Zone (Basic Wind Speed = 169 kmph), Moderate Damage Risk Zone – A (Basic Wind Speed = 158 kmph) and Moderate Damage Risk Zone – B (Basic Wind Speed = 140 kmph).

The Wind Hazard Map of Gujarat State is depicted in Figure 9.

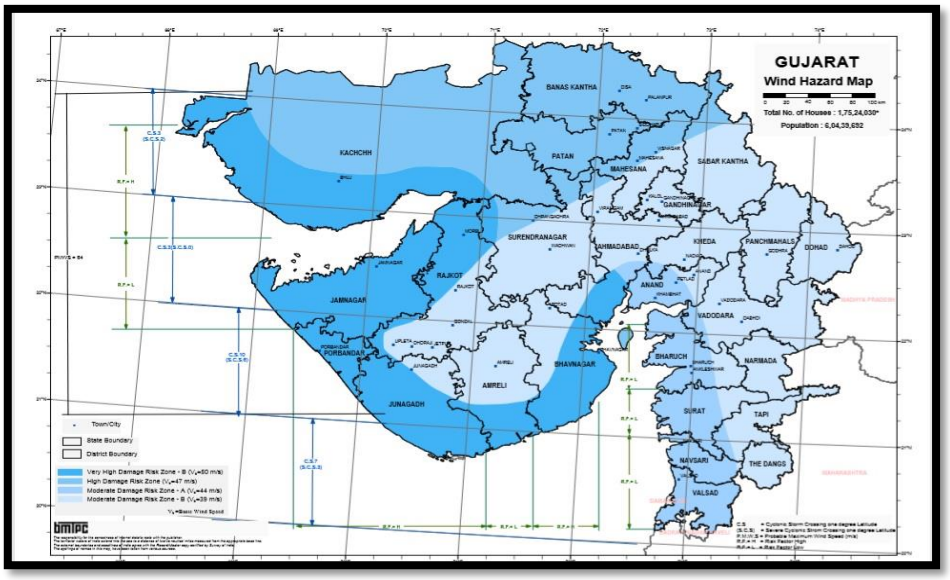


Figure 9: Wind Hazard Map of Gujarat State

3. Cyclone Occurrence Map of India published by BMTPC in 2019

BMTPC in 2019 published Cyclone Occurrence Map of India. Figure 10 depicts the same and Figure 11 reveals a zoomed out version over Gujarat state.

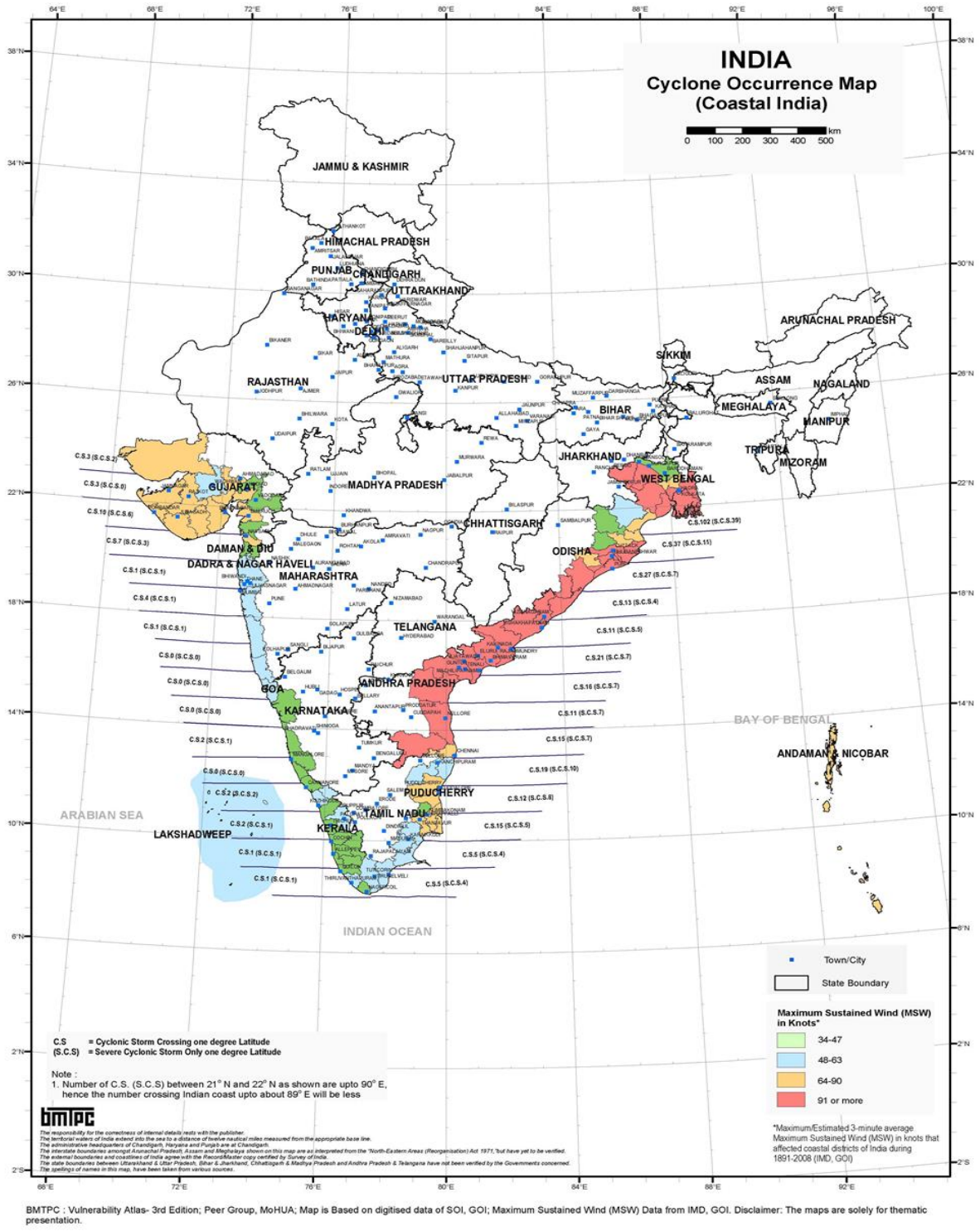


Figure 10: Cyclone Occurrence Map (BMTPC 2019)

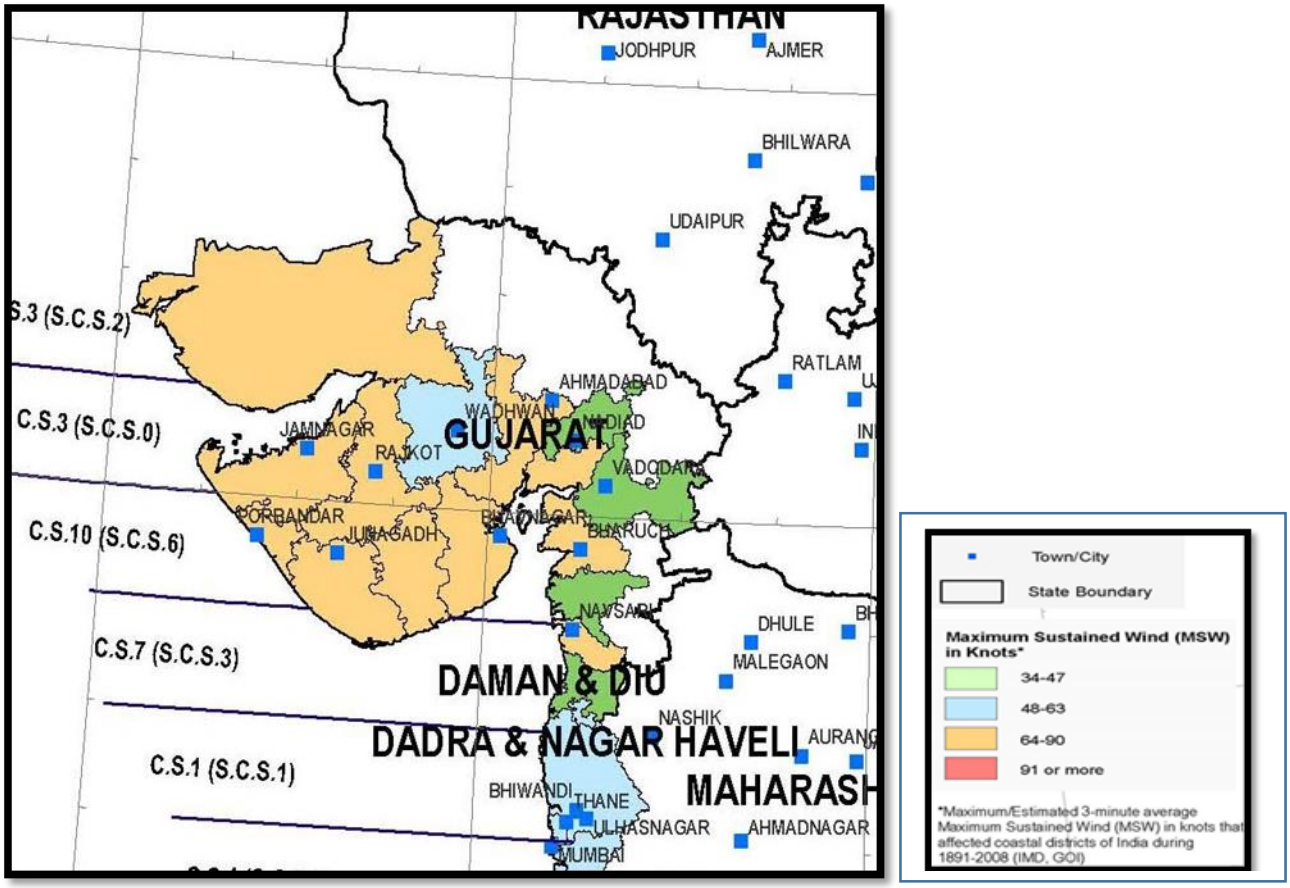


Figure 11: Zoomed out Cyclone Occurrence Map of Gujarat State (BMTPC 2019)

4. Hazard Risk Vulnerability Atlas of Gujarat state prepared in 2005 by GSDMA

The Hazard Risk Vulnerability Atlas prepared by GSDMA shows the cyclone hazard zonation along with basic wind speed at Taluka level. The *Figure 12* reveals:

- Maximum wind speed class of more than 198 kmph is observed along the Saurashtra coast, specifically in Porbandar, Jamnagar Junagadh, Gir Somnath and Dev Bhoomi Dwarka districts, which are exposed to high intensity cyclonic and storm impact.
- The 184 to 198 kmph class extends further inland to cover much of Jamnagar, part of Rajkot, Junagadh and Kutch districts.
- The 173 to 180 kmph class extends to most of Rajkot, part of Amreli and Jamnagar districts including Jamnagar, Rajkot cities and parts of Kutch.
- The 162 to 169 kmph class covers much of Saurashtra and all of Kutch.
- This is followed by the 144 to 158 kmph class that gets its swathe from Kutch through northern Saurashtra all the way to the coast of Gulf of Khambhat and southern Gujarat.
- The rest of the State falls into the 122 to 140 kmph class.

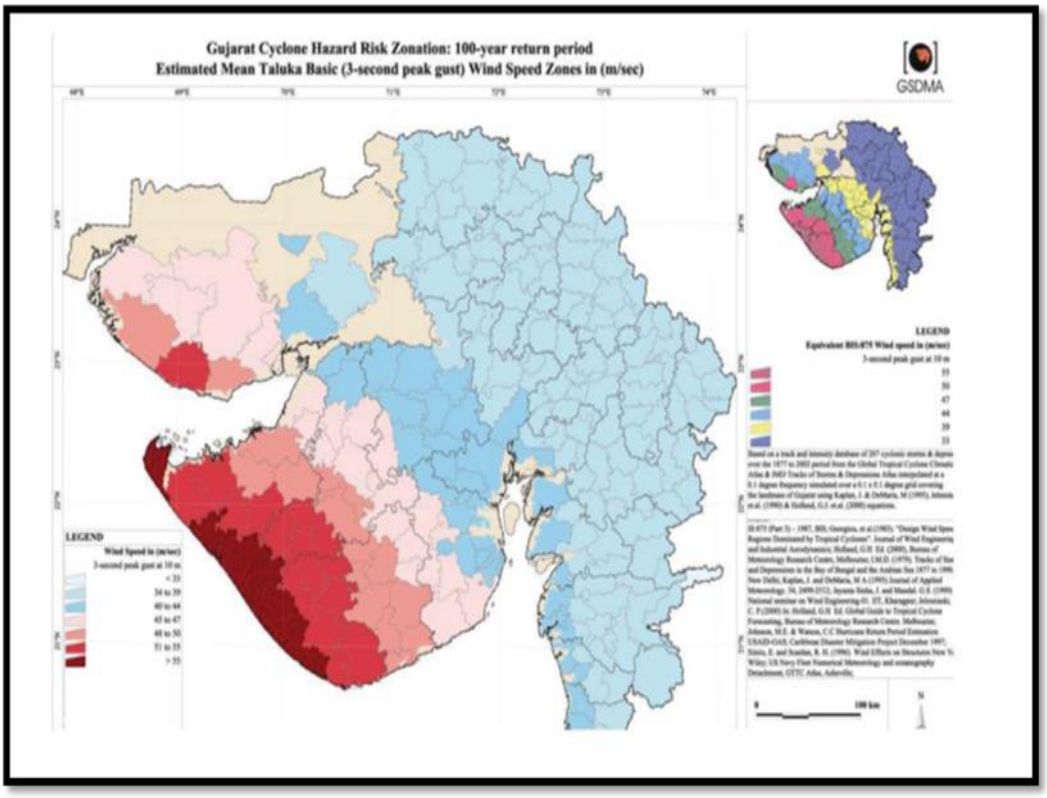


Figure 12: Cyclone Hazard Zonation 100 year returns period Map (Taluka Level)

Objectives of the lesson

The primary objectives of this lesson would be to:

- To explain hazards associated with cyclones.
- To discuss about cyclone vulnerable areas in Gujarat.

Duration

45 minutes depending upon the potential of the trainer to fan discussion and debate.

Methodology

Activities and questions have already been mentioned in the lesson. Activities should be performed and questions are needed to be answered by participants. If participants are unable to do so, assistance must be provided.

Training aids

Video clip, Power-point presentation, flip-charts, A4s, markers, pens etc.

Technical Session 3: Cyclone Risk Mitigation

Need of Session

As mentioned before cyclone hazard cannot be prevented entirely therefore, steps are needed to curtail down the negative effects to the extent possible. Cyclone mitigation is way cheaper than cyclone recovery. Cyclone mitigation encompasses the actions and planning taken before a tropical cyclone strikes to mitigate damage and injury from the storm. It includes usage of policies to make buildings and other infrastructure more resistant to the effects of tropical cyclones. Structural mitigation measures are any physical construction to reduce or avoid possible impact of hazards, which include engineering measures and construction of hazard-resistant and protective structures and infrastructure.

Coastal vegetation has been widely recognized as a natural method to reduce the energy of storm surges and tsunami waves. They could play a double role as while absorbing the force of severe storms and tsunamis, the 'bio-shield' could act as a 'carbon sink' by absorbing emissions of the greenhouse gas carbon dioxide.

The CRZ enables enhanced activities in the coastal regions and thereby promoting economic growth while also respecting the conservation principles of coastal regions. It enables precautionary measures like protecting and restoring natural bio-shields etc.

Units of the session

Learning Unit 3.1: Structural Measures

Learning Unit 3.2: Bio Shield & Coastal Zone Regulation

Learning Unit 3.3: National Cyclone Risk Mitigation Project

Objectives of the session

The primary objectives of this unit would be to:

- Explaining participants about various structural measures used for cyclone mitigation.
- Explaining about CRZ and role of bio shield in cyclone mitigation.
- Explaining about NCRMP.

Duration

150 minutes. (45 + 30+ 30) minutes for the sessions and 15-minute spill over time from each session.

Methodology

The methodology of this session is no different from the overall methodology of the training program. Every lesson or every unit must start with a question to intrigue the participants and foster discussion. Building up on such discussions, the trainer must start his presentation or lecture.

Training aids

Power-point presentation, Flip-charts, Markers etc.

Learning Unit 3.1: Structural Measures

Flow of Session

Severe cyclones not only wreak colossal damage to non-engineered buildings such as thatched roofs, tiled houses, etc., but also cause heavy damage to semi-engineered buildings such as schools, workshops and factory buildings, etc., and well-engineered structures including communications, transmission and windmill towers. Some of the typical failures of buildings and structures during cyclones were observed during post-cyclone damage surveys conducted by the Structural Engineering Research Centre, Chennai, and IMD on several occasions.

An important aspect of cyclone risk reduction is to ensure availability of **adequate numbers of shelters, community centres/school buildings, places of worship, etc., which can be utilised for moving people from vulnerable areas to safer places**. Besides this, the structural safety of various **critical infrastructure such as roads/culverts/bridges, communication and transmission towers, power houses, water towers and hospitals** needs be ensured, so that the communication system at all levels remains useable, the electricity and water supply systems do not break down and adequate medical attention is possible.

It is believed that design and maintenance considerations are the main focal points to be addressed which would improve the cyclone preparedness. This will cover:

(i) buildings, including multi-purpose cyclone shelters;
(ii) road links, culverts and bridges;
(iii) canals, drains, and surface water tanks, etc.;
(iv) saline embankments;
(v) communication towers and power transmission networks.

It is very important to provide safe shelters to protect human life at the time of cyclones. Many cyclone shelters constructed earlier were not connected by all-weather roads with nearby habitats from where affected people need to be shifted during emergency evacuation.

There is a need to improve the existing road network and provide at least one link road, in all-weather conditions, for each village that is accessible during cyclone or flooding periods as well. The importance of coastal canals need not be over-emphasised as it serves as an

alternative to road communication in the event of a cyclone or flood. Failure of even well-engineered structures such as communication and transmission towers during past cyclones brings the importance of the structural safety of such structures to the forefront.

Simple design and construction guidelines to improve the cyclonic resistance of various buildings and structures have been brought out and they are incorporated in the Indian Standard Code of Practice, viz., IS: 15498- 2004, '"**Design and Construction of Buildings and Structures in Cyclone Prone Regions'**". A document was drafted to detail out the '"**Guidelines for Mitigative Measures Related to Cyclones**'" at IIT Roorkee for the GSDMA as part of a World Bank sponsored project.

In a nutshell, it may be said that know-how is available in India for speeding up cyclone disaster mitigation activities. The basic mechanism is also available, by and large, to take up these activities. The need is to further strengthen and activate the machinery backed up with adequate resources.

3.1.1 Buildings: Cyclone Shelters

(i) Loss of life due to cyclones is largely due to the lack of an adequate number of safe shelters which can withstand the fury of cyclones, including wind and storm surge.

(ii) Circular cyclone shelters were initially constructed but they deteriorated very soon due to lack of proper usage and maintenance. While most of them have been dismantled, others that remained are in a dilapidated condition, unfit for use.

(iii) Shelters constructed at a later stage were designed differently but were largely meant to be used only as cyclone shelters. It is only in recent years that the concept of multi-purpose cyclone shelters has come into vogue.

(iv) Apart from the cyclone shelters, many other buildings have been used to provide shelter to people evacuated from affected areas. These include schools, places of worship, community halls, etc. An inventory of all such available buildings is generally maintained by the district administration. However, with more multi-purpose cyclone shelters being constructed, the relief operations can get streamlined.

3.1.2 Road Links, Culverts and Bridges

A 25 km band of the coastal stretch may be taken as most vulnerable to cyclones, with some scope for variation because of local topography and other factors. It has been observed that many of the coastal villages do not have all-weather approach roads. Therefore, all-weather

access roads need to be provided to all habitations/villages. There is need for a regular mechanism to review the conditions of roads, culverts and bridges for every quarter or pre- and post-cyclone season/ monsoon period by the DM departments. A reliable road network connecting vulnerable areas to select nodal centres from where transport, relief and rehabilitation operations can be coordinated in the event of a natural disaster will be an essential preparedness measure.

3.1.3 Canals, Drains, Surface Water Tanks

The coastal areas usually have tidal creeks, river mouths with natural delta formation and a network of canals and drains – both natural and man-made, except where there is a hilly terrain. The network of canals and drains as also the river mouths have very significant effect in alleviating the impact of cyclone by receiving, accommodating and returning back surge waters to the sea. However, these are usually very badly neglected. Canals and drains get choked by weeds, silting, sand and encroachments. These remain unattended for decades together, sometimes for over a century.

The main drains and canals are fed by primary and tertiary canals. Standard Operating Procedures (SOPs) have to be put in place in respect of their maintenance in totality. Their condition has to be assessed periodically, particularly in the pre-disaster and post-disaster seasons. It may be necessary to widen drains or even have diversion canals, wherever required, to cope with flooding due to heavy rains associated with cyclones and storm surges. It may be noted that surface water tanks also serve to lower the impact of cyclones and storm surges. But poor maintenance of these tanks lowers their storage capacity due to silting. Therefore, it is essential that desilting of surface water tanks is regularly undertaken.

3.1.4 Saline Embankments

Coastal areas are generally densely populated. It is estimated that about 32 crore people, which accounts for almost a third of the country's total population, are vulnerable to cyclone related hazards. These areas are vulnerable to inundation of various degrees depending upon the frequency of cyclone, coastal bathymetry and coastal inland topography of the place. Cyclone related rainfall and storm surges are mainly responsible for such coastal inundation that at times cause enormous loss of life and property. Construction of 'saline embankments' is one of the structural mitigation measures to protect habitation, agriculture crop and important installations along the coast. The protection of coastal areas by constructing saline embankments is already

in vogue in most of the maritime states. For instance, Orissa had a total of about 1517 km of saline embankments before the super cyclone of 1999, which were severely damaged by that cyclone. West Bengal (3500 km embankments) and other states also had saline embankments constructed along their coast in the past.

These embankments are designed to protect the coastal population and property from regular phenomena such high tides, low intensity cyclone and normal rainfall but, are not adequate or suitable to protect the coast from high intensity cyclones generating high surge. Moreover, existing embankments frequently get damaged and are destroyed due to regular impact of tides and weather and inadequate maintenance. Properly designed saline embankments need to be constructed after detailed survey of existing embankments and assessing vulnerability and requirements. Regular maintenance of such embankments needs to be institutionalised.

3.1.5 Communication Towers and Power Transmission Networks

The coastal areas are generally endowed with a large network of communication and power transmission lines in keeping with the comparatively higher requirement. Lessons have to be learnt from past experience of devastation due to cyclones in different states. Communications and power transmission towers needs to be designed on the basis of 100-year return period wind velocity of cyclone.

It is necessary to establish fail-safe communication rooms in all cyclone shelters and other identified relief/rehabilitation centres (schools, community halls and places of worship, etc.) as a part of last mile connectivity for receiving early warning messages and for organizing necessary relief and rehabilitation efforts.

3.1.6 Relevant IS codes

Various BIS codes are already developed, which needs be referred to for the construction of different structures such as cyclone shelters, embankments, roads, bridges, canals, drains, transmission towers, etc. The relevant B IS Codes are:

1. IS 456: 2000 Plain and Reinforced Concrete – Code of Practice (reaffirmed 2005).
2. IS 875: Part 3: 1987 Code of Practice for Design Loads (other than Earthquake) for Buildings and Structures - Part 3: Wind Loads (reaffirmed 2003).
3. IS 800: 1984 Code of practice for general construction in steel (reaffirmed 2003) IS 8237: 1985 Code of Practice for Protection of Slope for Reservoir Embankment (reaffirmed 2002).

4. IS 10635: 1993 Freeboard requirements in embankment dams – guidelines (reaffirmed 2003).
5. IS 11532: 1995 Construction and maintenance of river embankments (levees) – guidelines (reaffirmed 2005).
6. IS 12094: 2000 Guidelines for Planning and Design of River Embankments (Levees) (reaffirmed 2005).
7. IS 12169: 1987 Criteria for design of small embankment dams (reaffirmed 2002).

Objectives of the lesson

The primary objectives of this lesson would be to:

- To discuss about various structural measures involved in cyclone mitigation.
- To discuss about relevant statutory codes in structural measures for cyclone mitigation.

Duration

30 minutes depending upon the potential of the trainer to fan discussion and debate.

Methodology

This is an informative session.

Training aids

Power-point presentation.

Learning Unit 3.2: Bio shield & Coastal Zone Regulation

Flow of Session

3.2.1 Bio Shield

Nature has provided biological mechanisms for protecting coastal communities from the fury of cyclones. Mangrove forests safeguards the ecological security of coastal areas and the livelihood security of fishing and farming communities. Recently the ecological, economic and social value of mangroves has increased because of projected rise in sea level due to anticipated global warming.

In addition to mangroves that grow only in the estuarine environment, there are many other tree species which constitute as a valuable component in safeguarding the ecological security of coastal regions which are known as coastal shelterbelts. Shelterbelts are non-mangrove strips of vegetation composed of trees mostly casuarina & cashew and shrubs grown along the coasts to protect coastal areas from high velocity winds. The mangroves and shelterbelt are powerful tool to mitigate the impact of strong cyclonic activity. They also help in checking the soil erosion and inward sand drift, thereby protecting cultivated fields, houses and homesteads near the coast.

Mangroves and Shelterbelt reducing cyclone risk

Mangroves and Shelterbelts contribute to reducing loss of life and damage to property from storms and cyclones as they reduce the impacts of waves, storm surges and high winds.

- **Waves:** Mangroves and Shelterbelt rapidly diminish the height of wind and swell waves. Even during relatively large storm surges the leaves and branches of the forest canopy will help to reduce wave energy providing the trees are tall enough.
- **Storm surges**: Where mangroves are extensive they are able to reduce storm surge water depths as the surge flows inland. While storm surge depths may only be reduced by 5-50 cm per kilometre width of mangroves, nevertheless a small reduction in water level can already greatly reduce the extent of flooding in low lying areas behind the mangroves.
- **Debris movement:** Debris movement can also be reduced by mangrove as the complex network of roots and branches can serve to trap even large moving objects.

- **High wind speeds:** The dense mangrove forest and shelterbelts canopies also reduce wind speeds locally. This prevents further development of wind and swell waves in and immediately behind the mangroves, potentially reducing damage to nearby infrastructure.
- **Aftermath:** In the aftermath of a storm, mangroves and shelterbelts enhance recovery by providing food, fuel wood and construction wood.

3.2.2 Studies of role of shelterbelts and mangroves in cyclone risk mitigation

Following is the brief summary of the studies that were conducted to reveal the role of bio shield (mangroves and shelterbelts) in mitigating cyclone risk.

Study 1: Role of forests and trees in protecting coastal areas against cyclones

Fritz et. al 2007 performed a study to identify the role of mangroves in cyclone risk mitigation in 1999 Orissa Super Cyclonic Storm. Three situations were identified: (1) A village in the shadow of mangroves; (2) a village not in the shadow of mangroves and with no embankment; and (3) a village not in the shadow of mangroves, but with an embankment on the seaward side. The study revealed that the damage attributed to the cyclone was more extensive in the village further away from the mangrove shadow. The village, with no mangrove cover and no embankment, suffered the highest level of field inundation. The village, which was in the shadow of mangrove forest and had minimal embankment around it, suffered the least.

Study 2: Socio-economic and environmental impacts of casuarina shelterbelt in the Chittagong coast of Bangladesh

The study found that the casuarina shelterbelt reduced wind speed, increased the size of sand dunes, improved the aesthetic value, increased the protection facilities against cyclones, and enhanced the attractiveness of the beach for tourism. The study found the casuarina shelterbelt as a successful initiative against cyclones. It enhanced protection facilities significantly against cyclonic storm from low level to moderate level.

Study 3: Mangroves as protection from storm surges in Bangladesh

Dasgupta et al. 2017 confirmed the protective role of mangroves during cyclones and highlighted that the extent of reduction of the risk depends on mangrove species, width of mangrove area as well as the density of planting. Among the species of mangrove considered in the analysis, Sonneratia apetala caused maximum friction and hindrance to water flow caused by the storm surges.

Study 4: Cyclone Hudhud: Strategies and Lessons for Preparing Better & Strengthening Risk Resilience in Coastal Regions of India, 2015

This report was compiled by NDMA (National Disaster Management Authority) as an effort to document good practices and identify various issues which may need to be considered for effective and coordinated response for cyclone disaster risk management. This document takes into account the efforts made by the States of Andhra Pradesh and Odisha in managing Cyclone Hudhud in 2014. The report mentions that mangroves led to protection of coastal areas from storm surge and recommended that there is acute need to maintain more shelterbelts and mangrove plantations in coastal areas.

Study 5: Role of Mangroves in mitigating cyclone Gaja's impact

Muthupet in Tiruvarur district was among the coastal towns that faced the wrath of Cyclone Gaja. But considering the extent of the damage elsewhere, this town seems to have been spared the worst, thanks to its mangrove forests. The forest functioned as a shield and curtailed the velocity of the wind. Known as Alaiyathi Kadugal (forests that cool the waves), mangrove forests are spread across 12,000 hectares and are populated by six plant species. Since the force of the wind was deflected by the mangrove forests, it couldn't uproot coconut trees in Muthupet in the same manner as it did in other areas. It is believed that if the mangrove bio-shield was not there, point Calimere (wildlife and bird sanctuary) would have been completely destroyed.

Study 6: Study of Coastal Shelterbelt plantation in cyclone mitigation in the Coastal regions of Orissa

The MOEF, GOI under the scheme of Integrated Afforestation and Eco-development Project Scheme, had taken up afforestation activity in the coastal area with suitable tree species to form a shelterbelt along the coast line to mitigate the impact of strong cyclonic winds. The Govt. of Orissa undertook shelterbelt plantation in the district of Jagatsinghpur. The district which was previously severely affected by the cyclone benefited from the coastal shelterbelt plantation. The study recorded ensured reduced loss from any such activity.

3.2.3 Coastal Regulation Zone

Coastal areas are endowed with a wide range of coastal eco-systems, which are characterised by distinct biotic and abiotic processes. Coastal areas are also places that experience natural hazards like floods, cyclones and tsunamis. While it is not humanly possible to prevent or even

control these phenomena, a holistic approach to Coastal Zone Management, including precautionary measures like proper planning of the coastal areas for locating communities and infrastructure in safer areas, protecting and restoring natural bio-shields etc., can minimise loss of life and damage to property to a considerable extent. Such measures have to be truthfully addressed with the participation of all stakeholders.

CRZ are notified by the Government of India in 1991 for the first time. Under this coastal area have been classified as CRZ-1, CRZ-2, CRZ-3, CRZ-4. And the same were retained for CRZ in 2003 notifications as well.

CRZ-1: These are ecologically sensitive areas these are essential in maintaining the ecosystem of the coast. They lie between low and high tide line. Exploration of natural gas and extraction of salt are permitted

CRZ-2: These areas are urban areas located in the coastal areas.

CRZ-3: Rural and urban localities which fall outside the 1 and 2. Only certain activities related to agriculture even some public facilities are allowed in this zone

CRZ-4: This lies in the aquatic area up to territorial limits. Fishing and allied activities are permitted in this zone. Solid waste should be let off in this zone. This zone has been changed from 1991 notification, which covered coastal stretches in islands of Andaman & Nicobar and Lakshadweep.

Salient Features of Notification 2018

Floor Space Index Norms Eased: In CRZ, 2011 Notification, for CRZ-II (Urban) areas, Floor Space Index (FSI) was frozen as per 1991 Development Control Regulation (DCR) levels. In the CRZ, 2018 Notification, it has been decided to de-freeze the same and permits FSI for construction projects to enable redevelopment of these areas to meet the emerging needs.

New Categories for densely populated rural areas: For CRZ-III (Rural) areas, two separate categories have now been stipulated as below:

- **CRZ-III A -** These are densely populated rural areas with a **population density of 2161 per square kilometre as per 2011 Census.**
  Such areas will have a No Development Zone (NDZ) of 50 meters from the High Tide Line as against 200 meters from the High Tide Line stipulated in the CRZ Notification, 2011.

- **CRZ-III B** - Rural areas with a **population density of below 2161 per square kilometre as per 2011 Census.** Such areas shall continue to have an NDZ of 200 meters from the HTL.

Tourism infrastructure in coastal areas: Temporary tourism facilities such as toilet blocks, change rooms, drinking water facilities etc. have now been permitted in Beaches. However, a minimum distance of 10 m from HTL should be maintained for setting up of such facilities.

CRZ Clearances streamlined: Only such projects/activities, which are located in the CRZ-I (Ecologically Sensitive Areas) and CRZ IV (area covered between Low Tide Line and 12 Nautical Miles seaward) will be required to be cleared by Ministry of Environment, Forest and Climate Change. For, the CRZ-II (urban) or CRZ III (rural) areas, the CRZ clearance will be considered at the state level by the Coastal Zone Management Authority (CZMA).

No Development Zone (NDZ) of 20 meters for Islands: For islands close to the mainland coast and for all Backwater Islands in the mainland, NDZ of 20 m has been stipulated.

Ecologically Sensitive Areas have been accorded special importance: Specific guidelines related to their conservation and management plans have been drawn up as a part of the CRZ Notification.

Pollution abatement: In order to address pollution in Coastal areas treatment facilities have been made permissible activities in CRZ-I B area (the area between the Low tide line and High tide line) subject to necessary safeguards.

Defense and strategic projects are exempted from regulations.

Benefits

1. **Economic Growth:** The proposed CRZ Notification, 2018 will lead to enhanced activities in the coastal regions thereby promoting economic growth while also conserving the coastal regions.
2. **Boost to Tourism and Employment:** It will result in significant employment generation and in better living standard and add value to the economy of India.
3. **Boost to Conservation Efforts:** The new notification is expected to rejuvenate the coastal areas while reducing their vulnerabilities.

4. **Boost to Housing:** De-freezing FSI Norms will add to creating additional opportunities for affordable housing. This will benefit not only the housing sector but the people looking for shelter.

Objectives of the lesson

The primary objectives of this lesson would be to:

- To discuss about role of bio shields in cyclone mitigation & associated studies
- To discuss latest developments in coastal zone regulations.

Duration

30 minutes depending upon the potential of the trainer to fan discussion and debate.

Methodology

This was an informative session.

Training aids

Power-point presentation.

Learning Unit 3.3 National Cyclone Risk Mitigation Program

Flow of Session

Ministry of Home Affairs (MHA), Government of India conceptualized a comprehensive National Cyclone Risk Mitigation Strategy through consultation, ending with a National workshop, "**Developing Strategy for Cyclone Mitigation in the Coastal and Island Regions of India**", held on 4th and 5th of February, 2003 in the Administrative Training Institute, Kolkata. This strategy is a part of the Multi-Hazard Mitigation Plan being developed at the National level. To give effect to strategic interventions, the Ministry of Home Affairs decided to put in place the "National Cyclone Risk Mitigation Project". After the formation of National NDMA, management of the project was transferred to NDMA in September, 2006. The overall objective of the National Cyclone Risk Mitigation Project ('NCRMP') is to minimize vulnerability to cyclones and make people and infrastructure disaster resilient in harmony with conservation of the coastal eco-system in the cyclone hazard prone States and Union Territories of India.

3.3.1 Components of National Cyclone Risk Mitigation Program (NCRMP)

1. **Component A:** Improvement of early warning dissemination system by strengthening Last Mile Connectivity of cyclone warnings and advisories from source/district/sub-district levels to community.
2. **Component B:** Cyclone risk mitigation investment which has identified nine subcomponents like construction of cyclone shelters, construction of saline embankments, mangrove plantations, shelterbelt plantations, etc.
3. **Component C:** Technical assistance for hazard risk management and capacity building.
4. **Component D:** Project management and institutional support.

The NDMA under the aegis of MHA is implementing the project in collaboration with the State Governments and the National Institute for Disaster Management in the first phase. The project costing Rs. 1496.71 crores (US $ 308.60 million) is funded by the World Bank (International Development Association Credit) as an Adaptable Program Loan to be scaled up to US $ 969 million for covering the other States and UT's based on their readiness to implement the project. This project is proposed as a Centrally Sponsored Scheme with 75% contribution (for Component B of the Project) by the Central Government, as grant-in-aid and a matching 25%

contribution by State Governments. Other components will be completely funded by the Central Government, as grant-in-aid. The project is currently being implemented in the states of Andhra Pradesh and Orissa

The Project has identified 13 cyclone prone States and Union Territories (UTs), with varying levels of vulnerability. These States/UT have further been classified into two categories based on the frequency of occurrence of cyclone, size of population and the existing institutional mechanism for disaster management. These categories are:

Category I: Higher vulnerability States i.e. Andhra Pradesh, Gujarat, Odisha, Tamil Nadu and West Bengal.

Category II: Lower vulnerability States/UTs i.e. Maharashtra, Karnataka, Kerala, Goa, Pondicherry, Lakshadweep, Daman and Diu, Andaman and Nicobar Islands.

3.3.2 Mission Statement

The National Cyclone Risk Mitigation Project seeks to minimize vulnerability in the cyclone hazard prone states and Union Territories of India and make people and infrastructure disaster resilient, in harmony with conservation of coastal ecosystems.

3.3.3 Key Objectives

The Project aims to fulfil its mission by undertaking following structural and non-structural measures,

1. Early warning and communication system by improving the Last Mile connectivity.
2. Construction and sustainable maintenance of Multi-Purpose Cyclone Shelters, Improved access and evacuation to these and already exiting Multi-Purpose Cyclone Centre (MPCS) and habituations through construction of roads and bridges, construction of coastal embankments in selected places for protection against storms, flooding and storm surge in high risk areas and underground cabling.
3. Enhanced capacity and capability of local communities to respond to disasters, and Strengthening Disaster Risk Mitigation capacity at Central, State and Local levels in order to enable mainstreaming of risk mitigation measures into the overall development agenda.

3.3.4 Implementation Arrangements

NDMA will be responsible for overall management and co-ordination of the Project. A Project

Management Unit (PMU) will be set up at NDMA for this purpose headed by Project Director and having administrative staff and other expert and specialist will relevant experience. Similarly, Project Implementation Units (PIUs) will be set up in the Revenue Department in Andhra Pradesh and at Odisha State Disaster Management Authority in Odisha for implementation of various components of the project.

A Project Steering Committee headed by Secretary NDMA has been set up at the National level to oversee the implementation and for overall monitoring of the Project. Another committee headed by Secretary (Home) Govt. of India known as Project Oversight Committee has been set up for inter-ministerial co-ordination of the Project.

Project Steering Committee headed by the Chief Secretary of the State Govt. have also been set up for the participating states of A.P. and Odisha for effective monitoring of the project and looking into and solving the inter-departmental and co-ordination issues. All the Committees are meeting regularly in endeavour for improved implementation of the Project.

PMU set up for Phase-I in NDMA is also functioning for Phase-II. State Project Implementation Units (SPIUs) has been set up at State level and the details of SPIUs for each State under Phase-II are as under:

- **Maharashtra:** State PIU is housed with the State Relief & Rehabilitation Department and will be the nodal agency in charge of implementation. The Underground Cabling subcomponent will be implementation by Maharashtra State Electrical Distribution Ltd, MPCS subcomponent will be implemented by the Public Works Department and the Saline Embankments subcomponent by the State Water Resources Department.
- **West Bengal:** State PIU is housed within the West Bengal Department of Disaster Management and will be the nodal agency in charge of implementation.
- **Kerala:** State PIU is housed within the Kerala Department of Revenue and Disaster Management Department and will be the nodal agency in charge of implementation. The MPCS will be implemented by Nirmiti Kendras.
- **Karnataka:** State PIU is housed within Revenue Department (Disaster Management) and will be nodal agency in charge of implementation.
- **Goa:** State PIU is housed within Revenue Department and implemented through Water Resources Department.
- **Gujarat:** State PIU is housed within GSDMA and will be nodal agency in charge of implementation.

Objectives of the lesson

The primary objectives of this lesson would be to:

- To understand aims, objectives and institutional arrangement of NCRMP especially in Gujarat.

Duration

30 minutes depending upon the potential of the trainer to fan discussion and debate.

Methodology

This was an informative session.

Training aids

Power-point presentation.

Technical Session 4: Preparedness & Cyclone Warning System

Need of the session

Preparedness refers to the state of being prepared for specific or unpredictable situations. It is a continuous cycle of planning, organizing, training, equipping, exercising, evaluating and improving capabilities to ensure effective coordination to respond and to recover from natural and man-made disasters. In preparedness phase, disaster managers develop plans of action to manage and improve upon the necessary capabilities or infrastructure at hand.

Tropical cyclone warnings and watches are two levels of alert issued by national weather forecasting bodies to areas threatened by the imminent approach of a tropical cyclone. These warnings enable local population and civil authorities to make appropriate preparation for the cyclone, including evacuation of vulnerable areas where necessary. **The success of an early warning system depends both on technical processes that turn meteorological data into warnings, and on human factors that transform warnings into actions.**

Objectives of the session

The primary objectives of this unit would be to:

- Explaining Preparedness steps required in wake of cyclonic storm.
- Explaining cyclone warning generation and dissemination system in India.

Units of the session

Learning Unit 4.1: Cyclone Preparedness Task and Responsibility for Gujarat

Learning Unit 4.2: Cyclone Warning Generation & Dissemination

Duration

105 minutes. (30 + 45) minutes for the sessions and 15-minute spill over time from each session.

Methodology

The methodology of this session is no different from the overall methodology of the training program. Every lesson or every unit must start with a question to intrigue the participants and foster discussion. Building up on such discussions, the trainer must start his presentation or lecture.

Training aids

Power-point presentation, Flip-charts, Markers etc.

Learning Unit 4.1: Cyclone Preparedness Task and Responsibility for Gujarat

Flow of Session

Preparedness refers to the state of being prepared for specific or unpredictable situations. It is a continuous cycle of planning, organizing, training, equipping, exercising, evaluating and improving capabilities to ensure effective coordination to respond and to recover from natural and man-made disasters. In preparedness phase, disaster managers develop plans of action to manage and improve upon the necessary capabilities or infrastructure at hand. Common Cyclone preparedness measures include:

- Communication plans with easily understandable terminology and methods.
- Proper maintenance and training of cyclone disaster services, including mass human resources such as community based disaster response teams.
- Development and exercise of cyclone warning methods combined with cyclone shelters and evacuation plans.
- Stockpiling and inventory, management of essential supplies and equipments.
- as per the current thinking and policy of the State Government, disaster management is a continuous and an integrated activity. As such, the focus has shifted from response and relief activities in post disaster scenario to prevention and preparedness for all likely disasters which may affect the State.

4.1.1 Emergency preparedness measures for cyclone disaster for Gujarat

S. No.	Task	Responsibility	Activity
1	Development of Policies and Guidelines	GSDMA Revenue Dept/COR	Develop appropriate guidelines to ensure the implementation of the cyclone preparedness measures.
2	Development of Cyclone Preparedness and Response (P&R) Plan	Revenue Dept/COR	Prepare, test and update State Cyclone P&R Plan periodically.
		GSDMA	Provide guidelines and help to all concern departments to prepare Cyclone P&R Plan.
		All Line Departments	To prepare, test and update department level Cyclone P&R Plan.
3	Establishment of Cyclone forecasting and warning mechanism	IMD	○ Issues daily weather bulletins and weather forecasts. ○ Issues 4- Stage warning to State Government, Port Authority, Fisheries Officials and other key depts. in case of cyclone formation.

S. No.	Task	Responsibility	Activity
		GSDMA	Analyse the existing early warning and dissemination system, identify gaps and suggest advance system.
		GMB	Maintain effective coordination and liaison with CWC, Ahmedabad.
4	Ensure necessary safety measures along the Coastal areas	Revenue Dept/COR	○ Review the safety measures taken by concerned dept. before the cyclone season. ○ Establish continuous communication links with IMD, (ACWC and CWC) for further verification of weather condition during the cyclone season. ○ Review and monitor an implementation of Coastal Zone Regulation. ○ Make prior arrangements with armed forces so that the people can be rescued in case of cyclone event.
		GMB	○ Conduct awareness programs regarding the safety measures that need to be taken in case of cyclone and the meaning of the different hoisted signals. ○ Maintain effective coordination and liaison with CWC, Ahmedabad and their communication network during cyclone season.
		Fisheries dept. Port & Transport dept.	○ Fisheries officials should be well equipped and ready for search and rescue of fishermen out of sea during cyclone situation. ○ Advance planning for getting the help of coast guards in search and rescue operations should be made.
		Tourism Dept	○ Visitors/tourist should be informed about cyclone hazard who are visiting vulnerable coastal area during Cyclone season. ○ Take part in pre-cyclone season meetings and take all the safety measures recommended by Revenue Dept/COR.
5	Review and Strengthening relief distribution system and stock Piling	Revenue Dept/COR Dist. Collector Municipal Commissioner Civil Supply Dept	○ Strengthening of relief distribution and accounting system at state and district level ○ Identification of centralized system for receipt, storage and distribution of relief ○ Rate contract, procurement and stockpile of relief material
6	Fail-safe communication and last mile Connectivity	Revenue Dept. COR GSDMA Science & Technology Dept.	○ Undertake study to establish fail safe two way communication – information system from state level to disaster site connecting state, district, taluka and city level. ○ Undertake study to establish alert/siren with multi-lingual recorded massages in coastal areas

S. No.	Task	Responsibility	Activity
		Authorities Municipal Commissioner	○ Establishment of multiple/alternative System ○ Training/IEC campaign for general public of the vulnerable areas. ○ Plan for re-establishment of disrupted System
7	Resource Mapping	Revenue Dept./COR Line dept. Dist. Collectors GSDMA Other dist. authorities of line dept.	○ Identify available resources viz. Human, financial and equipment for cyclone disaster management with - State Dept. - Dist. Level - Taluka level - Village level - Public sector - Private sector - Community level ○ Identification of gaps of resources as per the need ○ Process for procurement of lacking Resources ○ Periodic upgradation, validation and maintenance of SDRN and IDRN - List of the fire fighting and search & rescue equipments provided to various districts, municipal corporations, municipalities and GIDCs are given in - Detailed list of the swimmers identified and trained by GSDMA is kept on GSDMA's Website ○ Identification of safe shelter for evacuation in cyclone prone villages and updating in the level specific plans through SDRN.

*The State Disaster Resource Network (SDRN) is operational in over 18,000 villages of the State. The SDRN system has three layers namely Village, Municipality and Taluka. The level specific data is collected in the standard disaster management plan format and uploaded in to the system either at taluka or district level. The centrally stored database in the server located at GSDMA, Gandhinagar can be accessed through GSWAN connectivity (**http://117.239.205.164/sdrnguj/**) and GSDMA Web Site (**www.gsdma.org**).*

IDRN, a web based information system, is a platform for managing the inventory of equipments, skilled human resources and critical supplies for emergency response. The primary focus is to enable the decision makers to find answers on availability of equipments and human resources required to combat any emergency situation. This database will also enable them to assess the level of preparedness for specific vulnerabilities.

Total 226 technical items listed in the resource inventory. It is a nationwide district level resource database. Each user of all districts of the state has been given unique username and password through which they can perform data entry, data updating on IDRN for resources available in their district. The IDRN network has functionality of generating multiple query options based on the specific equipment, skilled human resources and critical supplies with their location and contact details.

S. No.	Task	Responsibility	Activity
8	Cyclone preparedness, training and Capacity building/awareness Measures	Revenue Dept./COR GSDMA Information Dept. Education Dept. All line dept. Dist. Collectors Other Dist. Authorities	○ Arrangement for training to: - Trainers from the Districts - First Responders Police including Traffic personnel Home Guards Civil defense personnel Fire and Emergency services Personnel Medical Personnel Port officers Local bodies/PRI ○ Advertisement, hording, booklets, leaflets, banners, shake-table, demonstration, folk dancing and music, jokes, street play, exhibition, TV Spot, radio spot, audio-visual and documentary, school campaign, - Planning and Design - Execution and Dissemination
9	Medical Preparedness	Medical & Health dept. Commissioner of Health Medical Institutions	○ Preparation of authentic medical database for public and private facilities available in the State - Collection of Data - Mapping and gap analysis - Strengthening ○ Resource management - Manpower, logistics, medical equipments, medicines, antidotes, personal protective equipments, disinfectant, vaccine ○ Identification of medical incident command system - Incident Commander State Level Dist. Level Disaster site - Identification of each section head at each level Operation Planning Logistic Administration & Finance Media and Public information - Identification of key members of different task force - Control room arrangement Departmental control room State and district control room

S. No.	Task	Responsibility	Activity
			- Planning Preparation of medical management plan - State level - Dist. Level - Hospital preparedness plan - Training and capacity building Hospital preparedness, Pre hospital care, ○ Mass casualty management, etc.
10	Community Preparedness[3]	Revenue Dept./ COR GSDMA IMD Finance Dept. All Dist. Collectors Municipal Commissioner All Taluka Mamlatdars Local self Govt. UDD Panchayat and Rural Housing Dept.	○ Selecting vulnerable community and most vulnerable groups at risk (keep gender issues in mind) ○ Disseminate information about vulnerability and risk to the community ○ Promote local level cyclone risk management planning through participatory approach ○ Advice and issue direction wherever necessary for community cyclone prevention, mitigation and preparedness through local resources and participatory approach ○ Provide necessary resources and support for cyclone risk reduction at community Level ○ Promote community managed implementations ○ Review the preparedness at community Level ○ Take appropriate actions to enhance community preparedness ○ Promote community education, awareness and training ○ Ensure fail safe mechanism for timely dissemination of forecasting and warning of impending cyclone to the community ○ Disseminate information to community to deal with cyclone situation

Objectives of the lesson

The primary objectives of this lesson would be to:

- To understand Cyclone Preparedness Task and Responsibility for Gujarat state.

Duration

45 minutes depending upon the potential of the trainer to fan discussion and debate.

Methodology

This was an informative session.

Training aids

Power-point presentation.

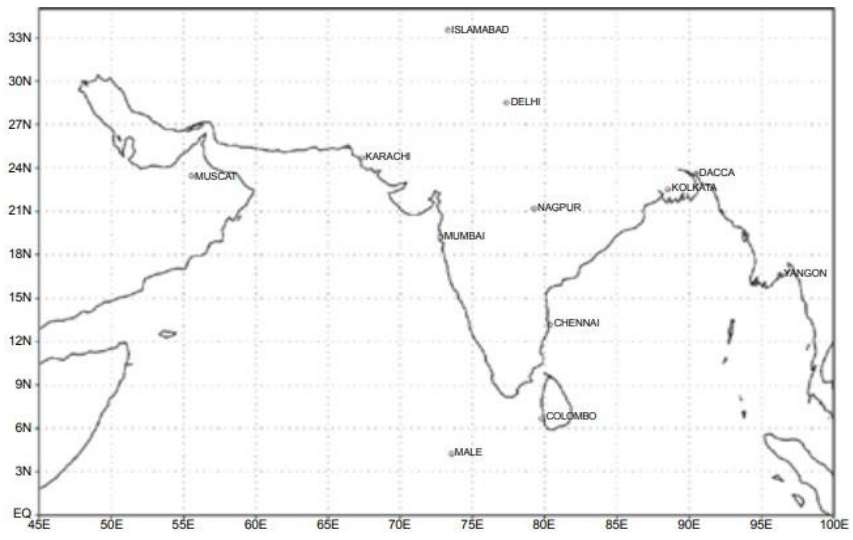
Learning Unit 4.2 Cyclone Warning Generation & Dissemination

Flow of session

This session will impart full fledge information of cyclone warning system prevailing in the country. The session contains theoretical details about early warning system, monitoring systems and different types of warning bulletins released by IMD and other agencies. If not checked, the plenary has enough content to turn into a monotonous session. Therefore, the it is responsibility of the trainer to engage participants in interactives discussions and activities. Trainer may begin by asking participants about their knowledge of early warning, who are potential stakeholders and what all is necessary for end to end warming dissemination.

4.2.1 Organizational Structure

At present, IMD has three-tier system to cater cyclone warning. There are Area Cyclone Warning Centres at Chennai, Mumbai and Kolkata and Cyclone Warning Centre at Visakhapatnam, Ahmedabad and Bhubaneswar. The Cyclone Warning Division, New Delhi is functions as Regional Specialised Meteorological Centre - Tropical Cyclones (RSMC - Tropical Cyclones), New Delhi. A Tropical Cyclone Regional Specialized Meteorological Centre is responsible for detecting tropical cyclones in its designated area of responsibility, and for providing basic information about the systems present and their forecast position, movement and intensity.



Area of responsibility of RSMC- Tropical Cyclones, New Delhi

There are six such meteorological centres in addition to six regional Tropical Cyclone Warning Centres that provide public tropical cyclone advisory messages:

(i) RSMC New Delhi
(ii) RSMC La Reunion
(iii) RSMC Tokyo
(iv) RSMC Nadi
(v) RSMC Honolulu
(vi) RSMC Miami

4.2.2 Early Warning for Cyclones: Generation and Dissemination

The generation of early warning for cyclones and its efficient dispersal to the probable stakeholders is an integral mitigation procedure to ascertain that loss of life and property is minimal during cyclone onset duration. Recent advancement in technologies have enhanced the operational ability of Early Warning Systems (EWS) in exponential terms. Presently, we have technology which can now monitor and track the possible sources of cyclonic disturbances accurately and concerned authorities and immediate stakeholders can be warned well in advance with margin of 2-3 days.

These warnings will not only indicate the intensity of the system but also the characteristics like landfall time and location. Thus vulnerable regions can readily be identified and population can be evacuated accordingly. There are numerous occasions when EWS have saved lives of citizens dwelling in coastal regions.

An efficient EWS must include components like efficient prediction- monitoring system and effective warning generation- circulating systems. Various components of early warning system for a cyclone include

(i) monitoring and prediction,
(ii) warning generation, presentation & dissemination,
(iii) coordination with disaster management agencies,
(iv) public education & reaching out and
(v) post event review.

4.2.3 Prediction and Monitoring by IMD Cyclones in the North India Ocean Basin are monitored with the help of land, ocean and space based observational systems that is inclusive

of standard meteorological observations, observations from ocean data buoys, coastal radars and national and international satellites. The cyclogenesis information is determined with satellite observations. When system comes closer to the coast, radar and satellites are used to monitor the system.

4.2.4 Warning Bulletins issued by RSMC New Delhi, IMD

1. **Track, intensity and landfall forecast:** IMD continuously monitors, predicts and issue bulletins containing track, intensity, and landfall forecast for +06, +12, +18, +24, +36 and +48… +96hrs lead period till the system weakens into a low pressure area. The above forecasts are issued from the stage of depression onwards five times a day and every three hours during the cyclone period.

2. **Cyclone structure forecast for shipping and coastal hazard management:** Forecast of maximum sustained wind speed was issued every six hourly for +06, +12, +18, +24, +36 and +96 hrs lead period.

3. **Four stage Warning:** The cyclone warnings are issued to state government in four stages:

- The **First Stage** warning known as **"PRE CYCLONE WATCH"** issued 72 hours in advance contains early warning about the development of a cyclonic disturbance in the north Indian Ocean, its likely intensification into a tropical cyclone and the coastal belt likely to experience adverse weather. This early warning bulletin is issued by the Director General of Meteorology himself and is addressed to the Cabinet Secretary and other senior officers of the Government of India including the Chief Secretaries of concerned maritime states.
- The **Second Stage** warning known as **"CYCLONE ALERT"** is issued at least 48 hrs. in advance of the expected commencement of adverse weather over the coastal areas. It contains information on the location and intensity of the storm likely direction of its movement, intensification, coastal districts likely to experience adverse weather and advice to fishermen, general public, media and disaster managers. This is issued by the concerned ACWCs/CWCs and CWD at HQ. It is represented by colour code 'yellow'.
- The **Third Stage** warning known as **"CYCLONE WARNING"** issued at least 24 hours in advance of the expected commencement of adverse weather over the coastal areas. Landfall point is forecast at this stage. These warnings are issued by ACWCs/CWCs/and CWD at HQ at 3 hourly interval giving the latest position of cyclone and its intensity,

likely point and time of landfall, associated heavy rainfall, strong wind and storm surge along with their impact and advice to general public, media, fishermen and disaster managers. It is represented by colour code 'orange'.

- The **Fourth Stage** of warning known as **"POST LANDFALL OUTLOOK"** is issued by the concerned ACWCs/CWCs/and CWD at HQ at least 12 hours in advance of expected time of landfall. It gives likely direction of movement of the cyclone after its landfall and adverse weather likely to be experienced in the interior areas. It is represented by colour code 'red'.

4. **Adverse weather warning bulletins:** The tropical cyclone forecasts alongwith expected adverse weather like heavy rain, gale wind and storm surge are issued with every three hourly update to central, state and district level disaster management agencies including NDRF, NDMA for all concerned states. The bulletins also contain the suggested action for disaster managers and general public in particular for fishermen. These bulletins are also issued to Defence including Indian Navy & Indian Air Force.

5. **Warning graphics:** The graphical display of the observed and forecast track with cone of uncertainty and the wind forecast for different quadrants are disseminated by email and uploaded on the RSMC, New Delhi website (http://rsmcnewdelhi.imd.gov.in/) regularly. The adverse weather warnings related to heavy rain, wind & storm surge are also presented in graphics alongwith colour codes in the website.

6. **Warning and advisory through social media**: Daily updates (every six hourly or whenever there is any significant change in intensity/track/landfall) and hourly updates are uploaded on Facebook and Twitter regularly during the life period of the system.

7. **Press release and press briefing:** Press and electronic media are given daily updates since development of low pressure area through press release, e-mail, website and SMS.

8. **Warning and advisory for marine community:** The three/six hourly Global Maritime Distress Safety System bulletins are issued by the Marine Weather Services division at New Delhi and bulletins for maritime interest are issued by concerned ACWs and CWCs ports, fishermen, coastal and high sea shipping community.

9. **Fishermen Warning:** Regular warnings for fishermen are issued.

10. **Advisory for international Civil Aviation:** The Tropical Cyclone Advisory Centre

bulletin for International Civil Aviation are issued every six hourly to all meteorological watch offices in Asia Pacific region for issue of Significant Meteorological Information. It is also sent to Aviation Disaster Risk Reduction centre of WMO at Hong Kong.

Objectives of the lesson

The primary objectives of this lesson would be to:

- Explaining cyclone warning generation and dissemination system in India.
- Discuss different types of warning bulletins issued in wake of any cyclonic activity.

Duration

45 minutes depending upon the potential of the trainer to fan discussion and debate.

Methodology

Sample of different types of cyclone warning bulletin should be shared and analysed with the participants. RSMC Delhi website should be surfed and the available cyclone related resources be discussed.

Training aids

Power-point presentation, flip-charts, A4s, markers, pens etc.

Technical Session 5: Institutional Response & Development of Recovery Strategy

Need of the session

Response measure in case of cyclones are those which are taken immediately prior to, and following, a cyclone, aimed at saving life and protecting property besides taking short term actions to immediately deal with damage caused by the disaster. For effective response all stakeholders need to have a clear perception about a tropical cyclone, its consequences and the actions that need to be taken in the event of a cyclone threat. An appropriate plan has to be in place, with the roles of various agencies clearly defined, for carrying out all necessary actions prior to, during and after a cyclone.

Aftermath of any disaster, be it cyclone national and state governments strive to assist the affected population to overcome the negative impact of disasters. These programs often require significant and unexpected amounts of financing, which, in the absence of sufficient resources, are deducted from normal development expenditures and investment. For that reason, the estimation of damage, loss and need costs involved in post disaster recovery and reconstruction activities needs to be made in the most objective and reliable manner, utilizing evidence-based and quantitatively reliable information to ensure the minimum disruption of ongoing development programs. A recovery framework is developed to that acts as a guide to enables effective recovery support to disaster-impacted regions, territorial and local jurisdictions. It provides a flexible structure that enables disaster recovery managers to operate in a unified and collaborative manner. It also focuses on how best to restore, redevelop and revitalize the health, social, economic, natural and environmental fabric of the community and build a more resilient society.

Units of the session

Learning Unit 5.1: Cyclone Action Plan

Learning Unit 5.2: Response on Receipt of Early Warning: Case Study of VSCS 'Vayu'

Learning Unit 5.3: Development of Recovery Strategy: Case Study of ESCS 'Fani'

Objectives of the session

The primary objectives of this unit would be to:

- Explaining institutional response on receipt of early warning.
- Explaining development of recovery strategy aftermath of cyclone

Duration

150 minutes. (45 + 30 + 30) minutes for the sessions and 15-minute spill over time from each session.

Methodology

The methodology of this session is no different from the overall methodology of the training program. Every lesson or every unit must start with a question to intrigue the participants and foster discussion. Building up on such discussions, the trainer must start his presentation or lecture.

Training aids

Power-point presentation, Flip-charts, Markers etc.

Learning Unit 5.1 Cyclone Action Plan

Flow of Session

The cyclone response structure will be activated on the receipt of cyclone warning by the IMD. The occurrence of a cyclone may be reported by the IMD to the CoR/GSDMA by the fastest means. The CoR will activate all the Departments for emergency response including the State EOC, District EOC and ERCs. CoR will issue instructions to include the details about required resources, type of assistance to be provided, time limit for assistance & details of task/response force. The State EOC, ERCs and other control rooms at the state level as well as district control rooms should be activated with full strength. The state Government may publish a notification in the official gazette, declaring such area to be disaster-affected area under GSDMA Act.

5.1.1 Roles and Responsibility

Time Frame	Task	Activity	Responsibility
Time = 0 – 72 Hrs.	**Warning Receipt and Dissemination**	1. Inform COR/ DOR, PS (Revenue), CEO (GSDMA), Crisis Management Group, Hon. CM, Hon. Minister (DM), NDMA, Ministers and Secretaries of all line depts. as per the warning of IMD. 2. Inform & instruct relevant District Collectors to activate District Control Room at full strength 3. Alert state response teams for deployment 4. Remain in constant touch with control rooms at National & State Level. 5. Instruct and alert heads of departments of the key line departments to activate their departmental plan and SOPs for Cyclone response	**In-charge, SEOC**
	Interdepartmental Coordination	6. Instruct all State Government officers and employees in the State to report to their respective Head for emergency duties (Only if the warning is of a level 2 disaster) 7. Alert the District Collectors of districts not likely to be affected to be prepared for providing additional manpower, machinery / equipment & relief material to the districts likely to be affected.	**COR/ DOR**

	Establishment of Lines of Communication	8. Activate alternative communication equipments i.e. satellite phones, HF/VHF sets, Ham radio, VSAT in SEOC, DEOCs, TEOCs and ERCs 9. Establish communication links with ERCs and Ham Radio Societies and alert them to keep their SAR teams in stage of readiness. 10. Establish communication links with villages likely to be affected as per the contact details available in SDRN	**COR/ DOR**
Time = 0 – 48 Hrs	**Review of situation and reporting**	11. Establish contact with IMD, CWC, ACWC, ISRO and the defense ministry of GoI for aerial / satellites imageries of the latest Cyclone threat 12. Get the latest weather report from IMD/other international websites to know the exact location of Cyclone and the likely area where landfall will take place. (Weather Watch Group meetings) 13. After reviewing the weather report and satellite images issue instructions and orders for emergency response to areas likely to be affected	**Revenue Dept./ COR**
	Management of EOC, ERCs and Cyclone Response	14. Take over full command of SEOC and ERCs 15. Instruct line departments to depute representatives at the State and District EOCs and brief personnel deputed at EOCs. 16. Hold a meeting with leaders of task forces and entrust them their tasks 17. Arrange emergency meeting with State Crisis Management Group to devise a plan of action 18. Arrange dissemination of information through various means of communication such as Radio, TV, Cable Network, SMS about Cyclone Warning to districts/areas which are likely to be hit by Cyclonic Storm. 19. Alert teams to remain in readiness- Evacuation, Emergency Medical Services, Search & Rescue, Fire &	**COR**

		Emergency Services, NDRF, Police, Home Guards, SRPF, Army, Air Force	
		20. Impose restriction on all transport activities heading towards coastal areas that are likely to be affected by Cyclone & head counts of Fisherman on each port.	**Port & Transport Dept.**
		21. Impose restriction to or alert all vessels in high sea through display of signals on respective ports, AIR broadcasts, coastal weather bulletins, etc.	**GMB / Coastal Radio Station/ Port Authorities**
	Cyclone Response to Coastal Areas (Likely to be Affected)	22. Based on the warning issued by IMD, pin point the districts and villages likely to be affected by cyclone and start the procedure for identifying safe places/shelters for evacuation in those villages 23. Prepare route maps for safe place and evacuation shelters 24. Village wise data of safe shelters for evacuation available on SDRN should be referred and the District Collectors/Village level officers should be contacted to know the status of the shelters with the capacity of the shelter and other available facilities at the site 25. Make transport arrangement for mobilization of all emergency response teams 26. Make logistic arrangements for response teams	**Revenue Dept., Transport Dept. and Dist. Collectors, Municipal Commissioner**
		27. Ensure arrangements are in place to evacuate fishermen and salt workers if needed	**Commissioner of Fisheries**
		28. Ensure safety of tourists visiting beaches along the coastline	**Tourism Dept.**
		29. Cordoning off coastal areas for restricting entries of rail or road traffic 30. Ensure law and order is maintained in areas likely to be affected	**Home Dept., Dist. Collectors,**
		31. Ensure that all critical activities (mainly industrial production) in areas likely to be affected are shutdown	**Line Depts.**

		32. Ensure that the schools and colleges are closed in areas likely to be affected by Cyclone and associated hazards 33. Ensure availability & serviceability of cyclone shelters issued in schools	**Education Dept.**
		34. Ensure dissemination of information to remote areas by local means 35. Ensure that local helplines are opened and effectively managed for public information and guidance. 36. Ensure that the information to public and media (AIR/ Doordarshan/ print/ FM) about the progress of Cyclone at periodic intervals is released	**Dist. Collector, Information Dept.**
		37. Activate Departmental Disaster Management Plan and Departmental SOPs for Management of casualties 38. Ensure availability of QRT & essential medicines	**Health Dept.**
		39. Issue alert/ warning through SMS by establishing liaison with service providers 40. Ensure safety & serviceability of critical communication towers through respective service providers 41. Ensure establishment of alternate communication links like HF, VHF, HAM, Satellite Phones, etc.	**Dept. of Science & Technology**
		42. Ensure availability of safe drinking water and deployment of plan for water tanker and mapping of vulnerable villages.	**Dept. of Water Supply**
		43. Ensure safety of dams & dewatering in case of heavy rains and deployment plan for dewatering pumps.	**Irrigation Dept.**
Time = 0 - 24 Hrs	**Review of Situation, Reporting and Advance Deployment**	44. Establish contact with IMD, CWC, ACWC, ISRO and the defense ministry of GoI for aerial / satellites imageries of the latest Cyclone threat 45. After reviewing the weather report and satellite images, issue instructions and orders for emergency response to areas likely to be affected areas. Regular meetings of WWG and immediate subsequent communication of status reports. 46. Review and monitor – evacuation	**Revenue Dept./ COR Information Dept.**

		from to be affected areas; positioning of search & rescue teams, mobile communication units, quick medical response teams; dissemination of information to vulnerable areas; preparedness measures to be taken by various authorities 47. Keep in touch with National, District and Taluka Control Rooms 47. Release information at appropriate time to media and public regarding response measures organized by the Government	
	Emergency Response Management	49. If reports regarding striking of cyclone are confirmed by IMD and other sources, start the emergency response and relief operations 50. Divert the emergency services to areas likely to be affected as per the warning issued by IMD 51. Inform the public residing in areas likely to be affected to evacuate through various means such as SMS, AIR, FM Radio, Doordarshan etc. 52. Start evacuation from the likely affected areas through Police support, if necessary	**Revenue Dept., COR, Dist. Collector, Home Dept.**
		53. Disconnect power supply at the time of cyclone striking	**Dept. of Power**
		54. To account for the exact number of fishermen in the sea and fishermen that have already reached the shore	**GMB/Coast Guard**
	Emergency Relief Management	55. Ensure that the Relief Management work planned in the areas likely to be affected by the Cyclone are well organized 56. Inform following agencies to be in a state of readiness for assisting in the Cyclone response measures (if required): ○ Public sector agencies ○ Private sector agencies ○ NGOs, CBOs ○ Volunteer Organizations 57. Request for help (if needed) to MHA/National Disaster Management Authority	**COR/ Revenue Dept.**

		58. Ensure that the arrangement for basic amenities (shown below) at evacuation/relief centres are made by the respective departments: ○ Drinking water ○ Food ○ Clothing ○ Sanitation and hygiene, ○ Lighting ○ Medicines and other Health Care	**COR, Food & Civil Supply Dept., Revenue Dept. & Dist. Collectors, Water Supply Dept., GEB, Health Dept.**
		59. Make necessary arrangements for Public information/guidance and public opinion	**Information Dept.**
		60. Impose restrictions for transportation in vulnerable areas	**Transport Dept. and Dist. Collector, Home Dept.**
Time = 0 Hrs	**Disaster Declaration**	61. Cyclone affected Dist. Collectors should send a communication to the State Govt. to declare the area as disaster affected, if necessary, (depending upon the nature and intensity of impact)	**COR, Dist. Collector**
	Preliminary Assessment, Deployment of Emergency Response Teams and Information Dissemination	62. Send teams to the affected areas to take stock of the effects of Cyclone and associated rain. 63. Send sector wise situation reports to: ○ State EOC/COR ○ GSDMA	**District Collector**
		64. Deployment of following teams to Cyclone affected areas: ○ Emergency Communication Teams ○ Emergency Medical Services Teams ○ Search and Rescue Teams (With Equipment) ○ Preliminary damage Assessment Teams ○ Need Assessment Teams	**COR, Dist. Collector, Municipal Commissioner**
		65. Establish communication link with affected districts by activating alternate communication equipments such as Satellite Phones, HF/VHF Sets, Ham Radio, V Set etc., in State/District EOCs and	**COR, Dist. Collector, Information Dept.**

		Taluka Control Rooms 66. Arrange dissemination of information about occurrence of Cyclone and areas that are affected by it to media & public.	
Time = 0+ 24 Hrs	**Mobilization and Deployment**	67. Remain in constant touch with IMD for updates on weather forecast for the coming hours and plan accordingly 68. Immediate mobilization of following units/teams to areas affected by Cyclone and associated rains o S & R Teams of Fire and Emergency Services o Quick Medical Response Teams o Quick Damage & Loss Assessment Teams o Quick Need Assessment Teams o Road Clearance Teams o Teams for disposal of dead bodies o Teams for disposal of carcasses o Teams for debris clearance (if any) o Teams for maintaining Law & Order in the affected areas o Arrange for S & R teams of Air Force (If required)	**COR, Dist. Collector, Municipal Commissioner Key line Dept.**
	Clearance of Access Roads to Reach at The Sites of Affected Areas	69. To survey the access roads/routes leading to the affected areas and manage traffic for mobilization of equipments, machinery and volunteers. 70. Identify alternate roads/routes for evacuation of affected people 71. Undertake repairing/restoration of damaged roads leading to the affected areas. 72. Identify and declare unsafe buildings/structures in Cyclone affected areas. 73. Evacuate people from unsafe buildings/structures and shift them to relief camps/sites 74. Divert/stop transport activities (Rail + Road) heading towards Cyclone affected areas	**R & B Dept., Transport Dept., Railways, COR**

	Necessary Arrangements at Evacuation/ Relief Centres	75. To ensure that necessary arrangements at evacuation/relief centers is made with sufficient availability of: a. Food, b. Water, c. Blankets/Clothing d. Medicines e. Lighting f. Sanitation and hygiene etc. 76. To ensure necessary security arrangements for the personnel (Emergency responders/relief teams) who are working at Relief Centers and involved in distribution of Relief Materials 77. To ensure that law and order is maintained at evacuation/relief centers and in the affected areas as well 78. Arrange for a logistic plan and warehouse for receipt and management of relief material	**Revenue Dept., Civil Supply Dept., Collectors, Municipal Commissioner Water Supply Dept., Health Dept., GEB, Power & Energy Dept., GWSSB & Local Authorities, Home Dept.**
	Safety of Fishermen and Salt Workers	79. Take immediate actions for safety of fishermen, salt workers and visitors at cyclone affected coastal areas 80. Ensure that all the fishermen and salt workers have returned from the sea or those who are in the sea are rescued and evacuated to safer places	**COR/DOR, Port and Fisheries Dept., Tourism Dept., Industrial Dept.**
	Immediate Health and Minimization of Disease Outbreak	81. To establish camp hospitals near the affected areas 82. To make transportation arrangements to shift seriously injured persons to nearest-camp Hospitals, Taluka and District Hospitals, Regional and State Hospitals 83. Ensure that the Hospitals are well prepared to deal with seriously injured persons 84. Ensure that the required medical assistance/aid and medicines are provided to the affected people at site as well as at evacuation/relief centers in the affected area and necessary records are maintained 85. Take sanitation and epidemic	**COR/ DOR, Port & Transport Dept, Fisheries Dept., Tourism Dept., Industrial Dept.**

		control measures for preventing any water borne disease 86. Keep adequate stock of essential medicines, first-aid etc. at taluka/district hospitals 87. Take steps to purify drinking water sources 88. If required, take the help of doctors/paramedics from the list of doctors/paramedics available at the taluka/district level for immediate medical assistance	
		89. Assess need for fodder if required 90. Keep ready teams for carcass disposal (if required)	**Animal Husbandry Dept.**
	Information to Public and Media	91. Establish Media/Press Centre for media management and information dissemination 92. Ensure that the information to media/general public about the response of the State Government is released in an organized manner 93. Organize media briefing twice a day at pre-determined intervals	**Information Dept., COR**
	Other Important Work Related to Immediate Response	94. Prepare quick need assessment report for planning of relief operation 95. Additional assistance may be asked for emergency response/relief from GoI-NDMA (If needed) 96. Prepare situation report and circulate it twice a day in the morning and evening to key Government functionaries 97. Maintain constant touch with National, District and Taluka EOCs and other control rooms 98. Remain in constant touch with IMD for updates on weather forecast for the coming days and plan accordingly 99. Conduct aerial survey of affected areas for taking a stalk of the Situation	**COR**
		100. Activate evacuation & relief centers according to needs/situation 101. Maintain record of persons admitted at evacuation/relief centres	**Revenue Dept. Collector, COR**

Time = 0 + 24 to 48 Hrs	**Review of Situation and Reporting**	102. ACWC, ISRO and the defense ministry of GoI for aerial / satellites imageries about further weather condition and plan accordingly	**COR**
	Restoration of Critical Infrastructure/ Essential Services	103. Ensure that the essential services/critical infrastructure of the affected areas have been restored or alternative arrangement is made for ensuring safety of people and smooth management of emergency response. 104. Ensure that key administrative and lifeline buildings are brought back to operation quickly. 105. Designate and deploy senior officers (as per the need) to worst affected area/s to oversee rescue/relief operation. 106. Ensure following primary necessities are restored o Power o Water o Telecommunication o Roads o Bridges	**COR, Line Depts., Dist. Collectors, Municipal Commissioner**
	Disposal of Dead Bodies	107. Ensure following procedure is followed before disposal/handing over of dead bodies: a. Photographs of the dead bodies are taken, b. Identification of the dead bodies is done, c. Post Mortem where ever necessary and possible is carried out, d. Handing over dead bodies persons known/identified to their relatives, e. Disposal of unclaimed and unidentified dead bodies.	**Revenue Dept., Dist. Collector, Municipal Commissioner, Home Dept., Health Dept., Local Authorities**
		108. Ensure medical aid to injured cattle 109. Disposal of animal carcasses with the help of local bodies/health dept.	**Animal Husbandry Dept.**

	Public Information and Media Management	110. Ensure that the information about progress of rescue and relief is provided to media/public in an organized manner at least twice a day 111. Establish help lines for facilitating communication between the victims and their relatives residing outside the affected area/s 112. Establish Information Centers at strategic locations for providing information about persons evacuated to the relief centres/hospitals	**COR, Information Dept., Dist. Collector, Municipal Commissioner**
	Miscellaneous Rescue and Relief Works	113. Assess the situation and take appropriate action to accelerate the Search & Rescue Operations 114. Depute additional officers and supporting staff to Cyclone affected areas from non-affected areas (if required) to accelerate the rescue and relief operations	**COR, Districts Collector, Municipal Commissioner**
		115. Ensure that the relief assistance received from outside is centrally received, stored and sent for distribution to Cyclone affected areas according to their need and proper accounts are maintained about both receipt and distribution	**COR, Civil Supply Dept.**
		116. District Collector may oversee the functioning of relief centres and ensure adequate supply of relief materials	**Revenue Dept, Civil Supply Dept.,**
Time = 0 + 48 to 96 Hrs	**Continuous Rescue and Relief Works**	117. Remain in constant touch with IMD for updates on weather forecast for the coming days and plan accordingly 118. Arrange for procurement of additional relief material required for relief operations (on the basis of need assessment) 119. Mobilize additional relief material required for relief operations 120. Maintain constant touch with State & Districts EOCs	**COR, Dist. Collectors, Civil Supply Dept.**

		121. Arrangement for transportation of injured from field hospital to base hospital 122. Arrangement for transport of dead bodies to their native places 123. Ensure maintenance of record, timely reporting and information management 124. Ensure maintenance of record and information database	**Revenue Dept,. Health Dept. , Transport Dept., Line Deptts.**
Time = 0 + 96 to 168 Hrs	**Continuous Rescue and Relief Works**	125. Remain in constant touch with IMD for updates on weather forecast for the coming days and plan accordingly 126. Review the restoration of all the public and essential buildings/ structures in Cyclone affected areas 127. Review and follow-up all necessary arrangements for emergency response & relief in the affected area/s	**COR**
		128. On receiving the message from IMD about degradation of Cyclone, inform the concern dist. Collector	**COR, IMD**
		129. Organize a quick rapid visual survey of the affected areas (through a technical team of engineers) to ascertain the safety of the structures decide on giving the go-ahead to people to move back to their respective houses	**COR, Dist. Collectors, Municipal Commissioner R & B Dept.**
		130. After receiving the massage of de-warning, ensure that people are moved back safely to their houses	**COR, Collector, Police Dept.**
		131. Ensure relief disbursement, allotment of funds and grants to line department and district collectors for organizing emergency response, relief and evacuation arrangements	**Revenue Dept.**

5.1.2 Short-term Relief Measures

Search, Rescue and Medical Assistance

i. Identification of areas where SAR Teams are to be deployed.

ii. Coordination of SAR teams for their quick deployment in allotted areas.
iii. Provision of quick transport of SAR teams to affected areas
iv. The department of Roads and Buildings to evolve a mechanism for clearing access routes in order to facilitate search and rescue operations
v. Mobilization of specialized equipment and machinery to affected areas
vi. Cordoning of affected areas with control of entry and exit
vii. Traffic Management by establishment of traffic points and check-posts
viii. The Home Department to evolve a mechanism for providing security of properties of government and public in the affected areas

Emergency Relief

i. Establishment of Temporary shelters for evacuees
ii. Ensuring Arrangement for food, clothing, blanket/bedding, drinking water, sanitation and hygiene, lighting arrangements and essential medicines
iii. Ensure deployment of mobile hospitals in affected areas for treatment of victims
iv. Provide counselling services to the cyclone victims and their relatives
v. Ensure establishment of communication link between the affected people and their relatives outside

The COR to ensure the following in the relief camps

i. Special emphasis on Hygiene and sanitation aspects should be given in relief camp sites
ii. Separate area should be earmarked within the relief camp for storage of relief materials
iii. Adequate manpower and transport facilities for the camp site.
iv. Arrangements to be made for trauma management
v. Mobile medical units to be sent to remote areas with a view to provide medical assistance to the victims/injured
vi. Information centre should be established by the administration

5.1.3 Interim Relief Measures

i. Arrangements to be made for quick identification and maintenance of the records of disposal of dead bodies in the affected areas (Home, Revenue, Health Dept., Local Authorities)
ii. Arrangements to be made to record the complaints of all persons reported missing. Follow up action in terms of verification of the report also needs to be made (Home Dept.)

iii. District Magistrates and Sub-Divisional Magistrates to be empowered to exempt the requirement of identification and post-mortem in case of mass casualties. Revenue Dept may depute additional sub-divisional magistrates to expedite disposal of the dead bodies (Revenue & Home Dept.)

iv. Unclaimed/unidentified dead bodies to be disposed off with the help of pre-identified voluntary agencies at the earliest after keeping their records (Home, Revenue, Health Dept. & Local Bodies)

v. Additional manpower to be deployed in the affected areas for supplementing the efforts of the local administration (GAD)

vi. Separate Cell to be established at state/district/taluka level to coordinate with the NGOs and outside donor/aid agencies (Revenue Dept.)

vii. Regular meetings of the different stakeholders/departments should be organized at state level for sharing of information, developing strategies for relief operations. (Commissioner of Relief & Collectors at District Level)

viii. Information & Public Relation Dept to coordinate with the media to play a positive role in disseminating appropriate information to public and the government in order to facilitate the speedy recovery

5.1.4 Assessment of Damage/Loss and Relief Needs

i. The Commissioner of Relief to issue instructions to the District Collectors to provide "the need assessment" report. The Commissioner of Relief should consolidate the same and to prepare "States Need Assessment Report"

ii. The Commissioner of Relief to issue instructions to the District Collectors to provide the damage and loss assessment report. The Commissioner of Relief to consolidate the same and to prepare "state's damage and loss assessment report" which will be useful in planning and implementing the relief operation after the disaster for the victims of the disaster

iii. Adequate manpower, vehicles, stationery etc. should be provided to supplement the efforts for need/loss assessment. (Commissioner of Relief & Revenue Dept.)

iv. The relief need assessment report should be provided by the Collectors (Commissioner of Relief & Collectors)

v. Identification and demolition of dangerous structures in the affected areas to minimize

further loss of life and injuries (R & B Dept., Revenue Dept and Local Bodies)

vi. Arrangements for distribution of gratuitous relief and cash doles (Revenue Dept., Panchayat& Rural Housing Dept., UD&UHD Dept. and Collectors)

vii. Arrangements to be made for survey of human loss and distribution of ex-gratia relief to the families of deceased persons (Revenue Dept.)

viii. Teams to be formed and dispatched to the affected areas for detailed assessment of houses and property damage assessment (Revenue Dept and Local authorities)

ix. As reconstruction of houses will take a long period, arrangements to be made to provide interim shelters to the affected (Revenue Dept and Line Departments like Water Supply Dept., GEB, R & B Dept. etc.).

Objectives of the lesson

The primary objectives of this lesson would be to:

- To explain the Cyclone Action Plan.

Duration

45 minutes depending upon the potential of the trainer to fan discussion and debate.

Methodology

This is an informative session.

Training aids

Power-point presentation, flip-charts, A4s, markers, pens etc.

Learning Unit 5.2: Institutional Response on Receipt of Early Warning: Case Study of VSCS Vayu

(Source: Status Report on Very Severe Cyclonic Storm 'VAYU', GoG)

Flow of the session

This session aims to impart suggestive measures that should be followed when the wrath of cyclone is already knocking at our doors. The session discusses the institutional preparedness steps that were undertaken when early warning for VSCS Vayu was received.

VSCS Vayu was the strongest tropical cyclone to affect the Saurashtra Peninsula of north-western India since the 1998 Gujarat cyclone. Vayu originated from a low-pressure area that was first noted by IMD on 9 June, near the northern Maldives. After consolidating into a depression, the storm tracked slowly north-northwestward over the eastern Arabian Sea, and reached cyclonic storm intensity late on 10th June.

5.2.1 Immediate Response on receipt of Early Warning

On the receipt of information of formation of depression in Arabian sea, the State Government swung into action immediately and took various actions.

- On receipt of the Bulletin from IMD on 10th June, 2019, regarding formation of Deep Depression over Arabian sea and likelihood of its movement towards Veraval, an Emergency Weather Watch Group Meeting was held under the chairmanship of Shri Pankaj Kumar, Additional Chief Secretary, Revenue Department on 10th June, 2019 at 1600 hrs to review the situation and likelihood of impact of cyclone on Gujarat coast. The immediate action to be taken-up by the state government were discussed in detail.
- Subsequently, Additional Chief Secretary, Revenue Department with Chief Executive Officer, GSDMA held another meeting on 11th June, 2019, at 1000 hrs with central and state agencies like Army, BSF, NDRF, SDRF, etc. for emergency response planning and operations in the wake of cyclone alert.
- With the deep depression converting into severe cyclonic storm, a meeting of State Crisis Management Group was held under the chairmanship of Dr J N Singh, Chief Secretary on 11 June, 2019, at 1315 hrs with all the State Government departments, its respective HoDs and Central government agencies and necessary instructions to be ready to be deployed and respond aiming at **'Zero Casualty'** were imparted.

- As a part of immediate execution of decision taken in the State Crisis Management Group Meeting, Chief Secretary along with Additional Chief Secretary, Revenue Department held a Video-conference at 1400 hrs with concerned district collectors, DDOs, SPs and CPs to sensitise them for situation and to give guidance for course of action.

5.2.2 Activation of Incident Response System (IRS)

- A three tired Incident Response Mechanism was activated. The operational command was led by Shri Pankaj Kumar, ACS (Revenue); the strategic command was led by the Chief Secretary and Hon. Chief Minister led Ministerial Group and provided critical guidance and encouragement.
- The entire administrative response system was put under the single command of Shri Pankaj Kumar, ACS – Revenue as **Incident Commander**.
- Similarly, at district level, incident command led by the District Collectors which was strengthened by guidance of 'Prabhari Mantri' and 'Prabhari Sachiv' who joined districts on June 12.
- The Incident commander was in constant touch with Dr Jayant Sarkar, Director, IMD, getting hourly feedbacks, in addition to the warning bulletins issued. Accordingly, Incident Commander updated Hon. Chief Minister, Chief Secretary, office of the Chief Minister and simultaneously imparted instruction for further action.

5.2.3 State Emergency Operation Centre (SEOC) and Support Mechanism

- Commissioner of Relief (CoR) and Director of Relief supervised control room activities in contact with DEOC and updated the Incident Commander. Smt. Anuradha Mall, CEO - GSDMA, GIDM and BISAG supported SEOC continuously as cyclonic effect in the form of heavy winds, rain and surges were ongoing in coastal areas.
- State Government departments and Central Government's respondent agencies deputed their nodal resources at SEOC to facilitate quick coordination between incident command and their representative organisations field formations.

5.2.4 Evacuation

Identifying all vulnerable people and shifting them to safe shelters was the first priority of the State Government. For that purpose, all people living in areas likely to be affected or living near the coast or in low lying areas in the coastal and adjoining districts were planned to be evacuated. The State Government, through district administrations, prepared comprehensive

evacuation plans for the people likely to be affected, living within a distance of 10 km from the coast and flood prone areas within 50km from the coast. Accordingly, 2,78,456 people were evacuated to 2,307 identified shelters. This includes evacuation of 2,635 salt pan workers from 153 saltpans. The detailed list of the number of people evacuated is given below:

S. No	District Name	No. of Village	Number of People Evacuated			
			Female	Male	Child	Total
1	Morbi	35	3700	4097	810	8607
2	Bhavnagar	42	9270	12776	6801	28847
3	Junagadh	24	12796	12731	6799	32326
4	Gir Somnath	67	7102	7323	5603	20028
5	Jamnagar	52	7468	8351	2851	18670
6	Dwarka	194	23500	26800	4383	54683
7	Kutch	72	14447	11415	3225	29087
8	Porbandar	94	13874	14750	11599	40223
9	Rajkot	122	5344	6177	2853	14374
10	Amreli	108	11017	11252	9342	31611
Total		**810**	**108518**	**115672**	**54266**	**278456**

- **Fishermen:** Immediately on the receipt of information regarding formation of cyclone, warnings were transmitted to all the fishermen who were reported to have ventured into deep sea and they were directed to return to the coast at the earliest.

Sr. No		No. of Fishing Boats		No. of Fishermen	
		In Sea	Returned	In Sea	Returned
1	Jamnagar	45	45	180	180
2	Dwarka	50	50	300	300
3	Porbandar	251	251	1152	1152
4	Gir Somnath	47	47	230	230
Total		**393**	**393**	**1862**	**1862**

As a result, all the 1862 fishermen in 393 boats were reported to have returned (details given in the table below). To ensure further safety, fishermen have also been advised not to venture

into sea along and off the Gujarat coast till June 15, 2019. In Gujarat, fishing activities are suspended from June 15 to October 15 due to monsoon season.

- **Salt pan Workers:** 2,635 salt pan workers were evacuated from 153 salt pans. The details of the evacuation of saltpan workers are given in the table below:

S. No	District Name	No. of Saltpan areas from where Evacuated	Salt Pans	
			No. of Salt pans Evacuated	No. of persons evacuated
1	Morbi	35	6	1383
2	Bhavnagar	42	48	467
3	Junagadh	24	0	0
4	Gir Somnath	65	0	0
5	Jamnagar	46	5	230
6	Dwarka	194	0	0
7	Kutch	61	0	0
8	Porbandar	89	0	0
9	Rajkot	87	0	0
10	Amreli	35	94	555
Total		**678**	**153**	**2635**

- **Vulnerable People:** Special care was taken to shift the old, physically challenged, women and children to shelters much before the cyclone was expected to make landfall. Pregnant women were provided ambulances and shifted to nearest CHC/District Hospitals. 5550 pregnant women with expected date of delivery in next 15 days were mapped and contacted.
- **Police Patrolling:** As per the direction of Hon. Chief Minister, continuous police patrolling was carried out by police on June 12, 2019, to safeguard the properties of the evacuated areas and to ensure that no one ventures out during the cyclonic effect. 1316 police officials with 305 vehicles were engaged in 12 districts.
- **Tourists:** Tourists from tourist/ religious places had been urged to seek shelter in safer places and let the cyclone pass. Additional buses have also been arranged to shift tourist to safer places by the State transport department. No. of tourists evacuated from the pilgrimage places are as under;

No.	Pilgrimage	No. of Trips	No. of Pilgrims Evacuated
1	Dwarka	36	1317
2	Gir Somnath	155	5966
3	Porbandar	38	1478
4	Diu	52	1992
Total		**281**	**10753**

- **Shelters Status:** Safe shelters were identified as per the respective existing Disaster Management Plans prepared in districts, talukas, cities and villages. Total of 2307 safe shelter places were identified and used. All necessary arrangements like drinking water, food, and other logistics support were made. District-wise details of shelters used is as under:

S. No	District Name	No. of Villages From Where Evacuated	Number of Temporary shelters			
			Cyclone Shelters	Govt. Schools	Others	Total
1	Morbi	35	0	41	4	45
2	Bhavnagar	42	0	48	5	53
3	Junagadh	24	10	900	0	910
4	Gir Somnath	67	0	50	30	80
5	Jamnagar	52	0	91	21	112
6	Dwarka	194	0	181	18	199
7	Kutch	72	6	42	3	51
8	Porbandar	94	0	108	42	150
9	Rajkot	122	0	156	10	166
10	Amreli	108	0	11	530	541
Total		**810**	**16**	**1628**	**663**	**2307**

- **Community Kitchen & Support Status:** Food packets were made available and distributed as under:

Sr. No	District	No. of Food Packets Ready	Distribution
1	Rajkot	3 lakh	1 lakh to Gir Somnath 1 lakh to Porbandar
2	Ahmedabad	2 lakh	1 lakh to Gir Somnath 1 lakh to Dev-bhoomi Dwarka
3	Vadodara	1 Lakh	25,000 to Amreli

At each of the shelter site, community kitchen started and warm, immediately cooked meals were provided to the evacuees.

5.2.5 Planning and Coordination Efforts

Important instructions/decisions that were taken/given, are as under:

- The Cabinet Meeting was postponed and concerned Ministers and Secretaries were instructed to remain present in their 'Prabhari districts' to assist district administration and monitor the situation. In addition, meeting of Member of Parliaments was postponed.
- Shala Pravesotsav program which was to be organised during 13 – 15 June was postponed. Holidays were declared in all the schools of the affected districts.
- Fishermen were advised not to venture into sea along and off the Gujarat coast till June 15, 2019.
- Tourists from Dwarka, Somnath, Porbandar, and other tourist/ religious places were urged to seek shelter in safer places.
- Additional buses were arranged to shift tourists to safer places by the State transport department.
- Leaves of all the officers/employees were cancelled and directed to remain present in the headquarter/offices.
- Prabhari Ministers and senior Prabhari Sachivs were directed to move to their allotted districts and camp there till normalcy is established.
- Nodal officers from all the line departments were posted at SEOC for departmental coordination and reporting of action taken by the respective departments.
- Owners of the cattle/livestock were advised to free their cattle (untie) and shift them to the safer places.

Strengthening of SEOC

6 IAS officers and 5 GAS officers were appointed to State Emergency Operation Centre (SEOC) at the disposal of Incident Commander.

5.2.6 IEC Activities

Media plays a vital role in disaster management by educating the public about disasters and ensuing disaster risks. Accordingly, continuous press briefings were being done by Additional Chief Secretary, Revenue Department, right from June 10, 2019, onwards to disseminate correct information and avoid any rumours. Arrangements were made to warn people of the impending cyclone through announcements in media and bulk SMS.

Regular media briefing was being done by Hon. CM, Chief Secretary and ACS – Revenue since June 10, 2019, to make media aware of the cyclone alert, possible impact and mitigation measures planned and actions taken by the state administration in coordination with other important stakeholders. Information regarding do's and don'ts to the general public for their

safety and survival were also being broadcasted since June 10, 2019. Social Media platforms (viz. WhatsApp, Twitter, etc.) were being effectively used to disseminate alerts and warnings and also for sending vital information regarding do's and don'ts to the general public. Mass awareness generation was being done continuously by the district administration.

Objectives of the lesson

The primary objectives of this lesson would be to:

- To explain the different steps taken by government after receipt of early warning using case study of Cyclone Vayu.

Duration

30 minutes depending upon the potential of the trainer to fan discussion and debate.

Methodology

Cyclone Action Plan from Gujarat State Disaster Management Plan should be provided to each group of participants and they should be asked to write down steps that should be taken by different government departments after yellow, orange and red alert warning is issued (as explained in learning unit 4.2).

Training aids

Power-point presentation, flip-charts, A4s, markers, pens etc.

Learning Unit 5.3: Development of Recovery Strategy: Case Study of ESCS Fani

(Source: DLNA Report on Cyclone Fani)

Flow of Session

In this session we will discuss the recovery strategy that was developed after damage, loss and need assessment was performed after the backwash of ESCS Fani.

While the relief operations were underway, the Government of Odisha in collaboration with The World Bank, Asian Development Bank and the United Nations undertook a detailed assessment of the damage and the recovery needs across different sectors. The assessment provided an overview of the macroeconomic and human impact of the disaster. Housing, power, telecommunication, agriculture, livestock, fisheries, and livelihoods were the most affected sectors. The assessment estimated the total damage to be worth INR 16,465 crore and total loss to be worth INR 7,712 crore. The estimated recovery needs were INR 29,315 crore.

5.3.1 Principles of Recovery

The process of recovery should be guided by the following principles aimed at improving the quality of recovery, emphasising social inclusion and promoting resilience of all sectors. These guiding principles are articulated below.

- Recognising the differential impact of the cyclone on people, the recovery process will prioritise the needs of the most vulnerable, which include people with disabilities, women-headed households, fishing community, slum dwellers, artisans, Scheduled Caste communities and people in extreme poverty.
- Recovery interventions should be based on the principle of gender equity, with a specific orientation towards investing in women's capacities to contribute to the recovery process. The women SHGs may be further capacitated to take up non-traditional reconstruction jobs, including construction of public works and higher paid skilled jobs to build their resilience.
- Recovery should be risk informed and disaster resilient. This can be done through establishing project approval processes which would ensure that the location, design and construction of all public and private infrastructure are multi-hazard resilient.
- Nature based solutions should be promoted in recovery, which include using environmentally safe and locally produced materials, and establishing coastal belt plantations as opposed to concrete infrastructure-based solutions. The reconstruction of infrastructure must take into

account environmental risks and be carried out in a manner that will prevent further degradation of the environment.

- Recovery efforts must build on international best practices, bringing in ideas and approaches that have been proven to be sustainable and resilient. At the same, they should promote vernacular design and the work of artisans to retain the local flavour of cultural heritage.
- Recovery should be a collective effort, using the resources and expertise of the government, civil society, development partners and the private sector. An inclusive and collective recovery effort will help the state reach out to all the affected areas and communities and reduce the burden on the state. People are integral to the recovery process and the government must create enabling conditions for their active participation and contribution.
- Recovery should be implemented in a transparent manner. All the information related to recovery must be made available in the public domain and be widely disseminated using means of communication that are accessible by the affected communities. Frequent monitoring and third-party audits should be conducted to provide quality assurance to recovery work undertaken by the government and private parties.

5.3.2 Recovery Strategy developed in wake of damage, loss & need assessment of ESCS Fani

With the intervention of technology in DRM we have been able to significantly reduce scale of mortality in case of cyclones. While the goal of zero mortality is close to realisation, the economic loss in the form of livelihoods and infrastructure has been increasing. The combined economic loss of INR 40,447 crore (USD 5.7 billion) from the recent cyclones—Phailin, Titli and Fani—demonstrates the need for establishment of a strong framework of disaster risk governance and integration of the principle of resilience in every area of development planning and recovery process to achieve a substantial reduction in economic loss. It is important to recognise that reducing economic loss due to these disasters is critical to reducing poverty and vulnerability of the affected region. This requires a continuous support for recovery as well as improving the quality of housing and infrastructure through better building standards and regulations.

A recovery programme is the right context for bringing about these long-term changes and improving resilience at the household, community and state levels. As part of the recovery process, emphasis should be on the need for building resilience across all sectors into the plans and programmes. The narrative for building resilience should be based on three pillars:

1. Resilient Housing
2. Resilient Livelihoods
3. Resilient Infrastructure.

Resilient Housing

- The high damage to housing stock can be attributed to two factors, the quality of houses and the poor quality of construction.
- Keeping in mind the **4th priority of Sendai Framework** of **Building Back Better**, cyclone reconstruction should be treated as an opportunity to incrementally replace all the housing stock and provide safe and affordable housing to reduce the human and economic costs in a recurrent cycle of disasters.
- The key strategy for the reconstruction of the houses is owner driven reconstruction, which would entail massive capacity building and skills training in disaster resilient construction technologies.
- The housing strategy should propose the use of cost-effective technologies and materials for rebuilding.
- The strategy should envisage that a prioritised approach for all women-headed households, people with disabilities, the elderly and low-income households would result in the provision of safe shelter for all vulnerable sections.

Resilient Livelihoods

- Extreme weather events such as cyclones have a detrimental impact on the livelihoods and coping capacities of people, particularly extremely vulnerable groups reliant on a single source of income and social protection schemes.
- The major sectors of the economy are extremely vulnerable to the changes in weather patterns and the impact of climate change. Fishing community, small farmers, sharecroppers and people in tourism sector are suffer severely by the repeated cyclones.
- The recovery strategy proposes immediate, medium- and long-term policy recommendations to protect the livelihoods of people. Immediate assistance would require the replacement of all livelihood related assets of people, with cash assistance and interest subvention to support the recovery of small businesses. Using the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), the state can support the restoration and creation of livelihood assets. In the long run, it is important to assist

businesses to move from the informal to the formal sector to qualify for insurance coverage, credit assistance and better quality services. Group insurance for all the Micro, Small and Medium Enterprises is recommended to encourage better coverage and to reduce the premium.

- Social protection schemes make a critical contribution to broader disaster recovery efforts by aiding disaster-affected households to protect their immediate well-being and helping them to recover more quickly. For example, the instant cash provided to the affected population post-Fani helped households purchase basic household items essential to resume economic activity. The existing social protection schemes can be made more effective through top-ups to beneficiaries who are pre-enrolled in an existing safety net programme. An expansion of social protection schemes maybe considered to add additional eligible people. An integrated package of support to vulnerable households through safe housing, supplementary income sources and expanded social protection schemes will insulate them from the effects of disasters.
- It is important to encourage women as economic actors, improve their level of financial inclusion, and provide necessary skills and credit to help them diversify their livelihoods. Financially independent women will improve household resilience significantly.

Resilient Infrastructure

- There is a need to create a comprehensive inventory and database of all public buildings currently in use and under construction, and to recommend steps to make them resilient from damage caused by cyclones. Buildings should be prioritised based on usage and a phased plan should be developed to repair, retrofit and reconstruct them. Additionally, there may be a need to develop guidelines to protect public buildings and assets in the cyclone-affected districts.
- The large number of public buildings that served as evacuation shelters need to be audited for their readiness to provide this function in future. An action plan for repair, retrofitting and enhancing the overall facilities should be prioritised. It is also important to introduce a survivability concept in these buildings to cope during and after the disaster, and add new features such as emergency communications, emergency lighting, emergency water provision (rain water harvesting), etc.
- Embankments need to be reviewed to establish a design and technical specifications for raising and strengthening embankments and protection of slopes.

- The power supply sector needs to work on accelerating the replacement of the overhead power supply with underground cable systems in the most vulnerable areas, even as remedial measures are taken to strengthen existing electric poles lines, incorporating features to withstand high wind speeds. In the long run, alternative energy sources such as solar power, bio mass and small hydro plants can be explored to reduce dependence on a single energy source.
- For the telecom sector, a gradual transition to future proof the communications systems should be adopted through better designed cell phone tower structures to withstand wind speeds above 250 kmph. Aerial cables should be replaced with underground cable ducts and multiple route redundancies with backup systems to ensure that telecom services are not disrupted in future cyclones.
- As the government continues to invest in infrastructure for economic growth, it is important to also invest in making assets multi-hazard resistant.

Objectives of the lesson

The primary objectives of this lesson would be to:

- To discuss the principle of recovery that should be followed in preparing recovery framework.
- To discuss scope of a potential recovery strategy in case of cyclones.

Duration

30 minutes depending upon the potential of the trainer to fan discussion and debate.

Methodology

Before starting the session, a video clip on recovery and reconstruction efforts taken after ‘the great Gujarat earthquake’ can be used to give an idea to the participants and asked them what should be the principle and strategy of recovery in case of cyclones.

If the participants have already been divided into groups, then each group can be handed out a sheet of paper and asked to write down the details which will be validated after the session.

Training aids

Power-point presentation, flip-charts, A4s, markers, pens etc.

Post -Training Evaluation & Conclusion

Context & Description

At the end of the training, evaluation of the knowledge, skill and attitude of the participants would determine their exit behaviour. The level of increase of knowledge and skill from the inputs given through the training has to be evaluated. Feedback from trainees regarding the training and related facilities would help in modifying future modules to make it more effective.

Objectives

To assess the exit behaviour of the participants at the end of the course.

To evaluate the knowledge and skills gained during the course.

To carry out formal internal evaluation

Duration: 75 minutes

Methodology

Any one of the following methods can be followed, according to the trainers' discretion:

Formal structured questionnaire – Each trainee is asked to fill up a structured questionnaire that evaluates their knowledge gained through the course.

Quiz on the course – Divide into groups and give points for correct answers. The group that wins, gets a small prize.

Informal discussion– The trainees divide into groups and identify the key learning points of the training and write them on a flip chart. After they finish, they move on to the next flip-chart

and add or comment on the points raised by other groups. At the end of the exercise, all the points are collated by the trainer and discussed.

Trainers' Note and Session Plan

The session should be covered in two parts; evaluation of knowledge and exit behaviour and feedback of the training. The first 30 minutes of the training should be devoted to evaluation of knowledge gained during the course of the programme through any of the methods described above. The last 30 minutes should be devoted to taking feedback from the trainees and their suggestions for more effective implementation of training in future. This can be done either through a structured questionnaire or through discussion wherein the training team notes down the suggestions of participants.

Training/ Performance Aids

Depending on the methodology chosen:

• Copies of pre-decided questionnaires or

• Flip charts, Markers, Tag-boards to pin the handouts

This successfully concludes the "Training Programme on Cyclone Risk Management".

A formal closing ceremony can be organized according to the protocol/ tradition followed by the host organization after the conclusion of the course.

GUJARAT INSTITUTE OF DISASTER MANAGEMENT

BUILDING RESILIENCE

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