



“Cyclone Hudhud”

Strategies and Lessons for Preparing Better & Strengthening Risk Resilience in Coastal Regions of India



NATIONAL DISASTER MANAGEMENT AUTHORITY

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Foreword

Disasters are inevitable phenomena in today's time and age. While disasters may not be the necessary result of hazards, more often they occur when these hazards intersect with the environment, particularly inappropriate location, inadequate infrastructural development and lack of capacity building of communities to deal with the disaster. Since the ability of the built environment to withstand the impacts of hazards plays a direct role in determining the casualties and monetary costs of disasters, it is important to reduce the vulnerabilities within the built environment and enhance its capacity for disaster mitigation and reconstruction to achieve resilience to disasters.

India with a coastline of 7516 kms. is vulnerable to cyclones of varying intensities. HUDHUD a Very Severe Cyclonic Storm (VSCS) hit the east coast at Vishakhapatnam on 12th Oct, 2014. Although it was not the most severe cyclone that hit the Indian coast, however, it has been the most devastating one in recent times which made landfall in an urban area. Its 'eye', lay exactly over the city causing tremendous loss to life, property and natural resources. However the human casualties were restricted to the minimum. This can be attributed to the sustained preparedness and mitigation measures undertaken in the past, and effective and timely response initiated by Central Government and State Government(s), right from the early warning stage.

NDMA deputed a team to visit the HUDHUD affected districts of Andhra Pradesh and Odisha to have first hand information on the good practices followed and to identify gaps and lessons learnt for better preparedness, pre-event mitigation and response/relief operations, to prepare better for future cyclonic events.

The report prepared by NDMA is 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. I hope that the findings and recommendations discussed in this document will assist all cyclone prone states of the country to strengthen preparedness and risk reduction efforts for coordinated response to cyclones in future in India.

R.K.Jain

Member Secretary

NDMA, GOI.

Acknowledgement

NDMA constituted and deputed a team Post Cyclone Hudhud to visit the affected coastal districts of Andhra Pradesh and Odisha to have first hand information on loss of life, property, agriculture and natural resources, the good practices that were followed, gaps identified and lessons learnt for pre-event mitigation, response and relief operations strengthening efforts on cyclone risk management.

The team visited the districts of Vishakhapatnam, Srikakulam, Vijayanagram in Andhra Pradesh, and Gajapati & Ganjam in Odisha. The team met Chief Secretary, Principal Secretaries and Heads of the Line Departments of Government of Andhra Pradesh and also interacted with Additional Chief Secretary (Disaster Management), Secretaries and Heads of the various Line Departments of Government of Odisha.

The team extends its appreciation to all the above mentioned senior officers along with District Collectors for sharing valuable information and their experiences. The team also wishes to acknowledge and sincerely thank the Government officials of various Line Departments at State and district headquarters who assisted and participated in our interaction during our visit to these two States.

The team is thankful to Members and Member Secretary of NDMA for their guidance and useful insights right from the process of undertaking the field visit to finalisation of the lessons learnt document. The undersigned as Team Leader also compliments the members of the team namely Shri R. K Singh, Director(Policy & Plans), NDMA, Shri Venkateshan, Consultant (Cyclone) and Shri B. B Ghadnayak, Consultant (IRS), NDMA. The photographs taken from the internet sources are also acknowledged. We are also thankful to Smt.Naghma Firdaus, Senior Consultant (CBDM), NDMA in rendering support to the team for content assimilation of the document.

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Abbreviations and Acronyms

AAI-	Airport Authority of India
BoB -	Bay of Bengal
CAD -	Command Area Development
CRRRI -	Central Road Research Institute
CRZ -	Coastal Regulation Zone
CS -	Cyclonic Storm
DD -	Deep Depression
DDMA -	District Disaster Management Authority
DEOC-	District Emergency Operation Centre
DM -	Disaster Management
DRR -	Disaster Risk Reduction
EOC-	Emergency Operation Centre
GPS-	Global Position System
IMD -	India Meteorological Department
Mo EF -	Ministry of Earth Sciences
MPCS-	Multi Purpose Cyclone Shelter
MSP-	Minimum Support Price
NBLS -	Narrow Based Lattice Structure
NCMC -	National Crisis Management Committee
NCRMP -	National Cyclone Risk Mitigation Project
NDMA -	National Disaster Management Authority
NDRF -	National Disaster Response Force
NEOC –	National Emergency Operations Centre
NGOs -	Non Government Organisations
NIO -	North Indian Ocean
OSDMA-	Odisha State Disaster Management Authority
PDS-	Public Distribution System

PRI -	Panchayati Raj Institutions
RC –	Resident Commissioner
RMU-	Ring Main Unit
SCS -	Severe Cyclonic Storm
SDMA -	State Disaster Management Authority
SDRF -	State Disaster Response Force
SEOC -	State Emergency Operation Centre
SOPS-	Standard Operating Procedures
URL -	Urban Local Bodies
VSCS -	Very Severe Cyclonic Storm
VSK -	Visakhapatnam
DDMP -	District Disaster Management Plan
DDRF-	District Disaster Response Force

Chapter - 1

INTRODUCTION

1. Introduction

1.1. India is vulnerable to natural hazards, particularly floods, drought, cyclone, earthquake, landslides etc. About 5700 kilometers of India's coastline is exposed to cyclones of severe intensity and magnitude. The most severe cyclone to hit India over the last few decades, was the Odisha Super Cyclone in 1999 wherein more than 10,000 people died. The enactment of Disaster Management Act, 2005 and National Policy on Disaster Management, 2009 facilitated adoption of proactive approach to deal with disasters, which is being practiced in Coastal States as well.

1.2. Tropical Cyclones are formed over warm ocean basins where some of them intensify into severe storms. Frequent Tropical Cyclones occur, over the North Indian Ocean (NIO) basin, encompassing Arabian Sea and Bay of Bengal, primarily in two seasons in a year viz: May to June and October to November. During the July to September period, although low-pressure systems do form, their intensification into Tropical Cyclones is remote. Tropical cyclones are characterized by high wind velocity, storm surges and very heavy rainfall. These three components of cyclone individually and collectively hugely affect life and assets in the coastal region where they strike.

1.3. Very Severe Cyclone 'HUDHUD' struck Andhra Pradesh Coast at Visakhapatnam on 12th October, 2014. It was one of the first episodes in the recent history that cyclone of such intensity landed on an urban city leading to high degree of devastation.

This Very Severe Cyclonic Storm developed from a low pressure area which lay over Tenasserim coast and adjoining North Andaman Sea in the morning of 6th Oct. 2014, concentrated into a depression in the morning of the 7th Oct. over the North Andaman Sea; then moving west-northwestwards to intensify into a Cyclonic Storm (CS) in the morning of 8th Oct. 2014 which crossed Andaman Islands close to Long Island between 0830 and 0930 HRS IST on 8th Oct. 2014. It then emerged into Southeast Bay of Bengal and continued to move west-northwestwards. It intensified into a Severe Cyclonic Storm (SCS) in the morning of 09th Oct. 2014 and further into a Very Severe Cyclonic Storm (VSCS) in the afternoon of 10th Oct. 2014.

It continued to intensify while moving northwestwards and reached maximum intensity in the early morning of 12th Oct. 2014 with a maximum sustained wind speed of 180 kmph over the West Central Bay of Bengal, off Andhra Pradesh coast.

It crossed north Andhra Pradesh coast over Visakhapatnam (VSK) between 1200 and 1300 HRS IST on 12th Oct. 2014 with the same wind speed. After landfall, it continued to move northwestwards for some time and weakened gradually into SCS in the evening and further into a CS by midnight. It then, weakened further into a Deep Depression (DD) in the early morning of 13th Oct.2014 and into a depression in the evening of 13th Oct. 2014. Thereafter, it moved northwards and weakened into a well-marked low pressure area over East Uttar Pradesh and neighborhood in evening of 14th Oct. 2014 (Fig 1).

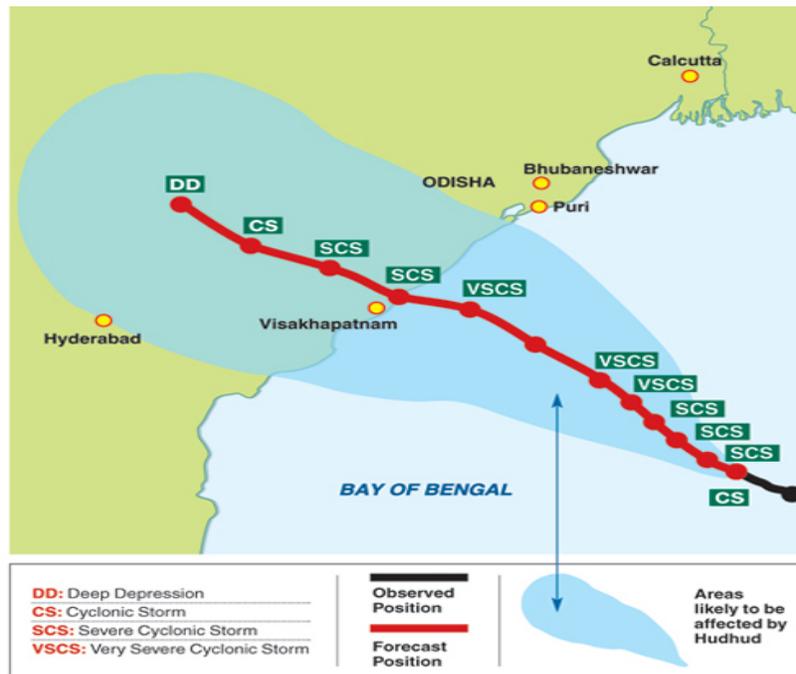


Fig 1: Path of Cyclone Hudhud.

1.4. HUDHUD caused heavy to extremely heavy rainfall with strong gale winds leading to large scale structural damage over North Andhra Pradesh and adjoining districts of South Odisha coast. Maximum 24 hour cumulative rainfall of 38 cm ending at 0830 HRS IST on 13 October 2014 was reported from Gantyada (Distt. Vizianagaram) in Andhra Pradesh. This caused floods at many places of the State (Fig. 2). Maximum storm surge of 1.4 meters above astronomical tide was reported by tide gauge at Visakhapatnam (Fig. 3).



Fig. 2: Floods after Hudhud.



Fig. 3: Storm surge during Hudhud.

1.5. The Cyclone Hudhud caused extensive devastation in the affected districts, wherein large number of trees were uprooted, roads and buildings were severely damaged, and power and telecommunication infrastructure was disrupted.



Fig. 4. Damaged Road.



Fig. 5. Damaged Buildings.



Fig. 6. Damaged power lines.



Fig. 7. Fallen trees

1.6. In A.P., about 9.2 million people in over 7285 villages in 4 coastal districts were affected resulting in 61 human casualties. The timely action of Govt. of India and State Government after the Cyclone warning resulted in minimum casualties. Over 2,22,000 people were evacuated from low lying and vulnerable areas to 310 relief camps. In addition, 1688 medical camps were opened, about 2.9 million food packets and 6.5 million water packets were distributed over a period of 15 days . This was made possible with the efforts of the Govt. of A.P. in close collaboration with district authorities, local self Government, National Disaster Response Force (NDRF), Indian Army and Navy.

1.7. Although the human casualties were relatively low, however there was massive loss of livelihood in the affected areas. About 1,12,850 houses were partially or fully damaged in the coastal areas of Vishakhapatnam district alone. More than 7,52,540 households living on agriculture, horticulture, livestock, fisheries and handlooms, were severely affected. Agricultural and horticultural crops were severely damaged on account of cyclonic storm and floods due to heavy rains. A rapid damage needs assessment team of the World Bank has estimated the total damages to the tune of about Rs. 13,263 Crores (US \$ 2155 million) to Hudhud.

1.8. In Odisha, 16 districts were put on high alert. Although there was loss of some assets and damage to agriculture and horticulture crops in three southern districts of the State but no loss of life was reported.

1.9. Central and State Governments responded by roping in personnel from the various line departments and emergency support function departments. In spite prompt and speedy response efforts, the event has put forth observations which can provide 'lessons for preparing better' for future cyclonic events of such kind and magnitude.

1.10. One of the overarching purposes of this document is to collate lessons learnt out of the Cyclone response which would provide institutional memory for future interventions of this kind in a more pragmatic and proactive manner.

1.11. NDMA deputed a team to visit the HUDHUD affected districts of Andhra Pradesh and Odisha to have first hand information of the type of losses sustained, the good practices followed and to identify gaps for better preparedness, pre-event mitigation and response/relief operations so as to prepare better for future cyclonic events. The team was led by Shri S.P. Vasudeva, Project Director (NCRMP) with Shri R.K. Singh, Director (Policy and Plans), Shri Venkateshan, Consultant (Cyclone) and Shri B.B Ghadnayak, Consultant (Incident Response System) as other members. The team visited villages and places affected by HUDHUD Cyclone in three Districts- Visakhapatnam, Vijayanagaram and Srikakulam - in Andhra Pradesh and two districts- Gajapati and Ganjam- in Odisha. The visit of the Technical Team was undertaken between 5th and 13th February 2015.

Chapter – 2

METHODOLOGY

2.0 *A team from NDMA was sent to Andhra Pradesh and Odisha to document lessons learnt from the response & management of cyclone Hudhud. A questionnaire was developed and circulated to various stakeholders in all the districts to gather their feedback. In this chapter, the process of data collection, compilation, scope and limitations of the study, is discussed.*

2.1. Scope

2.1.1. It was decided to send a team of NDMA officers to document lessons learnt from response & management of Cyclone Hudhud. The process was initiated by Member Secretary NDMA writing to Chief Secretaries of the States of Andhra Pradesh and Odisha in this regard. This was followed by the visit of the NDMA Technical Team to Andhra Pradesh (Capital Hyderabad and districts of Vijayanagaram, Vishakhapatnam, Srikakulam) and Odisha (Bhubaneswar and districts of Gajapati and Ganjam) to interact with the officers and representatives of District Administration, Urban Local Bodies (ULB), Panchayati Raj Institutions (PRI) and Community Based Organizations (CBO) which were involved in the various phases of management of Cyclone Hudhud.

2.1.2. This study covers the measures taken by State Government machinery as well as district administration in the coastal districts. The following parameters were studied in terms of states' preparedness and response to Cyclone Hud Hud

- 1) Preparedness during pre-disaster phase
- 2) Immediate response and relief in the aftermath of disaster
- 3) Mitigation measures
- 4) Damage assessment along with short term relief and rehabilitation measures taken during post disaster phase.

2.1.3. The study highlights upon the good practices, identifies the major gaps & challenges and recommends measures for better preparedness for response and coordination for cyclone risk management.

2.2. Field visit and interaction

2.2.1. A team of NDMA Officials headed by Shri. S.P. Vasudeva - Project Director (NCRMP) with Shri R.K. Singh, Director (Policy and Plans), Shri Venkateshan, Consultant (Cyclone) and Shri B.B. Ghadnaya, Consultant (Incident Response System) was constituted for undertaking

the study. The team during their field visit, held discussions with District Magistrates/Collectors and officials of the Line Departments of the affected districts who were involved in the management of Hudhud Cyclone, in addition to representatives of organizations as mentioned in Para 2.1.1.

2.2.2. A questionnaire was prepared by NDMA team which was circulated amongst various stakeholders of all the affected districts to facilitate discussion and gather information.

2.2.3. The team also visited many affected areas to understand the impact of damages and effectiveness of extant response mechanism - both in terms of loss of life, livelihood and property.

2.2.4. The findings were shared with the State Government during interaction with Chief Minister, Chief Secretary and Secretaries/Heads of Departments of Government of Andhra Pradesh and Additional Chief Secretary, Additional Relief Commissioners and officers of State Disaster Management Authority in Odisha. Dates and details of the interaction at various levels are mentioned in Annexure I of the document.

2.2.5. Based on these interactions and data collected, department wise analysis has been done to identify good practices in cyclone response and risk management. In addition, gaps have been identified which need to be addressed for effective cyclone response management in the country in future. The team has also suggested certain critical measures to address cyclone risk reduction methods. Strategy to deal with different phases of cyclone at State/District level and at household level has been also discussed.

2.3. Limitations

2.3.1. The lessons – learnt’ are primarily based on interactions with district officials and other stakeholders and reflect their views. The team did not interact with any Central Organization/Authority except Airport and Port at Vishakhapatnam. The findings related to Central Government Institutions are based upon the views obtained by State/District officials. One other critical limitations, was delay of visit of the NDMA Team, from the actual date of occurrence of cyclone- Hudhud.

2.3.2. The study report was presented to senior officials and Members in NDMA and was finalized based on the interactions with various stakeholders including senior officers of both the State Governments. Some of the recommendations emanate from interactions in Odisha, which has a robust disaster management and response system in place. A Publication “Managing Cyclone Phailin, Covering Experience to Action” by Odisha State Disaster Management Authority (OSDMA) must be referred to, by the coastal States for better management of cyclones.

Chapter – 3

LESSONS LEARNT

Good Practices, Gaps and Recommendations

3.0 In this chapter, lessons learnt with respect to the role and initiatives of Central Government and State Government Departments/agencies have been analyzed on the good practices they adopted and gaps that were felt in management of Cyclone Hudhud. Based on these recommendations, better management strategies in future have been suggested. The analysis has been done on the basis of feedback received from district authorities, other organizations at district level, discussions held at the level of State Government and State Disaster Management Authority. Integrated strategies for responding and managing cyclones by States along with Do's and Don'ts have been suggested.

3.1. Early Warning:

3.1.1. Central Government Agencies:

a) Indian Meteorological Department (IMD), Ministry of Earth Sciences.

Good practice

i) Early warning issued by IMD in advance helped in evacuation of most of the vulnerable population including fisher men resulting in minimal loss of life.

Recommendation

i) IMD needs to enhance its capabilities further, to predict the actual wind velocity and gusting speed, in advance to actual landfall.

3.1.2. Communication by State Governments:

Good practices

i) Communication plan having list of officers with locations, HAM channel number, mobile , land-line numbers and wireless frequencies, was prepared and circulated to all supervisory officers for coordinated response after receipt of early warning.

ii) HAM radios with operators were pre-positioned at strategic locations in affected areas (Cyclone shelters, relief camps, headquarters of state, district, subdivision and block etc.) that assisted in communication for making preparations and thereafter in response and relief operations.

iii) The electronic media and All India Radio were used as a mode of communication by the State Government and District Administration in forewarning communities before the cyclone struck/made landfall.

Gap

i) The early warning dissemination system was not in place to send communication directly to the last mile (to communities) by State Govt. /District Administration.

Recommendation:

i) State Emergency Operation Centres (SEOC) to link the receipt of Early Warning from IMD/other sources to the Last Mile directly through District Emergency Operation Centres (DEOC) and Local Level/Taluka/Block Emergency Operation Centres, have to be made operational. This needs to be coordinated through developing a web based early warning dissemination system based on satellite, radio, internet and mobile technologies. National Cyclone Risk Mitigation Project (NCRMP) is helping in developing such a system in A.P. and Odisha. This should be supplemented and linked through remote based sirens and loud speakers for wider dissemination of warning in time.

(ii) SEOC as a single point should also monitor the dissemination of Early Warning to all the remote areas (up-to the last mile).

(iii) The communication through this system should be/can be sent to all the registered mobiles of listed numbers/all the people in the vulnerable area of influence of the cyclone.

(iv) Ham Radios /Digital Mobile Radio availability may be encouraged by giving training to self help groups, members of PRIs and NGOs in the rural areas and district level as a redundancy for communication. However, the command and control of this system should be at SEOC/DEOC for uniform information dissemination.

(v) Establishment of community radio centre in various cyclone prone areas may be encouraged for dissemination of field information. All community radio centres however should be connected with either HAM radio or wireless or Digital Mobile Radio to SEOC/DEOC.

3.2. Preparation and Mitigation:

The cyclone or any other disaster can only be addressed if steps are taken before hand in preparing for mitigation of their effects. Risk preparedness needs to take into account the involvement right from the community to various stakeholders like Govt., NGOs and the Private Sector.

3.2.1. Central Government Agencies:

a) National Disaster Response Force, Ministry of Home Affairs.

Good practices

- (i) Forty two teams of the National Disaster Response Force (NDRF) were prepositioned in the vulnerable areas of states of Andhra Pradesh & Odisha at required locations within hours of receipt of 1st early warning.
- (ii) NDRF conducted coordination meetings with the state and district administration before proceeding to field locations.

Gap

- i) NDRF personnel at some places did not carry requisite resources/tools and equipments with them and were dependent upon district authorities for the logistic support, putting further pressure on the districts.

Recommendations

- (i) The capability of NDRF teams may be increased to work in smaller teams or sub teams with necessary essential equipments/tools.
- (ii) Dedicated aircraft/helicopters may be reserved for NDRF or made available to its teams for their swift and faster movement to the affected areas to reduce response time.
- (iii) A comprehensive list of equipments required for response during deployment, to cyclone prone areas may be prepared and be procured by NDRF.
- (iv) NDRF to separately prepare a list of tools and equipments required by them from the State/District authorities; to be made available to them on arrival. This must be circulated in advance to States and updated when required, based on the experience of handling previous cyclones.

b) Ministry of Defence

Good practices

- i) The four columns of Army were on stand-by to assist, in case required.
- ii) Four ships of the Indian Navy were on stand-by to aid for potential rescue missions.

Recommendation

i) Although NDRF is a dedicated force for response but it must be ensured by NDMA/State Govts./SDMA/District Administration to keep Army/Air Force/Navy always informed for any ground /air augmentation.

c) Zonal offices of Railways, Ministry of Railways

Good practices

(i) Considering the severity, the South Central Railways cancelled/diverted many trains, on receipt of early warning.

(ii) Majority of the train services to the affected areas were restored within 03 days after the cyclone.

Gaps

(i) The Railway stations were damaged as these were not cyclone resilient.

(iii) The power lines of railways supporting the movement of trains were also damaged.

Recommendation

(i) Adequate arrangements should be made at the railway stations to provide shelter to passengers who may get stranded. Adequate supply of essential materials should be ensured through bulk - storage.

(ii) Cyclone resilient railway stations may be designed in coastal areas. The above provisions may be reflected in the Disaster Management (DM) Plans of railway stations to be integrated in District Disaster Management Plan.

(iii) The power lines for running of railway trains may be made disaster resilient and if damaged, plan should be in place to restore them immediately.

d) Airport Authority of India (AAI)-Ministry of Civil Aviation

Good practices

(i) Control room was setup at Vishakhapatnam Airport wherein officials were designated and assigned specific duties for smooth functioning and communication.

- (ii) All flights to/from Visakhapatnam and Bhubaneswar Airports were cancelled 24 hrs before the cyclone landfall.
- (iii) Water for drinking and normal use was stored at airport.
- (iv) Sufficient sand bags were pre-positioned at different vulnerable locations of the Airport.
- (v) Power supply to the building was stopped to avoid accidents.
- (vi) Tarpaulins and ropes were arranged for response if required.
- (vii) Excavating machines and manpower were arranged for clearing of approach roads to the airport, if required, after the cyclone.
- (viii) Sufficient quantity of diesel was stored to run diesel generator sets.
- (ix) Dewatering pumps were kept ready.
- (x) All doors and openings in the airport premises were protected by giving additional supports.
- (xi) Manpower was kept ready at airport to restore the operations at the earliest.
- (xii) Sufficient food packets were arranged for the personnel on duty.

Gap:

- i) Airport building was not designed to sustain the wind velocity of high magnitude. Lessons were not learnt from regular occurrence of cyclones with high magnitude in other parts of the coastal region and proactive steps for strengthening the airport building, were not taken.

Figure 8 depicts the position of Airport before and after Cyclone.



Fig. 8. Vishakhapatnam Airport before and after cyclone Hudhud.

Recommendation

(i) Mitigation measures may be taken in terms of better design of roof and material used at the Airport, with wind resilient material or windproof design to resist high ranges of wind speed(300 km/hour of speed). These steps need to be taken while rebuilding the Vishakhapatnam Airport as multi hazard resistant airport building, to be protected from floods as well.

(ii) Each airport in the country shall have an operational disaster management plan and Standard Operating Procedures (SOPs). Airport Authority of India, Ministry of Civil Aviation, Govt. of India should address this at the earliest.

(iii) The Airport disaster management plan needs to be suitably integrated with the district disaster management plan. A nodal officer may be designated for updating of the Airport Disaster Management Plan, keeping in loop the district authorities.

e) Port Authority of India – Ministry of Shipping

Good practices

(i) DM plan was in place at Vishakhapatnam Port.

(ii) SOPs were available and were followed for effective response.

Gap

i) Planning was not done for the worst case scenario; learning's from other cyclones which had hit in recent past especially Phailin were not fully incorporated in the planning process, hence damages were seen.

Recommendations

(i) The port disaster management plan needs to be suitably updated taking care of learning's from Phailin & Hudhud. A nodal officer may be designated for updation of the Port Disaster Management Plan in co-ordination with the district authorities.

(ii) Mitigation measures may be taken in terms of better design of roof of Port building and other infrastructure preferably with a wind resistance of 300 km per hour.

f) BSNL – Ministry of Telecommunication

Gaps

(i) BSNL and other telecom agencies did not have sufficient stocks of diesel and were dependent

upon already stretched resources of district authorities.

(ii) Most of the towers owned by BSNL collapsed due to high wind speed. In A.P., out of 749 towers, only 17 remained functional and 100 towers collapsed completely. Similar was the position of towers of private mobile operators.

Recommendations

(i) BSNL and other telecom service providers should be invited to attend pre-cyclone session coordination meetings and mock drills for readiness.

(ii) All storage batteries should be charged fully after early warning for use during the post disaster period.

Directions may be issued from the Ministry of Telecommunication to all the private operators for restoration and proper function of all mobile towers in the affected areas. These directions may include:

i) Arrangements of alternate mobile towers at various strategic locations for quick restoration of mobile services after the cyclone.

ii) Ensuring functional capability of generators with sufficient fuel for a minimum of 15 days. The communication networks of BSNL and Airtel failed on account of lack of reserve stock of diesel, for running generators at transmission towers, thus resulting in delays in restoration of communication.

iii) Alternate mechanism for supply of power to mobile towers should be established as power supply is either switched off or gets disrupted due to falling of electric poles and lines due to high wind velocity.

iv) A specialised team including engineers with necessary equipment and transport facilities, may be prepositioned at various strategic locations of affected areas for early restoration of mobile services.

v) Mobile Towers with low height need to be developed that can withstand a wind speed of 300 kms/hour, or disc shaped towers that can withstand such wind speed, be erected as a mitigation measure in the coastal areas.

g) Ministry of Power

Gap

(i) Power cables/lines and poles supporting these were uprooted; resulting into disruption of power supply, their restoration in most localities took appreciable time.

Recommendation:

(i) Underground power lines along sea coast need to be laid down for developing a disaster resilient power infrastructure. This along with distribution centre should be water proof, to be effective during cyclones wherein flooding results due to heavy rain.

h) Ministry of Urban Development:**Smart Cities:****Recommendations:**

(i) The smart cities being built and many more cities/towns which are coming up or located in the vulnerable coastal areas, need to be designed and built based on Multi hazard resilient features.

ii) The smart cities and other cities being developed in coastal areas through Central Assistance must have a component of disaster management plan integrated with district disaster management plan.

i) Public Sector undertakings of Govt. of India

The assets of Steel Authority of India, and other Public Sector Undertakings located near Vizag which by rule, have to get insured from disasters, were not insured resulting into huge losses. The disaster risk reduction and mitigation measures for the infrastructure erected by these organizations and risk insurance mechanism needs to be taken up and put in place.

3.2.2. State Government Departments:

The steps for effective preparedness measures which need to be taken by the State Governments and District Administrations in order to mitigate effects of cyclone are discussed below:

1. Revenue/Disaster Management Department**Good practices**

i) Preparatory meetings were conducted to devise strategies to prevent/reduce potential losses/damages to life, livestock and properties.

ii) Dedicated officers especially having experience of developmental and welfare activities in the Cyclone prone coastal mandals/villages were deployed for coordination of relief activities.

iii) Control rooms were established immediately after receipt of first early warning at district and field level with representatives from Revenue, Police, Irrigation, Roads & Buildings, Panchayati Raj, Transport, and Rural Water Supply departments directly attending to the emergencies.

iv) Places for relief camps and shelters were identified with all required facilities like gas stoves/ cylinders, solar lamps, battery lights/ fully charged batteries, generators with sufficient diesel, containers for milk/milk powder, water and other essential commodities. Cooks for community kitchen were identified and utilised.

v) Mandatory evacuation of communities to safer havens was done. About 2,50,000 people in A.P., living in vulnerable houses and low lying areas, were evacuated.

Gap:

i) State of Andhra Pradesh was not fully prepared for a cyclone of such high magnitude as Hudhud even though cyclone “Phailin” had hit the state last year.

Recommendations:

i) Pre cyclone exercise meetings, on the pattern of Government of Odisha under the chairmanship of Chief Secretary in April/May and Sept./Oct., to review the various preparedness measures, are required to be held on regular basis by inviting all the stakeholders including Government of India. Such reviews are also required to be carried out at the level of Divisional Commissioners and Collectors of Coastal areas.

ii) The strategy for management of disaster, needs to be based on Zero casualty norms (Government of Odisha has prepared a document ‘Phailin- lessons learnt’ which should be referred by all the coastal states while facing and managing a cyclone.).

iii) All the vulnerable people living in Kutcha (mud) with GI, asbestos or grass roofed houses within 0-5 kms of the coast, need to be evacuated from their houses to MPCSS(Multi Purpose Cyclone Shelters) and safer places.

iv) Further, if required compulsory evacuation should be done under clause 34(c) of Disaster Management Act, 2005 to MPCSS and other safer places at least 24 hours before the landfall. The promulgation of this section helped in saving lives of thousands of people during cyclone Phailin.

v) Appropriate advisory may be issued for removal of Sign-boards, hoardings etc. which are prone to fall after strong winds of cyclone strike and cause damage to life and property.

vi) Vehicles need to be kept at such locations which could be utilised to evacuate people from affected areas after the cyclone.

vii) Proper record of dead and missing persons needs to be maintained. Immediate assistance should be rendered to affected family members after confirmation of Aadhar Records.

viii) Emergency Operation Centre (EOC) at State and district level with satellite, radio, internet and mobile technologies, each supporting the other; needs to be operationalised at the earliest. These need to be linked with control rooms set up by departments. This is being undertaken under NCRMP in A.P. and Odisha.

Cyclone shelters

Good practice

i) Cyclone shelters constructed under various schemes were used for housing the vulnerable section of society, thus helping in saving precious lives.

Gap

i) Many of Cyclone Shelters were in dilapidated condition and needed repair or renovation.

Recommendations

i) An appropriate policy needs to be framed and implemented for management of cyclone shelters by the community; learning from the model, being followed in Odisha.

ii) A list/database of equipments available in government/private establishments including excavators, cranes, fire tenders, satellite phones etc. should be available with Revenue/Disaster Management Departments/DDMAs within an hour of receipt of the first warning and should be circulated as well. The database needs to be updated based on the experience of management of each cyclone.

iii) Sufficient Power Saws may be kept ready for removing fallen trees and pruning the branches of the fallen trees for clearance of roads for movement of traffic at district, subdivision, tehsil and block levels. All these saws may be under the control of either Revenue Department (Tehsildar) or Home Department (Police – at Thana or outpost level) or Civil Defence & Home Guard or Power or Disaster Management Department. These can be made available to NDRF/SDRF on demand, although they move with such equipments when there is movement for clearing blocked roads.

iv) The District and State Administration should ensure to upload all details in handling and managing a cyclone on India Disaster Resource Network at link: <http://idrn.gov.in/default.asp>

2. Agriculture/Horticulture Department:

Good practices

- i) Immediately after receiving alert message by using print and electronic media, vegetable, horticulture and other crop growing farmers were advised to make proper drainage facilities to drain out excess rain water.
- ii) Advisory was issued to
 - Banana farmers for early harvesting.
 - Mango, Cashew and Guava growers for earthling - up of the soil to protect the plants.
 - Harvesting of matured balls (Cotton) and their storage at safer places.
 - Propping of Sugarcane crop by motivating the sugarcane growers for reduction of crop loss.
- iii) Deployment of officials of Agriculture Department from non-affected districts helped in impartial and speedy enumeration of losses.
- iv) Water from the fields was drained by making a single furrow in the water logged fields.
- v) All field functionaries were instructed to be alert and present at their respective headquarters to communicate precautionary measures to farmers. These officers were also instructed to report preliminary fruit and crop damage after land fall of cyclone.
- vi) Enumeration was completed in time for payment of compensation in transparent manner. (by obtaining farmer wise field photos).
- vii) Village organization/farmer groups were provided hand saws in order to facilitate cutting of fallen trees in the fields.

Gap

- i) After cyclone, majority of the crops like vegetables, mango, cashew, papaya, coconut etc. are prone to attacks of pest and diseases. No action was taken to protect the crops.



Fig. 9. Damaged Coconut Trees



Fig. 10. Effect of high wind velocity on Tall trees.

Recommendations

- i) The harvested sugarcane may be tied up separately and demarcated (by ropes of different colours as a mark of identification by the farmer) for their protection and stored in a safe place after receiving the early warning.
- ii) The Sugar Factories should give priority to purchase of sugarcane before hand in the affected areas, to minimise the economic loss to farmers.
- iii) The Department should encourage the Agricultural University for research work for creation of shelterbelts/wind barrier for protection of sugarcane/other crops.
- iv) A policy decision may be taken at state level to ensure compulsory crop insurance for agricultural and horticultural crops for farmers.
- v) Dwarf variety of coconut plant which is resistant to wind speed, may be planted by the farmers with compulsory plant insurance to minimize the loss. This dwarf variety can be provided by State horticulture department uniformly in the coastal areas 5-10 km from coast.
- vi) Arrangements may be made by the State Government to provide both pesticides & fungicides along with pumping equipment that will help the farmers to mitigating the attack of pests and diseases.

3. Animal Husbandry Department

Good practice

- i) Shelters for domestic animals were arranged in urban areas. This was done due to availability of Pucca infrastructure.

Gap

- i) Domestic animals were neither rescued nor were any specialized teams deployed for this purpose.
- ii) List of shelters for animals/cattle through resource inventory, was not available.
- iii) Veterinary hospitals were not mapped for their use during cyclone.

Recommendations

- i) The disaster management plan at the level of shelter, village, mandal, district needs to focus on the rescue of domestic animals also. Communities need to be fully involved for the same.

- ii) Shelter for domestic animals may be arranged in rural areas.
- iii) During the cyclone prone months, all fodder agencies/companies may be instructed to keep stock of fodder/feed for a minimum of 15 days in their store, for regular supply wherever needed.
- iv) The poultry products may be purchased at Minimum Support Price (MSP) from the farmers and transported to nearby safer districts, after the receipt of first early warning.
- v) After receipt of early warning, the district administration may ensure that all the poultry farmers shift their animals to the safer places (non affected districts).
- v) The States may take initiative for construction of Multipurpose *Pucca* animal shelters in rural areas or arrangement for their placement in already existing MPCS, should be made. For this purpose, the cattle crutch area of veterinary sub centre and veterinary hospitals in rural areas may be used by making them cyclone resilient.
- vi) There is a need to map demographic profile of families engaged in fishery, poultry, piggery, sheep and goat rearing, fish and prawn farming along with the location of respective village, mandal and district, to be available with Tehsildar and District Administration. This data can be used in making their infrastructure disaster resilient; informing them through early warning, and assessing the losses sustained by them.
- vii) Mapping of veterinary hospitals in coastal areas should be undertaken, which will assist in rendering treatment support based on proximity of the villages where animals have been injured.
- viii) Capacity building of fisherman, prawn, cattle and animal rearing communities on mitigation and risk reduction measures, to be taken for their animals/cattle before, after and during the disaster, is required and needs to be conducted on regular basis.
- ix) Policy may be introduced to ensure that all commercial poultry and other animal/cattle based industries are insured in cyclone prone areas.

4. Public Works Department

Good Practice

- i) After the removal of fallen trees and electric poles, repair of breaches as well as securing other damages on roads and bridges was carried out to restore traffic movement within 24-48 hours after the cyclone.

Gaps

- i) The breaching of road embankments and bridge approaches at certain locations caused caving of roads. Cross drainage structures were also affected.

ii) Inundation and overtopping caused surface damages to the roads such as potholes, pavements cracks, and erosion of pavements at some places.

Recommendations

i) Guidelines on road construction in coastal areas prepared in consultation with Central Road Research Institute (CRRI) under NCRMP, should be followed while constructing roads bridges and culverts in coastal areas.

ii) Disaster preparedness meetings should be conducted twice in a year to see that all roads, bridges, culverts are intact and in risk resilient mode. The emergency machinery to be used in the aftermath of disaster should also be tested twice to see their workability.

5. Civil Supplies Department:

Good practices

i) Officers were pre-positioned at various strategic locations for distribution of relief and smooth coordination of response after receipt of first early warning.

ii) Storage of essential commodities like food-grains and pulses. was arranged for 2 months in cyclone affected areas.

iii) 50 % of stocks (out of total capacity of the vendor) including petrol, diesel, kerosene oil was kept as reserve.

iv) Arrangements for necessary food items were made at identified relief camps (Multi Purpose cyclone shelters and schools which were converted as temporary shelters).

v) Baby food like milk powder, bread and biscuits were stored at various strategic locations.

vi) Sufficient domestic fuel and utensils with cooks were arranged in relief centres (Multi-purpose cyclone shelters and schools; those were converted to temporary shelters).

vii) Special teams were formed to curb black market and price hike of essential commodities and vegetables.

viii) Food & drinking water packets as well as milk and vegetables were distributed to the affected families. The distribution of relief materials to the cyclone victims was monitored.

ix) There was active NGO participation for drinking water supply including procurement of generators for power supply for a considerable period.

Gaps:

- i) Proper storage and distribution system for perishable material was lacking.
- ii) Supply of additional essential items through PDS (Public Distribution System) hindered the smooth distribution of PDS items as planned.
- iii) Lack of officers for receiving relief material from various districts, NGOs and other agencies hindered its time bound distribution.

Recommendations

- i) The items of PDS need to be stored for catering to 15 days demand in case the supply in affected areas is hampered.
- ii) Supply of essential food commodities may be managed through PDS system for distribution in affected areas.
- iii) The members of PRIs and Civil Defence volunteers may be involved in distribution of relief and restoration activity in the field under the command and control of Department of Civil Supplies.
- iv) The plan should be in place to involve owners of local private vegetable *Go-downs* for supply of vegetables to the communities if need arises.
- v) Necessary instruction may be given to the owners of local private vegetable *Go-downs* for storage of essential vegetable (Potato, onion etc.) for 15 days after receiving the first cyclone warning.

6. Power Department

Good practices

- i) 24X7 Control Room was opened at circle office/district level under the control of Divisional Engineer office for receiving and rectifying the complaints.
- ii) Field staff was deployed in advance to cyclone prone areas (Coastal Substations) for attending to rectification and repair works.
- iii) Power supply was restored in the affected areas; within two to seven days in the urban and 4 to 15 days in the rural areas.
- iv) In between the ten-day interruption of power supply, the arrangement made by NGOs with a supply of over 2000 solar lanterns in A.P. provided support in the relief operations.

Gap

i) Sufficient numbers of diesel generators were not in place. Had they been available, their use could have led to a state of normalcy faster.

Recommendations

i) Pre-positioning of men and material at strategic locations in all affected areas to be affected by cyclone, may be addressed on priority.

ii) Inventory of electrical requirements for quick restoration may be listed for use during cyclone.

iii) Storage of electric transformers and poles at strategic locations for their quick replacement after cyclone will help in early power restoration.

iv) Ready-made DTR, special structures and AB Switch Structures need to be fabricated in complete shape and made available in sufficient quantities wherever required by storing these at strategic locations.

v) For redressing fuse off calls, 10-15 batches with men and materials need to be formed (Substation wise) along with vehicle for early restoration of power.

vi) Wireless sets, power saws and power restoration materials with transport facilities may be provided to each team pre-positioned for restoration of power at various locations.

vii) Pruning of tree branches which may damage electrical lines, may be initiated within 01 hour of receiving early warning.

viii) Cranes for speedy assembly of poles should be placed at various strategic locations.

ix) Proper feedback mechanism through community participation is required for rectification of electricity.

x) A plan to priorities lifeline and critical infrastructure such as hospitals, communication stations, water works in maintaining/restoring electricity, needs to be in place. This should also be tested during the mock exercises.

7. Irrigation and Command Area Development (CAD) Department.

Good practices

i) Alertness of the Water User's Association (WUAs) Presidents, Sarpanches of inundation prone villages, helped in reduction of losses.

ii) Timely release of the water from vulnerable micro irrigation tanks, helped to mitigate potential heavy damages in view of flooding due to forced release of water.

- iii) Alternate arrangements were made using diesel generator and manual operations in the absence of power supply, for lifting of mechanical gates of irrigation infrastructure.
- iv) Calculations of rainfall data inflows in the reservoir and regular discharge of flood water through the spillway gates of the reservoir, helped in avoiding flood situation.
- v) Breached micro irrigation tanks were restored temporarily by forming ring bunds with sand bags and bullies to store water in them for use of saved water during Kharif season.
- vi) Identification of the vulnerable tanks/sources for special care and management for regulation of water discharge to avoid flood situation.

Gaps

- i) Weak bunds on canals/ivers are not being inspected and repaired through regular maintenance in coastal areas.
- ii) The mouth of drains in the coastal areas is not being cleared regularly.

Recommendations

- i) A Plan may be prepared for regulated release of water from micro irrigation tanks/reservoirs after receiving the early warning to avoid flooding.
- ii) Prepositioning of equipment like excavator, tractors and manpower at Mandal head quarters for fast restoration of breached portion of river embankments.
- iii) Sufficient sand bags and Casuarinas' bullies may be put in stocks at *Mandal* level/ especially in vulnerable pockets of the affected area for flood management in case of breach.
- iv) Improvements of rain gauge stations/river gauge stations may be done on priority.
- v) Community capacity building program may be conducted for restoration of breached portion of river embankments.
- vi) Fail safe micro-irrigation tanks may be constructed.
- vii) Appropriate water harvesting structure should be created to store the flood water for agriculture purpose.
- vii) Channels already in place may be widened to control flood through smooth flow of water.

8. Medical and Health Department

Good practices

- i) Medical teams were prepositioned in affected areas with all necessary equipments and man

power.

ii) Emergency drugs (for epidemic control) were available at the Primary Health Centers of all the affected areas.

iii) All hospitals were geared to attend the referral cases. These included the hospitals both in the affected and non affected districts of the state. The non –affected districts were fully prepared to receive patients if required.

iv) 108 Ambulance Service vehicles were prepositioned for transportation of emergency patients in various hospitals of the affected areas.

v) Medical teams were deployed with medicines to set up medical camps at the village levels. Supervisory officers were deployed to each of the medical camps.

vi) Door to door survey was conducted at the community level for early detection of any health issue and prevent situation of any epidemic.

vii) The Department ensured safe drinking water through supply of chlorine tablets to each household and bleaching powder to all affected Panchayats.

Gaps

i) Hospital Disaster Management Plan to deal with mass casualty management and emergency was not in place.

ii) Mock drills were not conducted to examine hospital readiness and preparedness for disasters.

Recommendations

i) District wise medical plan should be prepared to address emergency situations during cyclones in future. It also must contain mobilization plan for all kinds of resources (both men and material). Elements pertaining to Reproductive Health(focussing on health of women and children) also may be included in this plan. This plan must ensure that the Chief Medical Officers of the district constitutes a team of doctors and other resources like life saving drugs, regular medicines, disinfectants, vaccines, inoculations and chlorination equipments to move to vulnerable areas in the shortest possible time.

ii) All the hospitals in coastal areas need to prepare a Hospital Disaster Management Plan to deal with mass casualty management and emergencies.

iii) All hospitals need to be cyclone resilient and confirm to hospital safety norms including structural and non-structural measures; to be operational during disasters.

iv) Database for pregnant ladies should be maintained. Pregnant ladies in their fourth trimester may be shifted to the hospitals for emergency care after receiving the early warning.

- v) Special care needs to be taken for differently-abled people(mentally and physically challenged) and people affected with diseases like HIV/AIDS, TB, etc.
- vi) In-house patients may be released as per priority to enhance surge capacity in the hospitals after the receipt of early warning.
- vii) Voluntary Medical practitioners may be mobilized from nearby districts and prepositioned in affected areas.
- viii) A strategy may be designed to link the private medicine stores with the medical camps established by the administration in various affected areas wherever and when required.
- viii) Blood banks need to be checked and equipped with sufficient quantity of blood of different groups.
- ix) A record of persons treated for reference should be maintained and tracking mechanism for patients should be improvised.
- x) Post disaster immunisation for diseases such as Polio, Measles (especially in children) needs to be undertaken.

9. Panchayati Raj Engineering Department

Good practices

- i) Teams were prepositioned at *Mandal* level with necessary equipment for restoration of roads.
- ii) Sand bags were also kept ready at various strategic locations to meet any eventuality during cyclone.
- iii) Control rooms headed by Assistant Executive Engineers (AEE) were opened to monitor the situation.
- iv) Existing Circle and Division Level works at upstream and downstream side were identified and taken up for clearing of vents. Caution boards with danger sign were kept near all major causeways and culverts to avoid any accidents due to floods and heavy rains.
- v) Facilities like power supply, water supply, food arrangements and sanitation were ensured in all cyclone shelters and other places of shelter of vulnerable communities.
- vi) The department cleared the trees fallen on roads and restored traffic in the shortest possible time.
- vii) Damage to roads/buildings was inspected by the section officer of concerned Mandals of all the affected areas for assessment and preparing a plan for their early maintenance.

10. Housing Department

Gaps

- i) High speed winds caused major damages to housing, infrastructure especially huts, kutcha houses and houses with thatched, asbestos and GI sheet roofs.
- ii) It was also reported by people that the compensation given for damaged houses was grossly inadequate.

Recommendations

- i) A housing reconstruction policy needs to be formulated in consultation with all stakeholders. BIS codes for construction of cyclone resilient houses should be maintained.
- ii) A scheme may be launched to ensure that each village shall be free from semi-permanent houses and huts made of mud in the vulnerable coastal areas.
- iii) Construction of houses within CRZ region should be avoided as coast bank erosion takes place due to turbulent currents/tides during cyclone.
- iv) Housing should be avoided at slanted hillocks/mountain surfaces as the stability of structure will get compromised due to heavy rains and consequential landslides.
- v) The proposed house construction site must be above maximum sea level (MSL) to avoid damage due to storm surge during cyclones and other hydro-metrological disasters.
- vi) The selection of house site should be above maximum flood level on river banks in coastal villages to avoid the effect of back water at the time of floods.
- vii) The external walls should be made of masonry to withstand high wind speed in the cyclone prone areas. If found necessary, it should be reinforced by means of reinforced concrete bands and vertical reinforcing bars to make it more resistant.
- viii) Overhanging roofs as well as low pitched roofs should be avoided. If overhangs are desired, they should be tied to the main structure.

11. Public Health and Municipal Engineering Department

Good practices

Arrangements for Drinking Water Supply:

- i) Commodities like liquid chlorine, alum were procured in advance and prepositioned at various strategic locations for distribution in ensuring safe drinking water.

ii) Generators were put in place for lifting water in absence of power supply. These were also utilized at head water works. Small generators were taken on hire for water supply and to fill the water tankers from nearby wells.

iii) The Department supplied water through tankers till the restoration was normal.

iv) Damaged pipe lines, pump houses, motors, infiltration wells were restored on war footing.

v) Drinking Water -RO Plants were arranged through voluntary organisations (Rotary club, Lions Club, NTR Sujala Pathakam, Old age homes etc.) and used for supply of clean water where-ever required.

viii) Water tankers of fire services were used for supply of water.

Sanitation:

i) Items like bleaching powder, lime, phenol, bitex oil etc. were procured and pre-positioned in strategic locations and used subsequently to prevent communicable diseases.

ii) Special sanitation drive was taken up by duly engaging personnel and vehicles

Street Lighting:

i) Stock of Lamps, starters, chokes was kept available and used after the cyclones.

ii) Repair and replacement was undertaken of the damaged street lights; with the use of readily available stocks and procurement of further materials.

Fallen Trees

i) Fallen Trees from roads and building and electrical wires were removed by engaging man power & machinery like (JCBs), tippers and power saws.

ii) Services of neighboring State (Odhis) trained personnel and State Fire Service/NDRF were taken for early removal of trees.

iii) Local ward level volunteers were involved in removing the fallen trees. This led to the clearing of roads within 12 hours in the towns.

Machinery:

i) Earth moving machines (JCB) to clear the roads, pumps to take out water from lower areas were kept ready and used at various strategic locations.

Gap

- i) A few roads became unsafe due to inundation of flooded water.
- ii) Raw water intake points, water treatment plants and tube wells in many towns and cities became non-functional due to flooding and breaking of river and canal embankments.
- iii) Cyclonic storm damaged streetlights and damaged the structurally weakened roofs of public buildings.

Recommendations

- i) Resource inventory of both government and private sector infrastructure may be updated twice in a year.
- ii) Response plan may be prepared in advance for distribution of water through tankers. List of water tankers available with public/private agencies needs to be prepared and used after cyclones and during floods for safe drinking water.
- iii) Small capacity generators should be arranged in advance to run the water supply systems.
- iv) Sand bags should be arranged and made readily available in advance.
- v) Data of wells available in various areas to be known to all concerned stakeholders.
- vi) Electrical Power generators may be made available in all Municipalities.
- vii) Exclusive additional staff / Power boats may be kept ready, to attend to emergency damages to water supply installations in the river bed.
- viii) Exclusive bore wells/open wells may be kept ready for supply of water through tankers.
- ix) On and off control system may be developed in pump houses at Head Water Works in case of staggered infiltration wells.
- x) Sand bags may be kept ready for formation of cross bunds, arresting of breaches on roads.
- xi) Standby pump sets and generators may be kept ready to attend repairs to old pump sets and generators.
- xii) Small precast readymade drains may be kept ready for drainage of water.
- xiii) Maintenance of all equipments of pump houses needs to be attended just after receiving the early warning.
- xiv) Battery operated/solar lamps may be kept ready for use later on at various strategic locations of affected area.

xv) Additional equipment may be kept ready for removal of fallen trees and garbage at various strategic locations.

xvii) Bleaching / all other sanitary materials should be kept ready in advance for disinfection.

xviii) Emergency medicines may be kept ready at all the dispensaries in the affected areas.

12. Transport Department

Gap:

i) Exact location of vehicles could not be ascertained, which hampered, mobilisation of vehicles.

Recommendation:

i) Global Position System (GPS) based inventory mapping of vehicles should be done. All public transport vehicles should be linked with GPS system at the time of registration so that they could be tracked, located and called at the earliest for deployment during disasters

13. Fisheries Department

Good Practice

i) There was no casualty of fishermen community due to proper dissemination of early warning by district administration.

Gaps

i) Boats kept some distance away from the shore were completely damaged/washed away on account of absence of any protection mechanism i.e. in the form of mini-jetties or fishing harbour. Most of the boats lost in Srikakulam district were motorized boats- anchored at about 0.5 to 1.0 kilo meter, from the sea-shore.

ii) Similarly, no infrastructure to store the nets at safer places was in place.

iii) Fish and Prawns in open water farms were destroyed due to cyclone.

Recommendations

i) Advisory may be issued to fish and prawn farmers for early harvesting on receipt of first early warning.

- ii) Instruction may be issued to the fish and prawn go-down owners for purchase of the commodities without reducing the market price after receipt of first early warning.
- (iii) Mechanism for safe lodging of boats during cyclone may be formulated.
- iv) Teams should be constituted for visiting the fishermen villages for providing relief to fisherman at the earliest in the aftermath of disaster
- (v) Fishermen villages need to be made disaster/cyclone resilient in coastal areas in a phased manner.
- (vi) Mock drills to tackle disastrous cyclone situation need to be held regularly by District Administration/DDMA in co-ordination with Coast Guards and fishermen and fisheries department.
- (vii) INCOIS also sends messages to fishermen which may be done under intimation to SEOC and DEOCs.

14. Environment and Forest Department

Good Practices

- i) Raising of shelter belt plantations saved many agricultural fields and villages as these resisted and slowed down the wind speed.
- ii) Mangroves led to protection of coastal areas from storm surge.

Gap

- i) The construction at Vishakhapatnam Zoo, bio-diversity parks and other ecological infrastructure was not administered in a disaster resilient way which led to wide scale destruction in these areas.

Recommendations

- i) Well managed ecosystems help in reducing vulnerabilities to natural disasters and in mitigating the impacts from hazards, aiding recovery and reducing damages. These ecosystem benefits should be integrated into the disaster prevention, mitigation and adaptation strategies. Thus there is need to maintain shelterbelts and mangrove plantations in coastal areas.
- ii) Zoological and Bio-diversity Parks in coastal areas must subscribe to safety norms and cyclone resilience. New Parks should be constructed on this principle and old ones modified in a phased manner.

15. Fire Department

Good practices

- i) Prepositioning of fire tenders and Fire officers in various strategic locations.
- ii) Fire tenders were used as water tankers for supply of drinking water in the affected areas after the cyclone.

Recommendations

- i) The Fire and Emergency Department needs to be strengthened by providing adequate equipment and appropriate training for responding to cyclones and other hazards.
- ii) The manpower of fire department stationed throughout the coastal areas needs to be trained to work in close co-ordination with NDRF/SDRF and DDMA for disaster preparedness, relief and response operations.

16. Small Scale Industries

Gaps

- i) The buildings/sheds were not resistant to high speed winds.
- ii) No compulsory insurance was there, so loss on account of damage to equipments and buildings could not be covered.

Recommendations

- i) Cyclone resistant designs for the industrial sheds for resisting high wind velocity may be put in place.
- ii) Appropriate insurance policies may be introduced for equipments and materials which are procured through loan.
- ii) Mitigation measures may be taken in terms of better design of roof and material used for construction of small scale industry.

17. District Disaster Management Authority (DDMA)

All the districts have shown interest and stressed upon the development of local expertise for facilitating quick response. They suggested that it would be important to empower the local fire services to shoulder the responsibilities of SDRF/DDRF with suitable equipment support &

training. It may be noted that Odisha Fire Services rendered active assistance to Andhra Pradesh during Hud Hud response management.

Good practices

- i) DDMAAs have prepared the DDMPs.
- ii) Preparatory meeting is organized by DM/DC as chairperson of DDMA, twice in a year during the pre cyclonic season.

Gaps

- i) Strengthening of DDMAAs is required in terms of dedicated human resources.
- ii) Majority of the DDMPs are focused on response and relief mechanism. Adequate emphasis needs to be given to mitigation measures as well.
- iii) Regular mock drills are not conducted to test the efficacy of the DDMP.

Recommendations

- i) DDMA should prepare the district disaster management plan which should include prevention, mitigation & preparedness elements as well as relief and response management for cyclone.
- ii) It must be ensured that the areas in the district vulnerable to cyclone are identified and measures for prevention of cyclone and mitigation of its effects are undertaken by the departments of the Government at the district level as well as by the local authorities.
- iii) Directions should be given to different authorities at the district level and local authorities to take effective measures for the prevention or mitigation of cyclones as may be necessary.
- iv) The implementation of disaster management plans prepared by the key Departments of the Government should be monitored at the district level.
- v) The capabilities for responding to any cyclone in the district should be periodically reviewed and directions should be given to relevant departments/authorities at district level for their up-gradation as may be necessary.

vi) The preparedness measures should be periodically reviewed and directions should be given to the concerned departments/ concerned authorities at district level to strengthen preparedness measures upto the levels required; for responding effectively to cyclone.

vii) Organize and coordinate specialized training programmes for different levels of officers, employees and voluntary rescue workers in the district for effective response to cyclone.

viii) Facilitate community training and awareness programmes for mitigation with the support of local authorities, governmental and non-governmental organizations.

ix) It should be ensured that Government Departments at the district level and the local authorities prepare their cyclone response plans in accordance with the District Disaster Management Plan.

x) Quarterly up-dation of telephone directory and resource inventory should be ensured.

xi) Conducting mock drills to test the plan and updating the plan

xii) Updation of the District Disaster Management Plan (DDMP): The team tried to impress upon the District Administration to have a reference manual reflecting essentials on disaster risk management in the pre, during, and post disaster phases, in the DDMP and accordingly structure the same.

xiii) Thus DDMP shall cover the following details of 'Response Plan'.

- Planning for Preparedness
- Resources/ material identification and sourcing for the same
- Inventory of personnel for response management
- Advance training (including mock drills) for stakeholders
- Inter-agency coordination Cells
- Procurement cells (identified for relief material)
- Distribution cells in vulnerable areas
- HVRC(Hazard , Vulnerability, Risk and Capability Analysis) for every city (for every city and town in coast)
- Evacuation routes
- Shelters and nearby facilities
- Mapping of Critical facilities

- Assessment of service structures (power & communication)
- Inventory of alternative services (including Gen-sets; solar lanterns)

18. Household Emergency Management Plan:

The nature when it comes to its fury spells catastrophe, as had been the cyclones in the last 3 years. In view of changing climate dynamics, cyclones are bound to re-occur during their biannual phase in May/June and October/November. In anticipation of a potential disaster, people in the coastal areas (especially 10 km from the coastline) need to keep a Household Emergency Plan always ready with them. Household members together in a family and group of families in a locality must carry out a drill each year to test the plan so prepared for hassle free evacuation at the time of need.

In addition, people must have emergency disaster kit ready at their homes containing the following essentials:

S.No.	Item	Quantity
1.	Drinking Water	Minimum 10 litres
2.	First aid Kit	1
3.	Medicines	Medicines of daily use. This kit must contain medicines for chronic patients, blood pressure, diarrhoea, antiseptic solution, hydrogen peroxide solution, bandage, crepe bandage, etc
4.	Mosquito repellent	1
5.	Cotton	As per requirement
6.	Non perishable food items	Packed
7.	Bread	As per requirement
8.	Milk	As per requirement
9.	Sugar and salt	As per requirement
10.	Important documents	As deemed fit in sealed plastic cover
11.	Mobile with charger	1
12.	Torch	1
13.	Small transistor	1
14.	Money	

Thus, the emergency plan must have details including the emergency disaster kit, map of evacuation routes, place where all the family members would have reunion after the cyclone, etc.

3.3. RESPONSE

The response plan in State and District Disaster Management Plans should be based on actual field requirements and would be better if tested through conductance of mock drills. It must contain all possible details of vulnerable areas, evacuation routes, safe shelters, places of gatherings from where people can be transported to safer havens. The various actions for better response are :

3.3.1. Communication

- i) Police network for communication was very effective during response. Ham radios were used as a redundancy for communication for response.
- ii) The electronic media was used as a mode of communication by the state government and district administration.
- iii) However, an integrated Early Warning Dissemination System to the Last Mile needs to be developed based on satellite, radio, mobile and internet technologies for prompt response. This is being done at present in A.P. and Odisha under NCRMP.

3.3.2. National Disaster Response Force (NDRF)

- i) All the forty two teams were engaged in response and relief work; such as clearance of roads, rescue of affected persons, distribution of relief and providing medical support. They were very effective in rescue operations and clearance of roads.

3.3.3. State Disaster Response Force (SDRF)/State Fire Services: For quick response and minimum transportation time, SDRF needs to be operational in all the States. To further supplement their efforts, fire services as a multi-hazard response unit located throughout any State at each fire station, will help in efficient response and subsequently in relief operations.

3.3.4. Ministry of Railways: Railway authorities were very fast in restoration of the electric lines to start the train operations without any assistance from any other organisation.

3.3.5. Airport Authority of India:

- i) The work of removal of damaged materials and restoration of terminal was started immediately after the active phase of cyclone, to initiate the Airport operations.
- ii) AAI officials carried out restoration work of navigational tools and the runway with support of NDRF, Army and Navy personnel.
- iii) Temporary shelters were erected inside the terminal for passenger movement and operations.
- iv) The damaged boundary wall was repaired immediately to ensure airport safety and security.
- v) Air India resumed its flight from Vishakhapatnam airport on 17th October, 2014 i.e., within four days (after the active phase of cyclone)

3.3.6. Navy: Thirty teams of Navy equipped with boats and other equipments carried out rescue and relief operations.

3.3.7. Non Government Organisations (NGOs): A number of NGOs come for help during and after the disaster. To ensure that their support and assistance reaches all the affected areas, an NGO co-ordination cell needs to be established at NDMA/SDMA/DDMA. There is need to develop a web based system for efficient management of NGO assistance.

3.3.8. Volunteers: To follow and replicate what has been done by OSDMA, volunteers must be trained in specific components/skills of response. Identity cards must be issued to these volunteers by SDMA/DDMA as identification for performing these specific tasks. The SEOC/DEOC relevant officers of State Govt. and District Administration should be provided with address and mobile numbers of such trained volunteers. The volunteers shall also be provided with the mobile number of these institutions and officers. These volunteers should actively participate in all the mock exercises.

3.3.9. Mock Drill/s: Mock drill ensures the application of planning done and strategies devised for managing a disaster. The response capabilities of OSDMA have got strengthened on account of regular mock exercises and sustained capacity development. Therefore, it is advisable to have mock drills twice in a year just before the cyclone season in April and September, to field test the preparations made to tackle the cyclones.

3.3.10. Boats in Flood Prone Areas: Pre-positioning of adequate number of boats in flood prone areas will help in rescuing people from the flood situation which usually follows cyclonic events due to heavy rains.

3.4. RELIEF OPERATIONS:

- i) About 310 relief camps and 1688 medical camps were organised for the affected population.
- ii) About 1.6 million people were provided with food and drinking water in the relief camps.
- iii) District Disaster Management Authorities of these districts co-ordinated the efforts.

The recommendations for improved relief operations including distribution of relief are covered under the sub-segment of **“Preparedness”** of this chapter.

3.5. INTEGRATED STRATEGY FOR MANAGING CYCLONES BY THE STATES

The National Policy on Disaster Management 2009 stipulates the tackling of disasters through disaster management cycle starting with prevention, early warning, preparedness, mitigation, response, relief and rehabilitation. The States need to follow the below mentioned steps for management of cyclones:-

3.5.1. Early Warning to the Last Mile: On receipt of information from Indian Meteorological Department (IMD) of the approaching cyclone, the State Emergency Operation Centre (SEOC) would immediately through a web based early warning dissemination system (If not already developed; needs to be developed) send warning from Chief Secretary/Chief Minister right up to the last mile i.e. people living in far flung coastal areas and to fishermen through their mobiles or other systems so installed. This will help the people to become vigilant 48-72 hours before the landfall of cyclone and either shift to safer places such as Multipurpose Cyclone Shelters (MPCSs) or to move to areas within the state which are not likely to be affected by cyclone. Similarly, District Emergency Operation Centres (DEOCs) would ensure through their web based system that warning reaches to each and every village/habitation of the district for people to take appropriate action.

3.5.2. Preparedness: The State Emergency Operation Centre (SEOC) would be further strengthened if there is need to do so; to continuously transfer the warnings to various stakeholders to minimise the human and other material losses. Video conferencing if required can be done by Chief Minister/Chief Secretary/Relief Commissioner with districts and sub divisions to be affected by cyclones to fill the gaps of any requirements. NDRF teams as per need can be requisitioned and deputed to strategic locations for timely and effective response. Defence forces and Coast Guards should also be requested to be on the stand by and come for assistance at the time of need.

States should be ready through these exercises and inform the National Crisis Management Committee (NCCM) headed by Cabinet Secretary for any help, aid or assistance so required at the time of video conferencing. The District Disaster Management Authorities (DDMA) would also start preparing on these lines at the district level and be in touch with State Disaster Management Authority/State Emergency Operation Centre, Chief Secretary and Relief Commissioner. Section 34 of Disaster Management Act, 2005 can also be applied to compulsorily shift the vulnerable people in the cyclone affected areas to safer havens. This would help in saving the lives of the vulnerable population which was duly enforced during cyclone Phailin in Odisha.

3.5.3. Mitigation Measures: Based on the gaps identified with respect to the Management of Cyclones, the short-term and long term mitigation measures may be taken as explained in details in Chapter 5 of this document. However, immediate steps should be taken for :

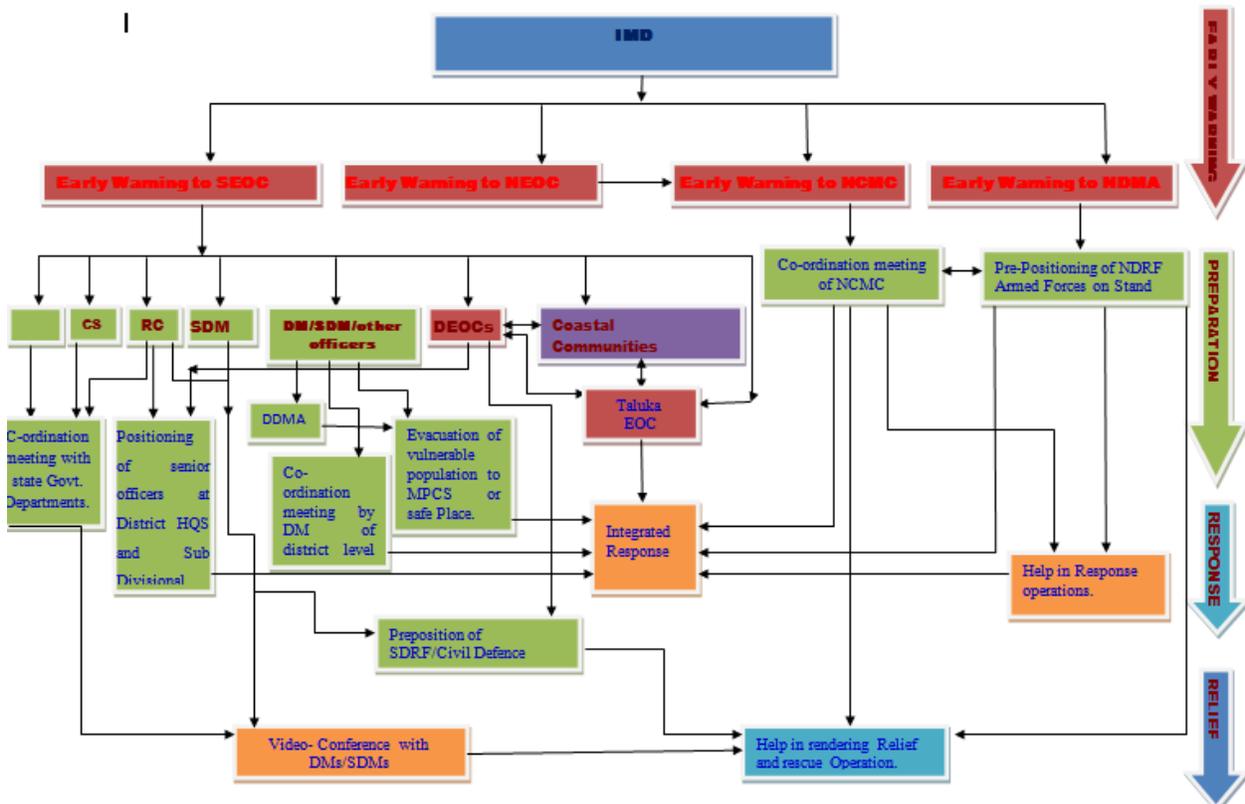
(i) Mainstreaming of Disaster Risk Reduction in the development plans of all existing and new development programmes, projects and schemes by incorporation of disaster resilient specifications in design and construction. This policy should not only cover Government and Public Sector but private sector as well both in urban and rural areas.

(ii) The development of infrastructure must be done in an environmentally sustainable manner. Climate change phenomena has contributed towards increase of frequency and intensity of disasters especially cyclones, flood and drought. This requires more attention.

3.5.4. Response: The movement of NDRF and SDRF (if in position) shall be followed so that the response strategy is focused and leads to precious saving of lives. Relief should be distributed to the affected people in an effective and efficient manner as already discussed in Chapter III of this document.

3.5.5. Rehabilitation: Rehabilitation as per policy in force would be undertaken to rehabilitate the poor and needy following the Relief and Rehab Manual at the earliest. Restoration should be in a way that disaster resilient practices are kept in view and implemented to avoid large scale damage as witnessed during this disaster. Feedback should be given to the States and Centre where-ever needed, for revision of any norms contained in the Manual for better rehabilitation and recovery. It can be seen that through appropriate risk reduction and mitigation measures, the number of lives lost has been reduced to less than 1% during cyclone Phailin and Hudhud compared to what was witnessed during super-cyclone of Odisha. However, bringing resilience to infrastructure, agriculture, livestock and poultry is the need of the hour.

The strategy is depicted in graphic form below



3.6. CYCLONE AWARENESS – Do’s and Don’ts

In brief, the below mentioned do’s and don’ts need to be followed by - relevant stakeholders and then improved on the basis of experience of facing cyclone that may come in future.

3.6.1. Do’s

3.6.1.1. Before the Cyclone season of May/June and October/November i.e., April and September every year.

- Remove dead and dying branches of trees around your house.
- Check the construction of house , by carrying out repairs of doors and windows, securing any loose tiles and bricks and anchoring firmly the water tanks/solar panels etc. at the roof of the house.
- Store wooden boards/ply wood ready in the house to replace these in case glass breaks.
- The glass put in the buildings need to be of such width to withstand wind speed from 250 —300 kms/hour.

-A cyclone lantern filled with kerosene, battery operated torches along with the adequate number of cells for battery and transistor to be kept ready.

- Demolish old and condemned buildings.

- Strengthen the electric poles/telecommunications poles to withstand wind speed at the time of cyclone

3.6.1.2. After Receipt of Early Warning:

- Refill your emergency management kit (page 35) and see that it is complete as per list.

- Store adequate dry non-perishable food ready for use during and after the cyclone.

- Listen to broadcasts from TV /Radio to get weather updates and warnings.

-Strong suitable support needs to be provided to outside doors to withstand speed of wind.

-Based on inputs from Radio and TV and also from early warning messages as sent through SEOC/DEOC, keep yourself in ready mode to face cyclone emergency.

- Consider only authentic official information for dissemination purpose

- Move to places above high tide and above flood level.

- People living in vulnerable Kucha houses to move to MPCs or to non-coastal safer areas.

3.6.1.3. After landfall of Cyclone

-Switch off electrical mains of your house.

- Remain calm and do not panic

-Do not go out till the cyclone passes off; that too after confirmation to that effect is received from official sources.

-In case of flood situation, move to upper storey along with important valuables (including documents).

-The glass windows should be boarded up or supported with strong shutters. Paper strips can also be put on glasses to prevent splinters, which can cause injuries.

3.6.1.4. Post Cyclone measures

- Those at shelters should remain there till informed for returning back home. Those at home should come out only when told to do so, from the official sources.

- Get vaccinated against diseases immediately after re-opening of hospitals/health facilities.
- Avoid any loose or hanging electric wires.
- Report actual losses to appropriate authorities at the earliest.
- Clear debris from your premises immediately. Sprinkle some disinfectants to sanitize the premises
- Avoid entering or playing with flood water at every cost. Children also need to be kept away from flood water.
- Use only boiled water till the drinking water supply normalises.

3.6.2. Don'ts

- Don't leave safer places till you are sure to reach your home or some other safer destination.
- Don't touch hanging wires, these may have electric current.
- People need not go back to houses which are vulnerable from safety standpoint
- Don't get misled by rumours; listen to official communication from official agency/ies.

Chapter 4

CYCLONE RISK MANAGEMENT - THE WAY FORWARD

One of the core objectives of the National Policy on Disaster Management 2009 is to promote a culture of prevention, mitigation, preparedness and risk resilience at all levels through knowledge, innovation and education. The NPDM further lays specific emphasis on capacity development and training of Govt. officials, functionaries, trainers, elected representatives and communities and provides a holistic framework which stresses upon investment in awareness generation, education, training, research and development as effective tools for addressing capacity development issues. Although a lot has been accomplished by Govt. of A.P. and Odisha, which led to low human casualties in the recent cyclones Phailin and Hudhud but still there is long way in making infrastructure disaster resilient and reducing losses sustained to agriculture, horticulture and animal resources. The restoration of basic services in the shortest possible time after these Cyclones can be attributed to State's effective capability in disaster preparedness and response.

4.1. Early Warning to the Last Mile: The existing gaps in dissemination of early warning to coastal communities including fishermen, still needs to be reduced. In the States of A.P. and Odisha, it is being done through development of a web-based Early Warning Dissemination System being developed under World Bank aided NCRMP based on radio, satellite, internet and mobile technologies with each complimenting and supplementing the other without breakup of communication at the time and after disasters to the last mile.

4.2. Cyclone Risk Mitigation Infrastructure: The erection and use of Cyclone Risk Mitigation Infrastructure is proving to be an important element of disaster resilience under present circumstances and needs to be taken up on war footing.

4.2.1. Multi-purpose Cyclone Shelters (MPCSs): 384 MPCSs in A.P. and 247 in Odisha have been constructed under various schemes. There is provision of construction of 138 MPCS in A.P. and 154 in Odisha under NCRMP-1 and 84 in A.P. and 162 in Odisha under NCRMP (Additional Financing). The Construction of these MPCS would help protecting the vulnerable population in coastal areas by sheltering them during cyclones. It may be ensured that for proper mobility to and from these MPCSs, these are connected through roads. A corpus fund to help the communities in their operation and maintenance after these are handed over to Multi-purpose Cyclone Shelter Management and Maintenance Committees, needs to be created by the States. These structures can be used during normal times for other activities such as schools, dispensaries, health centres etc.

4.2.2. Roads and Bridges: There is need to have uninterrupted road network in the coastal areas for movement of vehicles away from the affected areas to safer places after the receipt of Early Warning. Smooth road connectivity also ensures faster deployment of men, material and machinery to these affected areas for effective and efficient response and relief distribution. The road network would also improve the economic activity through faster movement of agricultural, horticultural and other produce to the market from rural areas. Where-ever needed, bridges and culverts shall be constructed to make this network absolutely uninterrupted.

4.2.3. Strengthening Coastal and Saline Embankments: There is need to design and improve the existing saline and riverine embankments and where-ever required construct new ones based on required design to bring more resilience from higher cyclone storm surges and flood levels. This will help in:

- Protecting the Coastal areas from saline water ingress.
- Protection of agricultural lands from saline water inundation.
- Protection from riverine flooding.
- Protection to properties in rural and urban areas from saline inundation.
- The top of these embankments can also be used as access routes.

4.2.4. Resilient Power Infra-structure: There is need to ensure and bring resilience to power infrastructure from future cyclones by taking up measures such as:

- (i) Vital and critical facilities and installations such as hospitals, water supply, telecommunication, railway stations, airports, bus stands, doppler weather radars etc. need to be connected through underground cables with double circuit. Supply in a ring/mesh mode having provision of Ring Main Unit (RMU) with adequate provision of captive power.
- (ii) The power sub-stations need to be constructed above the maximum recorded flood levels and located in cyclone resilient buildings.
- (iii) Establishment of robust transmission and distribution networks which can withstand cyclones and floods to a reasonable extent as well as take minimum time for restoration.
- (iv) Trunk lines (11 KV and 33 KV), overhead lines to be erected with reinforced narrow based lattice structure (NBLs) towers having the capacity to withstand wind speed of 300 KMs/Hr with a double circuit line wherever possible.

Such power infrastructure could withstand strong winds and flood situations to provide continuous supply of electricity which is very essential to withstand aftershocks of cyclone and to make response and relief operations prompt and effective.

The cyclone risk mitigation infrastructure as explained above would be established in States of Goa, Karnataka, Kerala, Gujarat, Maharashtra and West Bengal under NCRMP II to be implemented from this year with World Bank assistance.

4.3. Resilient Housing: The houses in the rural and in some cases in urban areas, have been constructed in vulnerable coastal regions, too close to high tide line including within Coastal Regulation Zone (CRZ). Many of the houses being kucha were destroyed in the affected areas during cyclone Phalin and Hudhud. There is need to develop a Reconstruction Policy and strategy for multi-hazard resilient housing to minimise losses in future. In this respect, houses with concrete roofs rather than slate, GI sheets, grass should be built in such risk prone areas above the high tide and if adjoining a river above high flood level. The walls of houses should be further strengthened through reinforced concrete bands to with-stand high wind velocity.

4.4. Hazard Risk Vulnerability of Coastal areas to Cyclones: A hazard risk vulnerability Atlas is being developed on a web-based model for assessing hazard risk vulnerability in coastal areas to hydro-meteorological disasters including cyclones to be used in reducing and mitigating risk under NCRMP. This is being developed for all coastal States/UTs including A.P. and Odisha. The Atlas would be ready in 2016 and the States should have institutional arrangements in place to immediately initiate its use.

4.5. Capacity Building of Youth and Civil Society in Risk Mitigation: Youth, PRIs and Civil Society need to be kept in focus as important stakeholders for the projects on Disaster Risk Mitigation and should be provided training on response skills that could be used for construction in resilient housing, public buildings, early warning and in evacuating the vulnerable people on receipt of early warning.

4.6. Advocacy through Popular Personalities: Prominent Local/National personalities can be engaged as Ambassadors for awareness and advocacy for strengthening risk resilience by promoting ideas of safe building, urban risk reduction, early warning, last mile connectivity etc. Short advocacy films can be produced by Govt./Local Cinema as well

4.7. Risk Transfer: There are certain insurance schemes operational in both the states for accidents, agriculture risk insurance, social safety net etc. There is urgent need to review all these schemes for establishing effective risk transfer mechanism for protecting the lives, livelihood, infrastructure, agriculture, horticulture and animal resources of the state.

The initiatives on awareness generation, community and volunteer participation, capacity building, Disaster Risk Management and Disaster Risk Reduction programmes taken up by Government of Odisha in the past are worth replicating to improve the capacity and capability of various community based, non government and Government organisations to respond proactively to disasters including cyclones.

Chapter 5

CONCLUSION

The last few decades have seen exponential increase in the disasters striking different parts of the globe. The Indian Sub-Continent has a multi – hazard profile on account of its unique geo-climatic conditions. The complex nature of disasters, urbanisation and expansion of slums, increased vulnerability of rural populace to deteriorating ecosystems and related issues like climate change have fuelled the intensity of disaster impacts.

While hazards are largely unavoidable, especially with the growing threat of climate change and alterations in habitat, they only become disasters when communities' coping mechanisms are unable to manage their impacts. The recent experiences during the Uttarakhand, Phailin, HudHud and Kashmir flood response constantly remind us of the need to invest in improved contingency planning, emergency communication & coordination and capacity development of relevant stakeholders in risk mitigation and management.

To combat such situations as far as cyclones are concerned:

- Putting in place an integrated web based early warning dissemination system to connect to the last mile, is pre-requisite to save human lives.
- The infrastructure of public and private buildings, roads, bridges, powerhouses and stations, water supply, food distribution and other essential commodities needs to be made disaster resilient in phased manner but in shortest possible time.
- There is need to have IT/GIS based models for prevention, preparedness, mitigation and early response to disasters. These could be in the form of developing a Risk Atlas based on hazard risk vulnerability assessment of coastal areas of the country, which could help in locating vulnerable hotspots and making these resilient to disasters. This Risk Atlas can also be utilised for relief management purposes.
- The development of web-based post disaster need assessment model can help in assessing the damages at the earliest and taking up rehabilitation and relief measures promptly. Stakeholder awareness generation on the aspects of mitigation and risk reduction will go a long way in appropriate response management for cyclones.

Annexure I

DETAILS OF PLACES VISITED AND INTERACTION

A. State Visited: Andhra Pradesh

1. District Visakhapatnam

- i) Visit to Visakhapatnam Port Trust (VTP) and interaction with VPT authorities.
- ii) Visit to 'Beach Erosion' site at R.K. Beach.
- iii) Visit to Rajiv Smrithi Bhawan (Damaged Building).
- iv) Visit to Airport and interaction with Airport Authorities.
- v) Visit to Gorapuda village, Rambilla Mandal (Damage of Horticulture) and interaction with village people.
- vi) Visit to Gajuivaka – Autonager MSME (Industrial Damage) industries and interaction with industrialists.
- vii) Visit to Simhapuri Colony and Visakhapatnam Rural Mandal House Damages.
- viii) Meeting with District Magistrate and Officers of concerned Line Departments.

2. District: Vizianagaram

- i) Meeting with District officials
- ii) Interaction with Ward Councillors and ULBs in Vizianagaram Municipal Wards.
- iii) Field visit to Kavulawada, Tudem, and Dibbalapalem Villages of Bhogapuram Mandal for inspection of coconut & cashew plant damages.
- iv) Inspection of Fisheries & Transco Damages at Mukkam Village of Bhogapuram Mandal.
- v) Inspection of CPW Scheme source damages at Nathavalasa Village of Denkada Mandal.
- vi) Interaction with Officials and Community leaders such as Z.P.T.C., M.P.P. Surpanches, M.P.T.Cs etc., Stake Holders and Voluntary Organizations in Tahsildar Office, Poosapatirega.

3. State Headquarter: Hyderabad:

Interaction with Chief Minister, Chief Secretary, Principal Secretaries and Heads of line Departments.

B. State Visited: Odisha

State Headquarters (Bhubaneswar)

- i) Additional Chief Secretary & Managing Director of SDMA, Senior Officials of SDMA
- ii) Additional Special Relief Commissioner and his team

District (Gajapati)

- i) Interaction with officers of District administration.
- ii) Interaction with people's representatives of ULBs of Gajapati.
- iii) Interaction with officers and Community of Guma Block.
- iv) Interaction with affected community of Tribal Villages – Santoshpur of Namna Garh Gram Panchayat (Guma Block).
- v) Interaction with PRI members of Namna Garh Gram Panchayat (Guma Block) and grass root level NGOs.
- vi) Interaction with Officers of Kasinagar Block.
- vii) Interaction with affected community of village Mangarajpur (R Udayagiri Block).
- viii) Interaction with Affected site for crop damage and house damage of Ganda Hati Gram Panchayat of Raygada Block.

District headquarters (Ganjam)

- i) Interaction with Officers of District administration.
- ii) Interaction with affected scheduled caste community of village known as Rambha.
- iii) Interaction with PRI members of Rambha ULB (NAC) (Ganjam block)